Django v5 Tutorial

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Install and **Setup Django Environment** with Base Template

```
📁  Create project environment
```

```
mkdir project_folder && cd project_folder
```

```
🖥️  Virtual Environment (venv) to issolate pip packages                📁 .venv
```

```
python -m venv .venv       # Create .venv folder

.venv/Scripts/activate     # Windows              to exit,  type: deactivate
source .venv/bin/activate  # Linux                OR use buttons: ctrl + c
```

```
📝 Environment Variables                                                  📁 .env
```

```
echo 'DEBUG=True'    > .env   # create .env file  (with variable DEBUG=True)
echo 'SECRET_KEY=…' >> .env   # add $SECRET_KEY   (make it a strong password)
source .env                   # Linux             (imports $VARIABLES)
```

I will use the **load_dotenv** function from the **python-dotenv** library in django_project/**settings.py** to automatically load environment variables from the .env file.

> In production, it is generally recommended to avoid using python-dotenv. Instead, rely on the hosting platform's (Heroku / Railway) built-in mechanisms for managing environment variables to avoid conflicts.

```
📝 .gitignore

ignores specified directories when pushing the
project to platforms such as: GitHub and GitLab
```

```
echo '
# Environments
.env
.venv
env/
venv/
ENV/
env.bak/
venv.bak/

# Node.js
node_modules/
' > .gitignore
```

```
echo '\n
# Ignore SQLite database files
*.sqlite
*.sqlite3
*.db
*.db3

# Ignore staticfiles
staticfiles/' >> .gitignore

# Append more paths to .gitignore
# In this instance, ignore SQLite DB
# and staticfiles boundle
```

```
# creates/writes .gitignore file (This is basic .gitignore, learn more here)
```

```
📝 requirements.txt

register, downloaded via: pip (package manager), 📚libraries in this text file
```

```
echo > requirements.txt   # create empty file

# write/create file with installed pip packages (Use only while in 🖥️ (venv) )
pip freeze > requirements.txt
```

🖥️ (venv) @ project_folder 🧰 **Django Framework**

```
pip install django
django-admin startproject my_website .     # use snake_case naming convention
```

🖥️ (venv) @ project_folder 🐍 manage.py

```
python manage.py startapp app_name          # create app
python manage.py migrate                    # update database
python manage.py createsuperuser            # create admin user
python manage.py runserver localhost:8000   # run/start project

# in the terminal, press ctrl and c buttons simultaneously, to stop the server
```

Don’t use these commands because we haven’t initialized app with static folder

```
# in production, collect all /static files TO /staticfiles (STATIC_ROOT)

python manage.py collectstatic

# use the below commands in terminal after modifing apps’ models.py

python manage.py makemigrations # prepare any modifications for the database
python manage.py migrate        # update databse with these new modifications
```

🖥️ (venv) @ project_folder 📚 pip library

```
pip install
    python-dotenv
    django-bootstrap5 django-crispy-forms crispy-bootstrap5
    django-sass libsass
```

```
python manage.py sass                    ← Don’t use this code yet!
app_name/static/app_name/scss/           app’s .scss files will be automatically
app_name/static/app_name/css/ --watch    converted to .css & saved at static/css
```

```
pip freeze > requirements.txt  # update requirements.txt
```

🖥️ (venv) @ project_folder 🗂️ media & staticfiles

```
mkdir media staticfiles

# media       - for serving user’s data: images, recordings, videos etc…
# staticfiles - for serving website’s assets: css, js etc... in compressed form
```

📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
import os

from dotenv import load_dotenv # Remove this code in production
load_dotenv()                  # Remove this code in production
```

```
BASE_DIR = os.path.dirname(os.path.dirname(os.path.abspath(__file__)))

SECRET_KEY = os.getenv('SECRET_KEY')

DEBUG = os.getenv('DEBUG', 'False').lower() in ['true', '1']
```

```
INSTALLED_APPS = [
    'django.contrib.admin',
    ...

    # Add libraries above apps
    'crispy_forms',
    'crispy_bootstrap5',
    'django_bootstrap5',
    'django_sass',

    # Add apps below
    'app_name.apps.AppNameConfig',
]
```

```
TEMPLATES = [{
    ...

    'DIRS': [os.path.join(BASE_DIR, 'templates')],
    ...
}]

DATABASES = {
    'default': {
    'ENGINE': 'django.db.backends.sqlite3',
    'NAME': os.path.join(BASE_DIR, 'db.sqlite3'),
    }
}
```

```
STATIC_ROOT = os.path.join(BASE_DIR, 'staticfiles')
STATIC_URL = '/static/'

MEDIA_ROOT = os.path.join(BASE_DIR, 'media')
MEDIA_URL = '/media/'

CRISPY_ALLOWED_TEMPLATE_PACKS = "bootstrap5" # Includes styled forms in B5
CRISPY_TEMPLATE_PACK = "bootstrap5"          # Includes styled forms in B5
```

🖥️ (venv) @ project_folder/app_name 🗂️ app_name

```bash
# Update tree structure of app_name (Linux)

app_name=$(basename "$PWD")

touch forms.py urls.py

static="static/$app_name"
mkdir -p "$static/"{scss,css,ts,js,img}
touch "$static/scss/index.scss"
touch "$static/ts/main.ts"

temps="templates/$app_name"
mkdir -p $temps
touch "$temps/base.html"
touch "$temps/form.html"
touch "$temps/index.html"

tree .
```

```
app_name
├── admin.py
├── apps.py
├── forms.py
├── __init__.py
├── migrations
│   └── __init__.py
├── models.py
├── static
│   └── app_name
│       ├── css
│       ├── img
│       ├── js
│       ├── scss
│       │   └── index.css
│       └── ts
│           └── main.ts
├── templates
│   └── app_name
│       ├── base.html
│       ├── form.html
│       └── index.html
├── tests.py
├── urls.py
└── views.py
```

📝 project_folder/my_website/**urls.py** 🐍 urls.py

```
Function views
    1. Add an import:  from my_app import views
    2. Add a URL to urlpatterns:  path('', views.home, name='home')

Class-based views
    1. Add an import:  from other_app.views import Home
    2. Add a URL to urlpatterns:  path('', Home.as_view(), name='home')

Including another URLconf
    1. Import the include() function: from django.urls import include, path
    2. Add a URL to urlpatterns:  path('blog/', include('blog.urls'))
```

```python
from django.urls import path, include
from django.conf import settings
from django.conf.urls.static import static
```

```python
urlpatterns = [
   … # imports URLs from my_website/app_name/urls.py
   path('', include('app_name.urls')),
]

if settings.DEBUG:
    # Serve static files during development
    urlpatterns += static(settings.STATIC_URL, document_root=settings.STATIC_ROOT)
    # Serve media files during development
    urlpatterns += static(settings.MEDIA_URL, document_root=settings.MEDIA_ROOT)
```

📝 project_folder/app_name/**urls.py** 🐍 urls.py

```python
from django.urls import path
from . import views

urlpatterns = [
    path('', views.indexView, name='index'),
]
```

📝 project_folder/app_name/**views.py** 🐍 views.py

```python
from django.shortcuts import render

def indexView(request):
    return render(request, 'app_name/index.html')
```

📝 project_folder/app_name/templates/app_name/**index.html** </> index.html

```
{% extends 'app_name/base.html' %}
{% load static %}

{% block title %}Index Page{% endblock %}

{% block head %}
    <link rel="stylesheet" href="{% static 'app_name/css/index.css' %}">
{% endblock %}

{% block content %}
    <h2>Welcome to the Index Page!</h2>
{% endblock %}
```

```
{# this is inline comment #}


{% comment "comment name" %}
This is multi-line comment
{% endcomment %}
```

📝 project_folder/app_name/templates/app_name/**base.html** </> base.html

```
{% load django_bootstrap5 %}
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>{% block title %}{% endblock %}</title>
    {% bootstrap_css %}
    {% block head %}{% endblock %}
</head>
<body>
    <main class="container p-5">{% block content %}{% endblock %}</main>
    {% bootstrap_javascript %}
    {% block base %}{% endblock %}
</body>
</html>
```

Create **Model** with

Form Post Request from **Template**

TO update our ☭ Model 卍

📝 project_folder/app_name/**models.py** 🐍 models.py

```python
from django.db import models
from django.utils.translation import
gettext_lazy as _

class ModelName(models.Model):

  id = models.AutoField(primary_key=True)

  title = models.CharField(
      max_length=100,
      blank=False,
      verbose_name=_('My Title')
  )

  COUNTRIES = [
      ('GB', 'Great Britain'),
      ('PL', 'Polska'),
      ('DE', 'Deutschland'),
  ]

  country = models.CharField(
      max_length=100,
      blank=False,
      default=COUNTRIES[1][1], # → Polska
      choices=COUNTRIES,
      verbose_name=_('Select a country')
  )
```

```python
# IGNORE BELOW CODE! It's just an example

class Model(models.Model):
  name = models.CharField()
  context = models.TextField()

  def __str__(self):
    return f"Model(name={self.name},context={self.context})"
```

In settings.py the **DEFAULT_AUTO_FIELD** allows you to specify the default type of auto-incrementing primary key field that will be used for models that do not explicitly define a primary key.
DEFAULT_AUTO_FIELD @ djangoproject.com

```
DEFAULT_AUTO_FIELD =
'django.db.models.BigAutoField'
```

🖥️ (venv) @ project_folder 🐍 manage.py

! IMPORTANT NOTE !

You should **ALWAYS** execute:

```
python manage.py makemigrations
python manage.py migrate
```

when you **create** & **update** models.py
to initialize the model table in database

String/Text	`char_field = models.CharField(max_length=100)`
	`text_field = models.TextField()`
	`url_field = models.URLField()`

Numbers	`integer_field = models.IntegerField()`
	`positive_integer_field = models.PositiveIntegerField()`
	`decimal_field = models.DecimalField(max_digits=5, decimal_places=2)`

Time	`date_field = models.DateField()`
	`time_field = models.TimeField()`
	`date_time_field = models.DateTimeField(auto_now_add=True)`

Other	`email_field = models.EmailField()` ← max 254 chars by default
	`boolean_field = models.BooleanField(default=False)`
	`file_field = models.FileField(upload_to='uploads/')`
	`image_field = models.ImageField(upload_to='images/')`

📝 project_folder/my_website/**admin.py** 🐍 admin.py

```python
from django.contrib import admin
from .models import ModelName

# Register your models here TO display and manage them at the .../admin/ page
admin.site.register(ModelName)
```

📝 project_folder/app_name/**forms.py** 🐍 forms.py

```python
from django import forms
from .models import ModelName

class ModelForm(froms.ModelForm):
    class Meta:
        model = ModelName                # Select fields from ModelName
        fields = ['title', 'country']    # for your <form> rendered @ form.html
```

📝 project_folder/app_name/**views.py** 🐍 views.py

```python
from django.shortcuts import render, redirect
from .forms import ModelForm

def formView(request):
    if request.method == 'POST':         # <form method='POST'> onSubmit
        form = ModelForm(request.POST)
        if form.is_valid():              # Verifies posted by client data
            form.save()                  # Creates new model - ModelName
            return redirect('index')     # Sends user to URL path name='index'
    else:
        form = ModelForm()

    return render(request, 'app_name/form.html', {'form': form})
```

📝 project_folder/app_name/**urls.py** 🐍 urls.py

```python
urlpatterns = [
    path('', views.indexView, name='index'),
    path('form/', views.formView, name='form'), # ← Add this path
]
```

📝 project_folder/app_name/templates/app_name/**form.html** </> form.html

```
{% extends 'app_name/base.html' %}
{% load static %}
{% load crispy_forms_tags %}

{% block title %}Form Page{% endblock %}


{% block content %}
  <form action="{% url 'form' %}" enctype="multipart/form-data" method="POST">
    {% csrf_token %}  # Secures our data when sending it to the backend server
    {{ form|crispy }} # Formats form in bootstrap5 & supports error events
    <button type="submit">Create Model</button>
  </form>
{% endblock %}
```

```
{{ form }} → inputs
{{ form.as_p }} → labeled inputs
{{ form|crispy }} → bootstrap inputs
{{ form.field_name }} → this input
{{ form.field_name.value }}
{{ form.field_name.label }}
{{ form.field_name.label_tag }}
{{ form.field_name.help_text }}
{{ form.field_name.errors }}
```

NOTE: My first **view** is called: **formView** (for simplicity)
However, you should rename it to **createModelView** (for semanticity)

Client lacks indication of **Model's** creation!

Let's add **MESSAGES** & display **Models**
from **Database** with **Pagination**

(Output **Models** at 🏠 Index Page)

📚 **messages** - are pre-initialized by default in Django >=5 🐍 settings.py

```
INSTALLED_APPS = [
   ...
   'django.contrib.messages',

   # Add libraries above apps
   'crispy_forms',
   ...
]
```

```
MIDDLEWARE = [
  ...
  'django.contrib.sessions.middleware.SessionMiddleware',
  'django.contrib.messages.middleware.MessageMiddleware',
  ...
]
```

📝 project_folder/app_name/**views.py** 🐍 views.py

```
messages.success()
messages.error()
messages.warnig()
messages.info()
messages.debug()
```

```python
from django.shortcuts import render, redirect
from django.contrib import messages
from .forms import ModelForm

def formView(request):
    if request.method == 'POST':
        form = ModelForm(request.POST)
        if form.is_valid():
            form.save()
            messages.success(request, 'Model created successfully!')
            return redirect('index')
        else:
            messages.error(request, 'Something went wrong!')
    else:
        form = ModelForm()

    return render(request, 'app_name/form.html', {'form': form})
```

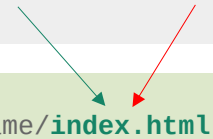
📝 project_folder/app_name/templates/app_name/**base.html** </> base.html

```
{{ messages }}
{{ message }}      → 'My Message'
{{ message.tags }} → success, error, info…
```

```
{% load django_bootstrap5 %}
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>{% block title %}{% endblock %}</title>
    {% bootstrap_css %}
    {% block head %}{% endblock %}
</head>
<body>
    {% if messages %}{% bootstrap_messages %}{% endif %}
    <main name="container p-5">{% block content %}{% endblock %}</main>
    {% bootstrap_javascript %}
    {% block base %}{% endblock %}
</body>
</html>
```

📝 project_folder/app_name/**views.py** 🐍 views.py

```python
from django.core.paginator import Paginator, EmptyPage, PageNotAnInteger
from django.shortcuts import render, redirect
from django.contrib import messages
from .forms import ModelForm
from .models import ModelName

---

def indexView(request):

    # ASCENDING:(a-z) - order_by('field')
    # DESCENDING:(z-a) - order_by('-field')
    model_list = ModelName.objects.all().order_by('title')

    # Paginate the queryset
    paginator = Paginator(model_list, 5)      # Show 5 models per page
    page_number = request.GET.get('page', 1) # Get 'page' from request's query:
                                              # localhost:port/?page=0-9 (number)

---

    try:
        models = paginator.page(page_number)
    except PageNotAnInteger:
        # If page is not an integer, deliver the first page
        models = paginator.page(1)
    except EmptyPage:
        # If page is out of range (e.g., 9999), deliver the last page
        models = paginator.page(paginator.num_pages)

---

    return render(request, 'app_name/index.html', {'models': models})
```



📝 project_folder/app_name/templates/app_name/**index.html** </> index.html

```
{% extends 'app_name/base.html' %}
{% load static %}
B {% load django_bootstrap5 %}

{% block title %}Index Page{% endblock %}

{% block head %}
    <link rel="stylesheet" href="{% static 'app_name/css/index.css' %}">
{% endblock %}
```

...(more on next page)

📝 project_folder/app_name/templates/app_name/**index.html** </> index.html

```
{% block content %}

<h2>Welcome to the Index Page!</h2>

{% if models %}
    <ul class="list-group pb-3">
    {% for model in models %}
        <li class="list-group-item">
            <h2>{{ model.title }}</h2>
            <p>{{ model.country }}</p>
            <small class="text-muted">{{ model.created_at }}</small>
        </li>
    {% endfor %}
    </ul>
    <-- PAGINATION -->
{% endif %}

{% endblock %}
```

Pagination Example_1 ➖🅱 django-bootstrap5 📚library

```
<div class="pagination">
    <span class="links">

    {% if models.has_previous %}
        <a href="?page=1">&laquo; First</a>
        <a href="?page={{ models.previous_page_number }}">Previous</a>
    {% endif %}

    <span class="current">
        Page {{ models.number }} of {{ models.paginator.num_pages }}
    </span>

    {% if models.has_next %}
        <a href="?page={{ models.next_page_number }}">Next</a>
        <a href="?page={{ models.paginator.num_pages }}">Last &raquo;</a>
    {% endif %}

    </span>
</div>
```

Pagination Example_2 ➕🅱 django-bootstrap5 📚library

```
🅱 {% bootstrap_pagination models %}
```

📝 **Edit** & **Delete** Models

📝 project_folder/app_name/**urls.py** 🐍 urls.py **(BOTH)**

```
# Add below paths   integer (ℤ),  argument: model_id  (it's a custome name)

path('edit-model/<int:model_id>', views.editModelView, name='edit_model'),
path('delete-model/<int:model_id>', views.deleteModelView, name='delete_model'),

# URL example - localhost:8080/delete-model/2
```

📝 project_folder/app_name/**views.py** 🐍 views.py **(DELETE)**

```
from django.core.paginator import Paginator, EmptyPage, PageNotAnInteger
from django.shortcuts import render, redirect, get_object_or_404
from django.contrib import messages
from .forms import ModelForm
from .models import ModelName

---

def deleteModelView(request, model_id):
    model_instance = get_object_or_404(ModelName, pk=model_id)
    model_instance.delete() # ← Removes Model

    messages.warning(request, f'Deleted model: {model_instance.title}')

    return redirect('index')   # CALLS  path(... name='index')  at  urls.py
```

📝 project_folder/app_name/templates/app_name/**index.html** </> index.html **(BOTH)**

```
{% block content %}
...
{% for model in models %}
    <li class="list-group-item">
        <h2>{{ model.title }}</h2>
        <p>{{ model.country }}</p>
        <small class="text-muted">{{ model.created_at }}</small>
        <section class="d-flex justify-content-between">
            <a href="{% url 'edit_model' model.id %}">
                <button class="btn btn-secondary">Edit</button>
            </a>
            <a href="{% url 'delete_model' model.id %}">
                <button class="btn btn-danger">Delete</button>
            </a>
        </section>
    </li>
{% endfor %}
...
{% endblock %}
```

📝 project_folder/app_name/**views.py** 🐍 views.py **(EDIT)**

```python
from django.core.paginator import Paginator, EmptyPage, PageNotAnInteger
from django.shortcuts import render, redirect, get_object_or_404
from django.contrib import messages
from .forms import ModelForm
from .models import ModelName

# ---------------------------------------------------------------------------


def editModelView(request, model_id):
    model_instance = get_object_or_404(ModelName, pk=model_id)

    if request.method == 'POST':
        form = ModelForm(request.POST, instance=model_instance)

        if form.is_valid():
            form.save() # ← Updates Model
            messages.success(request, f'Saved model as: {model_instance.title}')

            return redirect('index')
        else:
            messages.error(request, f'Model not saved: {model_instance.title}')
    else:
        form = ModelForm(instance=model_instance)

    return render(request, 'app_name/form.html', {'form': form})
```

📝 project_folder/app_name/templates/app_name/**form.html** </> form.html **(EDIT)**

```
...
{% block content %}
<form action="{% url 'form' %}" enctype="multipart/form-data" method="POST">
    {% csrf_token %}  # Secures our data when sending it to the backend server
    {{ form|crispy }} # Formats form in bootstrap5 & supports error events
    <button type="submit">Create Model</button>
</form>
<form action="{% if form.instance.id %}{% url 'edit_model' form.instance.id %}
{% else %}{% url 'form' %}{% endif %}" enctype="multipart/form-data"
method="POST">
    {% csrf_token %}
    {{ form|crispy }}
    <button class="btn btn-success" type="submit">
        {% if form.instance.id %}
        <span>Update Model</span>
        {% else %}
        <span>Create Model</span>
        {% endif %}
    </button>
</form>
{% endblock %}
```

Register and **Login** new **Users**

Create **Users** App 👤

🖥️ (venv) @ project_folder — 🐍 manage.py

```
python manage.py startapp users
```

Register Users **App** and it's **Urls** to Django Website

📝 project_folder/my_website/**settings.py** — 🐍 settings.py

```
INSTALLED_APPS = [
    'django.contrib.admin',
    ...

    # Add libraries above apps
    'crispy_forms',
    'crispy_bootstrap5',
    ...

    # Add apps below
    'app_name.apps.AppNameConfig',
    'users.apps.UsersConfig',
]

...

LOGIN_REDIRECT_URL = 'index'  # Redirects to path(… name='index') on
                              # successful form POST from auth_views.LoginView

LOGOUT_REDIRECT_URL = 'login' # Redirects to path(… name='login') on
                              # successful form POST from auth_views.LogoutView
```

app_name > apps.py

```
from django.apps import AppConfig


Codeium: Refactor | Explain
class AppNameConfig(AppConfig):
    default_auto_field = 'django.db.models.BigAutoField'
    name = 'app_name'
```

📝 project_folder/my_website/**urls.py** — 🐍 urls.py

```
...

urlpatterns = [
    ...
    path('', include('app_name.urls')),

    # imports URLs from my_website/users/urls.py
    path('users/', include('users.urls')),
]
```

Django has build-in **generic Models, Forms & Views** for **Users** App

User (Build-in **Model**)

username, first_name, last_name, email, password (password: encrypted / hashed)

groups, user_permissions,

is_staff, is_active, **is_superuser** ← Boolean (True | False)

last_login, date_joined ← Date & Time fields

UserCreationForm (Build-in **Form**)

password1, password2 ← temporary fields used to create password

auth_views (Build-in **Class View**)

📝 project_folder/users/**forms.py** (**register** users) 🐍 forms.py

```
from django import forms
from django.contrib.auth.models import User
from django.contrib.auth.forms import UserCreationForm
```

```
class UserRegisterForm(UserCreationForm):
    email = forms.EmailField(max_length=255)
    first_name = forms.CharField(max_length=35, label='Forename')
    last_name = forms.CharField(max_length=35, label='Surname')

    class Meta:
        model = User
        fields = [
            'username',
            'first_name',
            'last_name',
            'email',
            'password1',
            'password2'
        ]
```

User model's build-in fields:
email, first_name & **last_name**, are overwritten in this **form**

📝 project_folder/users/**urls.py** (users) 🐍 urls.py

```
from django.urls import path
from django.contrib.auth import views as auth_views  #  ← (Build-in Class-View)
from . import views

---

urlpatterns = [
  path('login', auth_views.LoginView.as_view(template_name='users/form.html'),
name='login'),
   path('logout', auth_views.LogoutView.as_view(), name='logout'),
   path('register', views.registerUserView, name='register'),
]
```

📝 project_folder/users/**views.py** (users) 🐍 views.py

```
from django.shortcuts import render, redirect
from django.contrib.auth import authenticate, login
from django.contrib import messages
from .forms import UserRegisterForm

---

def registerUserView(request):
    if request.method == 'POST':
        form = UserRegisterForm(request.POST)
        if form.is_valid():
---
            # Register the user, (and returns user instance)
            user = form.save()
            messages.success(request, f'Created account: {user.username}')
---
            # Authenticate the user
            raw_password = form.cleaned_data.get('password1')
            user = authenticate(username=user.username, password=raw_password)
---
            # Sign-in new user
            if user is not None:
                login(request, user)
                messages.success(request, f'Logged-in: {user.username}')
                return redirect('index')
            else:
                messages.error(request, 'Failed to login user')
                return redirect('login')
---
        else:
            messages.error(request, 'Invalid credentials!')
    else:
        form = UserRegisterForm()

    return render(request, 'users/form.html', {'form': form, 'registry': True})
```

📝 project_folder/**users**/templates/users/**form.html** </> form.html

```
{% extends 'app_name/base.html' %}
{% load static %}
{% load crispy_forms_tags %}

{% block title %}
    {% if registry %}Register{% else %}Login{% endif %} Page
{% endblock %}
```

```
{% block content %}

    {% if user.is_authenticated and not registry %}
        <div class="p-3 mb-5 bg-light rounded">
            <p>You are already logged-in as: <strong>{{ user }}</strong>
            <br>would you like to sign-in to another account?</p>
        </div>
    {% endif %}
```

```
    <form method="POST" enctype="multipart/form-data">
        {% csrf_token %}
        {{ form|crispy }}
        <button type="submit" class="btn btn-success">
            <span>{% if registry %}Register{% else %}Login{% endif %}</span>
        </button>
    </form>
```

```
    <section class="float-end">
        {% if not registry %}
        <p>Don't have an account?  <a href="{% url 'register' %}">register now</a></p>
        {% else %}
        <p>Already have an account?  <a href="{% url 'login' %}">login now</a></p>
        {% endif %}
    </section>

{% endblock %}
```

📝 project_folder/**app_name**/templates/app_name/**index.html** </> index.html

```
{% block content %}
...
<a href="{% url 'form' %}">add model</a>
{% if user.is_authenticated %}

<form action="{% url 'logout' %}" method="POST">
    {% csrf_token %}
    <button type="submit" class="btn btn-warning">logout</button>
</form>

{% endif %}

{% endblock %}
```

NOTES

authenticate() from django.contrib.auth
adds property: **is_authenticated** to **user**

Hence: {% *if* user.**is_authenticated** %}

---

auth_view.LogoutView requires POST method, due to security reasons

Hence: <form action="{% url 'logout' %}" method="POST"> ✓

instead of: <a href="{% url 'logout' %}"> X

Secure Views 🔐

Anyone can access **views** to create, edit & delete **models**. Let's secure them!

📝 project_folder/app_name/**views.py** 🐍 views.py

```
def formView(request):

    if not request.user.is_superuser:
        messages.error(request, 'you must be logged-in as a super user')
        return redirect('index') # redirect client to URL path(... name='index') at 🐍 urls.py

    if request.method == 'POST':
        form = ModelForm(request.POST)
        if form.is_valid():
            form.save()
            return redirect('index')
    else:
        form = ModelForm()

    return render(request, 'app_name/form.html', {'form': form})
```

In above example, only users with special privilege may access a **formView**()
This approach is ideal for a website with **single-user** in mind

🔓 Let's secure the **view** for **multi-user-based** platform

📝 project_folder/app_name/**views.py** 🐍 views.py

```
from django.contrib.auth.decorators import login_required

@login_required(login_url='login')
def formView(request):

    if request.method == 'POST':
        form = ModelForm(request.POST)
        if form.is_valid():
            form.save()
            return redirect('index')
    else:
        form = ModelForm()

    return render(request, 'app_name/form.html', {'form': form})
```

decorator: **@login_required(**login_url='login'**)** redirects client to URL path(… name='login') at 🐍 urls.py

📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
LOGIN_URL = 'login'
```

NOT logged-in users trying to access to restricted **view:** @login_required are redirected to → URL path(… name='login') by default.

```
@login_required(login_url='login')
@login_required
def formView(request):
    ...
```

Profile Model

🖼️ 👧👦 📞

🖥️ (venv) @ project_folder 📚 pip library

```
pip install pillow django-resized
pip freeze > requirements.txt  # update requirements.txt
```

📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
INSTALLED_APPS = [
    'django.contrib.admin',
    ...

    # Add libraries above apps
    'django_resized',
    'crispy_forms',
    ...
]
```

📝 project_folder/users/**models.py** (**profile** users) 🐍 models.py

```
from django.db import models
from django.contrib.auth.models import User
from django_resized import ResizedImageField

---

class Profile(models.Model):

    user = models.OneToOneField(User, on_delete=models.CASCADE)
    phone_number = models.CharField(max_length=15)

    image = ResizedImageField(
        size=[300, 300],
        crop=['middle', 'center'],
        quality=75,
        force_format='JPEG',

        # 📁 /profile_pics
        upload_to='profile_pics',
        default='default_profile.jpg'
    )
```

models.CASCADE → Delete this model IF its referenced model is deleted

📁 **/profile_pics** is created at 🗂️ **/media** → 📁 **/media/profile_pics**

1. Register model: **Profile** in → 🐍 users/admin.py &
2. Using 🖥️ terminal: **makemigrations** + **migrate** them to the database →
3. Place: 🖼️ **default_profile.jpg** inside 🗂️ **/media** directory

📝 project_folder/users/**forms.py** (**profile** users) 🐍 forms.py

```
from django import forms
from django.contrib.auth.models import User
from django.contrib.auth.forms import UserCreationForm
from .models import Profile

class ProfileForm(forms.ModelForm):
    class Meta:
        model = Profile
        fields = ['phone_number']
...
```

📝 project_folder/users/**views.py** (**profile** users) 🐍 views.py

```
...

from .forms import UserRegisterForm, ProfileForm


def registerUserView(request):
    if request.method == 'POST':
        form_user = UserRegisterForm(request.POST)
        form_profile = ProfileForm(request.POST)

        if form.is_valid() and form_profile.is_valid():


---


            # Register the user, (and returns user instance)
            user = form_user.save()

            # Create Profile model for new user
            profile = form_profile.save(commit=False)
            profile.user = user
            profile.save()

            messages.success(request, f'Created account: {user.username}')

            # Authenticate the user
            raw_password = form_user.cleaned_data.get('password1')
            ...
---


...
    else:
        form_user = UserRegisterForm()
        form_profile = ProfileForm()

    context = {
        'registry': True,
        'register_view_forms': {
            'user': form_user,
            'profile': form_profile
        }
    }

    return render(request, 'users/form.html', context)
```

📝 project_folder/**users**/templates/users/**form.html** </> form.html

```
...
{% block content %}
    ...
    <form method="POST" enctype="multipart/form-data">
        {% csrf_token %}
    B {{ register_view_forms.profile|crispy }}
    B {{ register_view_forms.user|crispy }}
    B {{ form|crispy }} # ← auth_views.LoginView ← URL path(… name='login')
    ...
{% endblock %}
```

Update Profile Details Page

📝 project_folder/users/**forms.py** (**profile** users) 🐍 forms.py

```
class UserUpdateForm(forms.ModelForm):

    email = forms.EmailField(max_length=255)
    first_name = forms.CharField(min_length=4, max_length=35, label='Forename')
    last_name = forms.CharField(min_length=4, max_length=35, label='Surname')

    confirm_password = forms.CharField(
        widget=forms.PasswordInput,
        help_text='Surname'
    )
```

```
    class Meta:
        model = User
        fields = [
            'username',
            'email',
            'first_name',
            'last_name',
            'confirm_password'
        ]
```

📝 project_folder/users/**urls.py** (**profile** users) 🐍 urls.py

```
from django.urls import path
from django.contrib.auth import views as auth_views
from . import views
```

```
urlpatterns = [
  path('login', auth_views.LoginView.as_view(template_name='users/form.html'),…
name='login'),
  path('logout', auth_views.LogoutView.as_view(), name='logout'),
  path('register', views.registerUserView, name='register'),
  path('profile/<int:user_id>', views.profileView, name='profile'),
]
```

📝 project_folder/users/**views.py** (**profile** users) 🐍 views.py

```python
from django.contrib.auth.decorators import login_required
from django.shortcuts import render, redirect, get_object_or_404
from django.contrib.auth import authenticate, login
from django.contrib.auth.hashers import check_password
from django.contrib.auth.models import User
from django.contrib import messages
from .forms import UserRegisterForm, UserUpdateForm, ProfileForm
from .models import Profile
```

user_instance : **User** Model with ID → **user_id**

```python
@login_required
def profileView(request, user_id):
    user_instance = get_object_or_404(User, pk=user_id)

    if request.method == 'POST' and request.user.id == user_instance.id:
```

request.user.id : logged-in user's ID

```python
        form_user = UserUpdateForm(
            request.POST,
            instance=user_instance
        )
        form_profile = ProfileForm(
            request.POST,
            request.FILES,
            instance=user_instance.profile
        )
```

confirm_password : value of <input name="confirm_password">

```python
        if form_user.is_valid() and form_profile.is_valid():
            confirm_password = form_user.cleaned_data.get('confirm_password')

            if check_password(confirm_password, user_instance.password):
                form_user.save()
                form_profile.save()
                messages.success(request, 'Successfully updated profile')
            else:
                messages.error(request, 'Invalid password!')
                form_user.add_error('confirm_password', 'Invalid password!')
        else:
            messages.error(request, 'Invalid credentials!')
```

.add_error() → form|crispy → RED <input name="confirm_password"> + Error

```python
    else:
        form_user = UserUpdateForm(instance=user_instance)
        form_profile = ProfileForm(instance=user_instance.profile)

    context = {
        'profile_user': user_instance,
        'forms': {
            'user': form_user,
            'profile': form_profile
        }
    }

    return render(request, 'users/profile.html', context)
```

📝 project_folder/**users**/templates/users/**profile.html** </> profile.html

```
{% extends 'app_name/base.html' %}
{% load static %}
{% load crispy_forms_tags %}
{% block title %}Profile Page{% endblock %}
{% block content %}
<div class="container">
    <div class="row">
        <aside class="col-md-4">
            <div class="p-3 bg-secondary text-white">
                <img width="100%" src="{{ profile_user.profile.image.url }}">
            </div>
        </aside>
        <main class="col-md-8">
            <div class="p-3 bg-light">
                {% if user.id == profile_user.id %}
                    <form action="{% url 'profile' profile_user.id %}"
                          enctype="multipart/form-data"
                          method="POST"
                    >
                        {% csrf_token %}
                    {{ forms.profile|crispy }}
                    {{ forms.user|crispy }}
                        <button class="btn btn-warning" type="submit">Update Profile</button>
                    </form>
                {% else %}
                    {% for field in forms.user %}
                        {% if field.label|lower != "confirm password" %} <!-- Disclude: confirm_password -->
                            <div class="mb-3">
                                <label for="{{ field.id_for_label }}" class="form-label">{{ field.label }}</label>
                                <p class="bg-white p-3" id="{{ field.id_for_label }}">{{ field.value }}</p>
                            </div>
                        {% endif %}
                    {% endfor %}
                    {% for field in forms.profile %}
                        {% if field.label|lower != "image" %} <!-- Disclude: image -->
                            <div class="mb-3">
                                <label for="{{ field.id_for_label }}" class="form-label">{{ field.label }}</label>
                                <p class="bg-white p-3" id="{{ field.id_for_label }}">{{ field.value }}</p>
                            </div>
                        {% endif %}
                    {% endfor %}
                {% endif %}
            </div>
        </main>
    </div>
</div>
{% endblock %}
```

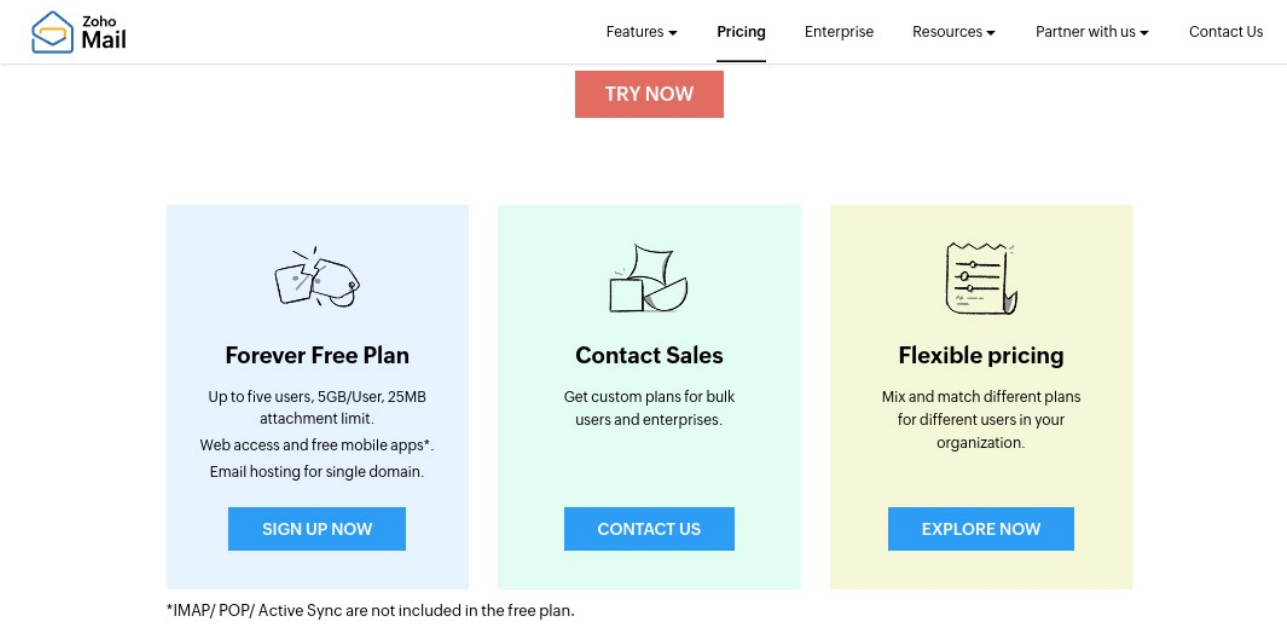
📝 project_folder/**app_name**/templates/app_name/**index.html** </> index.html

```
...
<a href="{% url 'form' %}" class="float-start">add model</a>

<a href="{% if request.user.is_authenticated %}{% url 'profile' request.user.id
%}{% else %}{% url 'login' %}{% endif %}" class="float-end">
    <button type="submit" class="btn btn-primary ms-3">profile</button>
</a>
{% if request.user.is_authenticated %}
<form action="{% url 'logout' %}" method="POST" class="float-end">
    {% csrf_token %}
    <button type="submit" class="btn btn-warning">logout</button>
</form>
{% endif %}

...
```

Update User’s **password** using custom **Email**

🎨 👦👧 ☎️

Zoho Mail



Email is required for this stage
Hence, I will be using Zoho mail's

Forever Free Plan

(you can also create and manage additional emails via admin user)

admin@… , noreply@… , support@…

However, you may need to
buy a **domain** for custom emails

GoDaddy

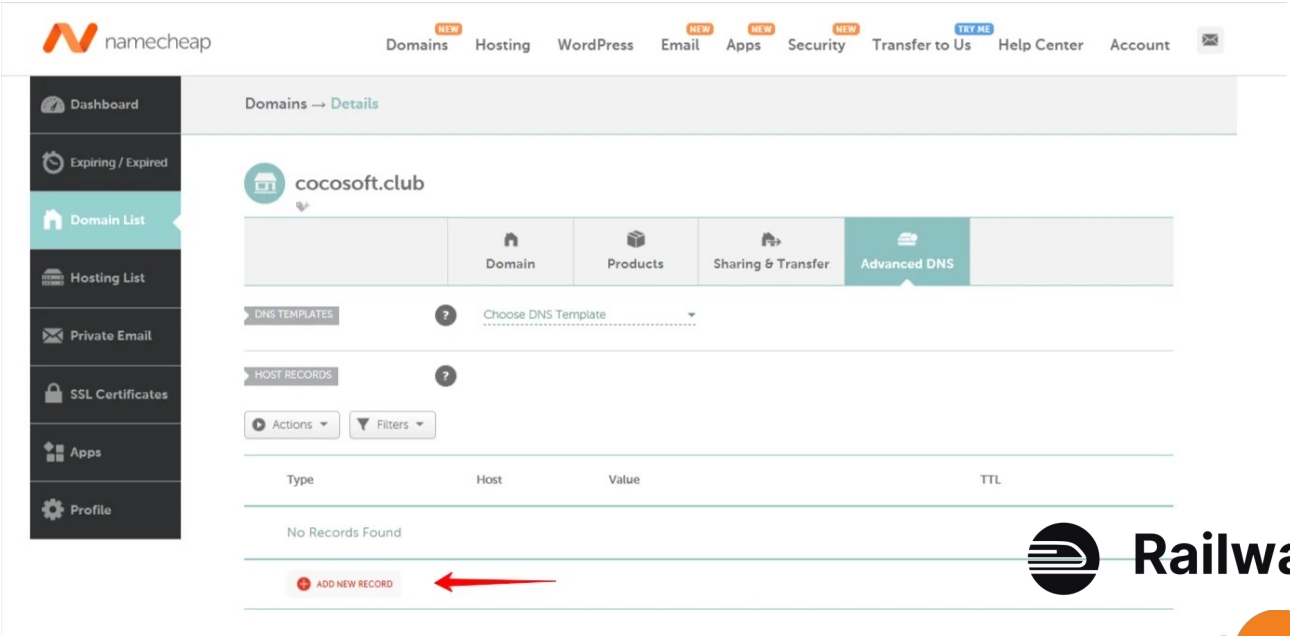
OR

namecheap

HOSTINGER

Hostinger provides domains and can host websites

I personally recommend **NameCheap**
service as it’s easy to manage



Railway

CLOUDFLARE

Domain can be linked to
Email & Web-Hosting, Services

ZOHO

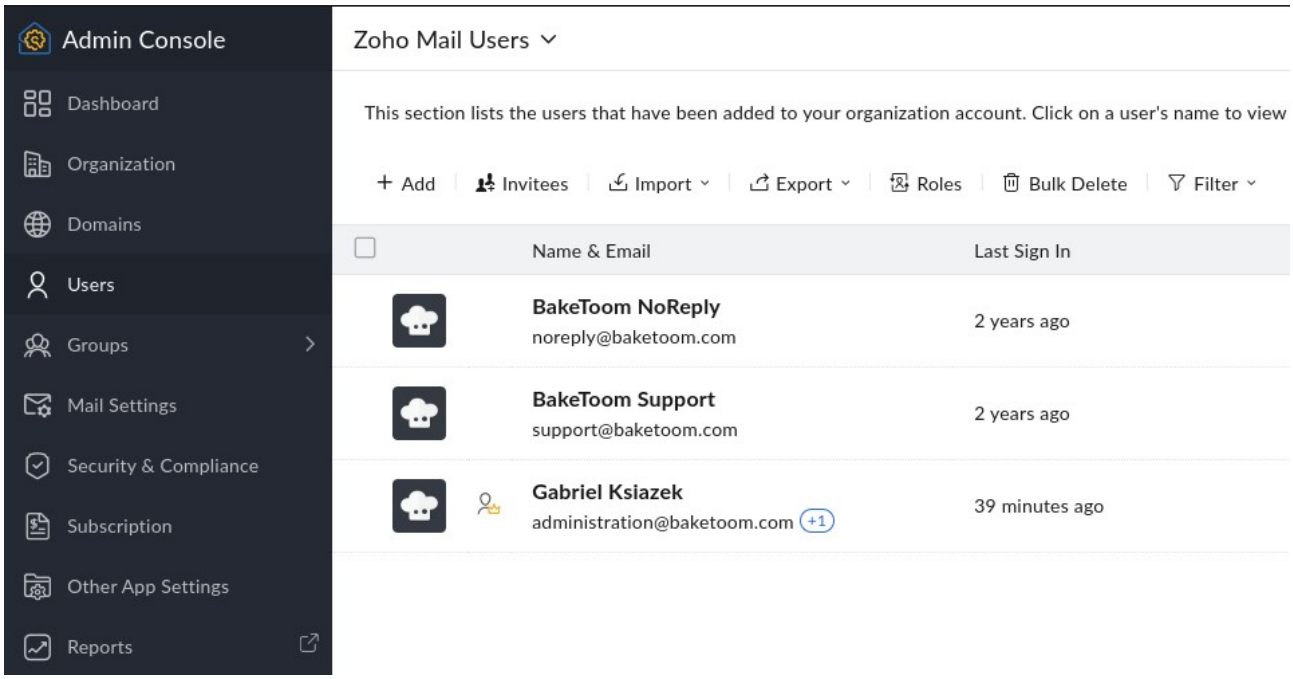
heroku

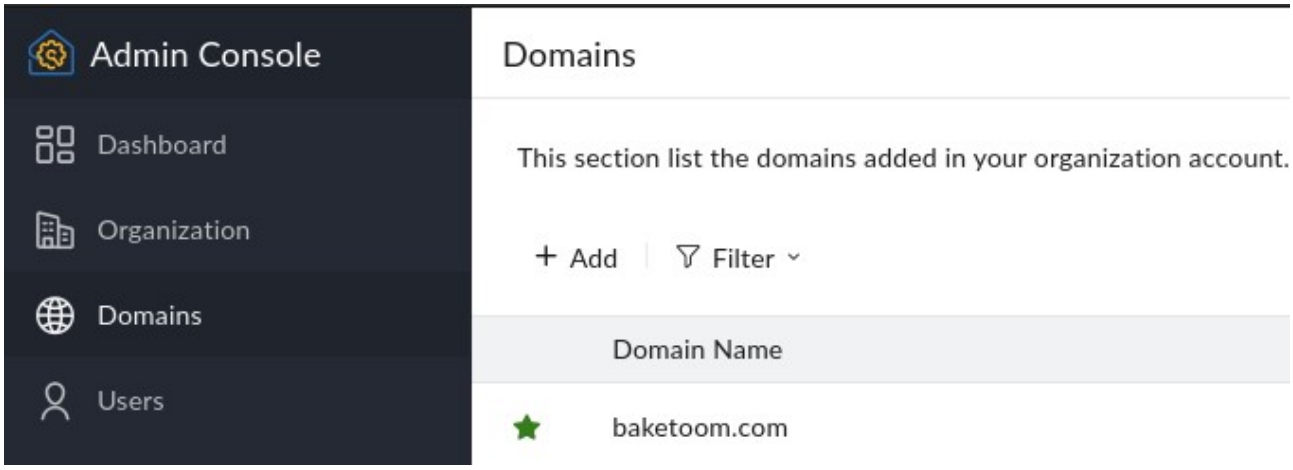
Zoho Admin Console

mailadmin.zoho.com | mailadmin.zoho.eu

Email Hosting Guide (link at dashboard)

https://www.zoho.com/mail/help/adminconsole/email-hosting-setup.html





📝 project_folder/**.env** .env

```
...

# Zoho Mail : Account

EMAIL_HOST_USER='noreply@domain.com'
EMAIL_HOST_PASSWORD='email's password here'
```

📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
...

EMAIL_BACKEND = 'django.core.mail.backends.smtp.EmailBackend'
EMAIL_HOST = 'smtp.zoho.eu'
EMAIL_PORT = 587
EMAIL_USE_TLS = True
EMAIL_USE_SSL = False # Avoid SSL because it's less secure

EMAIL_HOST_USER = os.getenv('EMAIL_HOST_USER')
EMAIL_HOST_PASSWORD = os.getenv('EMAIL_HOST_PASSWORD')
DEFAULT_FROM_EMAIL = f'(Domain) <{EMAIL_HOST_USER}>'

# DEFAULT_FROM_EMAIL : (Domain) <noreply@domain.com>
```

📝 project_folder/users/**urls.py** (**profile** users) 🐍 urls.py

```
from django.urls import path
from django.contrib.auth import views as auth_views
from . import views


---

urlpatterns = [
   path('login', auth_views.LoginView.as_view(template_name='users/form.html'),
name='login'),
   path('logout', auth_views.LogoutView.as_view(), name='logout'),
   path('register', views.registerUserView, name='register'),

   path('password-reset/',
      auth_views.PasswordResetView.as_view(
         template_name='users/password_reset.html'),
      name='password_reset'),

   path('password-reset/done/',
      auth_views.PasswordResetDoneView.as_view(
         template_name='users/password_reset_done.html'),
      name='password_reset_done'),

   path('password-reset-confirm/<uidb64>/<token>/',
      auth_views.PasswordResetConfirmView.as_view(
         template_name='users/password_reset_confirm.html'),
      name='password_reset_confirm'),

   path('password-reset-complete/',
      auth_views.PasswordResetCompleteView.as_view(
         template_name='users/password_reset_complete.html'),
      name='password_reset_complete'),

]
```

📝 project_folder/**users**/templates/users/**profile.html** </> profile.html

```
...
 <form action="{% url 'profile' profile_user.id %}"
       enctype="multipart/form-data"
       method="POST"
 >
      {% csrf_token %}
 B    {{ forms.profile|crispy }}
 B    {{ forms.user|crispy }}
      <button class="btn btn-warning" type="submit">Update Profile</button>
      <div class="row justify-content-between">
           <div class="col-auto">
                <button class="btn btn-warning" type="submit">Update
Profile</button>
           </div>
           <div class="col-auto">
                <a href="{% url 'password_reset' %}" class="btn btn-link">change
password</a>
           </div>
      </div>
 </form>
...
```

📝 project_folder/**users**/templates/users/**password_reset.html** </>

```
{% extends 'app_name/base.html' %}
{% load static %}
{% load crispy_forms_tags %}
{% block title %}Reset Password{% endblock %}

{% block content %}

<form action="{% url 'password_reset' %}"
     enctype="multipart/form-data"
      method="POST"
>
    {% csrf_token %}
B   {{ form|crispy }}
    <button type="submit" class="btn btn-warning">
        <span>Request Password Change</span>
    </button>
    <a href="javascript:history.back()" class="float-end">
        <span>Return to previous page</span>
    </a>
</form>
{% endblock %}
```

📝 project_folder/**users**/templates/users/**password_reset_done.html** </>

```
{% extends 'app_name/base.html' %}
{% load static %}
{% block title %}Reset Password{% endblock %}

{% block content %}

<div class="mx-auto" style="max-width: 750px">
    <section class="bg-light p-3 mb-3">
        <h1 class="fs-3">Request sent</h1>
        <p>An email with instructions to reset your password has been sent to
the email address you entered.</p>
    </section>
    <section class="d-flex justify-content-between">
        <a href="{% url 'password_reset' %}">
            <button type="submit" class="btn btn-warning">
                <span>Resend request</span>
            </button>
        </a>
        <a href="{% url 'index' %}">
            <button type="submit" class="btn btn-primary">
                <span>Continue</span>
            </button>
        </a>
    </section>
</div>

{% endblock %}
```

📝 project_folder/**users**/templates/users/**password_reset_confirm.html** </>

```
{% extends 'app_name/base.html' %}
{% load static %}
{% load crispy_forms_tags %}
{% block title %}Reset Password{% endblock %}
{% block content %}

{% if form %}
<form method="POST" enctype="multipart/form-data">
    {% csrf_token %}
    {{ form|crispy }}
    <button type="submit" class="btn btn-warning">
        <span>Change Password</span>
    </button>
</form>
{% else %}
<div class="mx-auto" style="max-width: 750px">
    <section class="bg-light p-3 mb-3">
        <h1 class="fs-3">Request sent</h1>
            <p>ERROR 404 - Something went lost in the dust of the universe.</p>
    </section>
</div>
{% endif %}

{% endblock %}
```

📝 project_folder/**users**/templates/users/**password_reset_complete.html** </>

```
{% extends 'app_name/base.html' %}
{% load static %}
{% block title %}Reset Password{% endblock %}
{% block content %}

<div class="mx-auto" style="max-width: 750px">
    <section class="bg-light p-3 mb-3">
        <h1 class="fs-3">Success!</h1>
        <p>Your password has been updated successfully.</p>
    </section>
    <a href="{% url 'index' %}">
        <button type="submit" class="btn btn-primary">
            <span>Continue to main page</span>
        </button>
    </a>
</div>

{% endblock %}
```

Models are modifiable by
all logged-in users

Let’s Create, Edit & Delte
User’s Models only!


📝 project_folder/app_name/**models.py** 🐍 models.py

```
from django.db import models
from django.contrib.auth.models import User
from django.utils.translation import gettext_lazy as _

class ModelName(models.Model):

  id = models.AutoField(primary_key=True)
  creator = models.ForeignKey(User, on_delete=models.CASCADE)

  title = models.CharField(
      max_length=100,
...
```

🖥️ (venv) @ project_folder 🐍 manage.py # **IGNORE BELOW CODE** (Reminder Example)

! IMPORTANT NOTE !

You should **ALWAYS** execute:

```
python manage.py makemigrations
python manage.py migrate
```

when you **create** & **update** models.py
to initialize the model table in database

```
class Model(models.Model):
  name = models.CharField()
  context = models.TextField()

  def __str__(self):
    return f"Model(name={self.name},context={self.context})"
```

In settings.py - The **DEFAULT_AUTO_FIELD** allows you to specify the default type of auto-incrementing primary key field that will be used for models that do not explicitly define a primary key.
DEFAULT_AUTO_FIELD @ djangoproject.com

```
DEFAULT_AUTO_FIELD = 'django.db.models.BigAutoField'
```

🖥️ (venv) @ project_folder 🐍 manage.py

Sometimes, you may have to **remove migrations**: 🐍 NNNN_initial.py from app_name
you can also make migrations with --fake flag to resolve conflicts (← AVOID!)

```
python manage.py migrate --fake          ← Avoid using: --fake OR --fake-initial
python manage.py migrate --fake-initial Used for integrating existing db schema

python manage.py migrate --fake app_name zero  ← Use these commands when you
python manage.py makemigrations app_name         can't fix conflicts and want
python manage.py migrate app_name                to preserve your database data
```

🖥️ (venv) @ project_folder 🐍 manage.py (shell)

We also have old instances of model: ModelName.
Update their **creator field** manually **OR delete** them all:

```
python manage.py shell
(shell) >> from app_name.models import ModelName
(shell) >> ModelName.objects.all().delete()
(shell) >> exit()
```

📝 project_folder/app_name/**views.py** 🐍 views.py

```
...
from django.contrib.auth.decorators import login_required
from django.shortcuts import render, redirect, get_object_or_404
from django.contrib import messages
from .forms import ModelForm
from .models import ModelName
```

```
@login_required
def formView(request):                                    # CreateModelView
    if request.method == 'POST':
        form = ModelForm(request.POST)
        if form.is_valid():
            form.save()
            model_instance = form.save(commit=False)
            model_instance.creator = request.user
            model_instance.save()

            messages.success(request, 'Model created successfully!')
            return redirect('index')
        else:
            messages.error(request, 'Failed to create new model!')
    else:
        form = ModelForm()

    return render(request, 'app_name/form.html', {'form': form})

...
```

```
# (OPTIONAL EXAMPLE) - declare custom functions in  🐍 views.py
#    use:  user_instance == model_instance.creator         # (for simplicity)
# or use:  is_model_creator(model_instance, user_instance) # (for semanticity)


def is_model_creator(model_instance, user_instance):
    return user_instance == model_instance.creator # → True | False
```

```
from django.core.exceptions import ValidationError
from django.db.models import Model

def is_model_creator(model_instance=None, user_instance=None):

    if model_instance is None or user_instance is None:
        raise ValueError("Both 'model_instance' and 'user_instance' must be provided")

    if not isinstance(model_instance, Model):
        raise ValidationError(f"{model_instance} is not a valid Django model instance")

    if not hasattr(model_instance, 'creator'):
        raise ValidationError(f"{model_instance} does not have a 'creator' field")

    return user_instance == model_instance.creator
```

📝 project_folder/app_name/**views.py** 🐍 views.py

```python
...

@login_required
def editModelView(request, model_id):
    model_instance = get_object_or_404(ModelName, pk=model_id)

    if not is_model_creator(model_instance, request.user):
        messages.error(request, 'You are not the owner of this model')
        return redirect('index')

    if request.method == 'POST':
```

```python
@login_required
def deleteModelView(request, model_id):
    model_instance = get_object_or_404(ModelName, pk=model_id)

    if not is_model_creator(model_instance, request.user):
        messages.error(request, 'You are not the owner of this model')
        return redirect('index')

    model_instance.delete()
    messages.warning(request, f'Deleted model: {model_instance.title}')

    return redirect('index')
```

Search for Users' **Models** 🔎

📝 project_folder/app_name/templates/app_name/**index.html** </> index.html

```
<form method="POST" action="{% url 'index' %}{% if request.GET %}?{% for key, value in request.GET.items %}{{ key }}={{ value }}{% if not forloop.last %}&{% endif %}{% endfor %}{% endif %}">

    {% csrf_token %}
    <div class="input-group py-3">

        <input  type="search"
         placeholder="Search"
               class="form-control rounded-start"
                name="search_query">

        <button type="submit" class="btn btn-outline-primary">search</button>

    </div>
</form>
```

Include Search bar 🔎

📝 project_folder/app_name/**views.py** 🐍 views.py

```
...
def indexView(request):

    model_list = ModelName.objects.all()

    if request.method == 'POST':
        search = request.POST.get('search_query')
        if search:
            model_list = model_list.filter(title__icontains=search)

---

    #localhost:8000/?country_code=PL&creator=McRaZick → request.GET.items()

    for key, value in request.GET.items():
        if key == 'country_code':                   # PL
            model_list = model_list.filter(country=value)
        elif key == 'creator_id':                   #
            model_list = model_list.filter(creator=value)
        elif key == 'creator':                                          # McRa…
            model_list = model_list.filter(creator__username__icontains=value)

...
```

title, **country** & **creator** are fields of model: ModelName @ app_name.models.py

Django Lookup for ORM (Object-Relational Mapping): **.filter(field__lookup)**		**Queryset Lookups**
Category	**Regexp Equivalent**	**Lookup**
Exact match	^value$	field__exact="value"
Case-insensitive Exact match	(?i)^value$	field__iexact="value"
Contains	.*value.*	field__contains="value"
Case-insensitive Contains	(?i).*value.*	field__icontains="value"
In		field__in=[**value1**, **value2**, ...]
>		field__gt=**value**
>=		field__gte=**value**
<		field__lt=**value**
<=		field__lte=**value**
Starts with	^value.*	field__startswith="value"
Case-insensitive Starts with	(?i)^value.*	field__istartswith="value"
Ends with	.*value$	field__endswith="value"
Case-insensitive Ends with	(?i).*value$	field__iendswith="value"
Range (From → To)		field__range=(**start_value**, **end_value**)

The **code** we've implemented is decent but it **is also faulty**. For example:

```
When client uses pagination buttons, we will only receive:
localhost:port/?page=N in our URL.

By adding query parameter: &country_code=GB,
and heading to the next page, using template's pagination button,

we expect our URL to become: localhost:port/?page=N&country_code=GB.

However, we are redirected to: localhost/?page=N+1, instead.
```

This is an **issue because** additional **filters** will **not** be **applied**.

Another issue is with the `<form action ...>`. It's cool that we can include any query parameter and also use a `search <button>` to also filter the models' title.

However, this is **impractical**, because **if client decides to make a new search**, then the additional filters will not be removed. It's more practical to include additional filters using radio buttons and checkboxes.

📝 project_folder/app_name/templates/app_name/**index.html** </> index.html

```
<form method="POST" action="{% url 'index' %}{% if request.GET %}?{% for key, value in request.GET.items %}{{ key }}={{ value }}{% if not forloop.last %}&{% endif %}{% endfor %}{% endif %}">
    ...
</form>
```

Remove the above code &
Use django_bootstrap5 librarie's pagination, with **url** argument like so:

```
{% bootstrap_pagination models url=request.build_absolute_uri %}
```

📝 project_folder/app_name/**views.py** 🐍 views.py

```
from django.urls import reverse
from django.http import HttpResponseRedirect
```

```
...
def indexView(request):

    model_list = ModelName.objects.all()

    if request.method == 'POST':
        search = request.POST.get('search_query')
        if search:
            # Note: request.GET is immutable, hence we need to create a mutable copy.
            query_params = request.GET.copy() # query_params is a mutable copy
            query_params['search'] = search    # add search parameter to request copy

            new_url = reverse('index') + "?" + query_params.urlencode()

            # return back to the previous render, with updated url
            return HttpResponseRedirect(new_url)

            model_list = model_list.filter(title__icontains=search)


    for key, value in request.GET.items():
        if key == 'search':
            model_list = model_list.filter(title__icontains=search)
        elif key == 'country_code':
        if key == 'country_code':
            model_list = model_list.filter(country=value)
...
```

.urlencode() method converts special characters to %XX format:

Space	( )	%20 or +
Exclamation Mark	(!)	%21
Double Quote	(")	%22
Hash	(#)	%23
Dollar	($)	%24
Percent	(%)	%25
Ampersand	(&)	%26
Plus	(+)	%2B
Equals	(=)	%3D
Question Mark	(?)	%3F

There is more...

reverse - is used to IMIDIEATELY get the url.
(from my_website/urls.py file) - often used in - function_based views

reverse_lazy - is used to get the url later when needed.
(from my_website/urls.py file) - often used in - class_based views

---

This is a better solution, however, we haven't implemented our filters just yet. We can include the query parameters into the URL with JavaScript. Or do that in the backend.

I will implement a solution in the backend out of preference and to demonstrate view's control flow of request in custom function, and show other cool perks :)

📝 project_folder/app_name/templates/app_name/**index.html** </> index.html

```
...
<form action="{% url 'index' %}" enctype="multipart/form-data" method="POST">
   {% csrf_token %}
   <div class="input-group py-3">
      <input type="search" name="search_query" class="form-control rounded-start"
placeholder="Search">
      <button type="submit" class="btn btn-outline-primary">search</button>
   </div>
```

```
   <div id="filters">
      <h3 class="fs-4">Include filters in your search</h3>
      <ul class="list-inline list-unstyled py-2">
```

```
         <li class="list-inline-item">
            <label for="creator_empty">no creator:</label>
            <input type="radio" name="creator" id="creator_empty" checked>
         </li>
         <li class="list-inline-item">
            <label for="creator_username">creator username:</label>
            <input type="radio" name="creator" id="creator_username">
         </li>
         <li class="list-inline-item">
            <label for="creator_id">creator id:</label>
            <input type="radio" name="creator" id="creator_id">
         </li>
```

```
         <li class="mt-2">
            <input type="text" name="creator_username_value" id="creator_value"
class="form-control mt-2" placeholder="Enter model creator's username" disabled hidden>
            <input type="text" name="creator_id_value" id="creator_value" class="form-
control mt-2" placeholder="Enter model creator's ID" disabled hidden>
         </li>
         <li class="my-2">
            <label for="country_code">country code:</label>
            <input type="checkbox" name="country_code" id="country_code">
            <input type="text" name="country_code_value" id="country_code_value"
class="form-control mt-2" placeholder="Enter model's country code" disabled>
         </li>
```

```
      </ul>
   </div>
</form>
...
```

```
...

{% block base %}
    <script name="search.js" src="{% static 'app_name/js/search.js' %}" defer></script>
{% endblock %}
```

📝 `project_folder/app_name/static/app_name/js/search.js` JS search.js

```
// location - localhost:port/?param1=a&param2=b...
// location.search - param1=a&param2=b...

// Get search parameters into Map Object with their values
const search = document.location.search.slice(1).split('&');

// searchMap - Map(param1 -> a, param2 -> b...)
const searchMap = new Map(search.map(s => {
    const [key, value] = s.split('=');
    return [key, decodeURIComponent(value)];
}));


// searchMap - Map(param1 -> a, param2 -> b...)
const filters = document.querySelector('#filters');


---

function showOnlySpecifiedCreatorInput(input_id, value) {
    /* Summary of this function:
    /
    / Hides all creator inputs,
    / Shows creator input specified by input_id, and
    / It optionally updates creator input's value if provided
    */

    let creatorInputs = filters.querySelectorAll('#creator_value');
    [...creatorInputs].map(input => {
        input.disabled = true;
        input.hidden = true;
    });

    if (input_id == undefined) return;

    let input = filters.querySelector(`#creator_value[name=${input_id}]`);
    input.disabled = false;
    input.hidden = false;

    if (value != undefined) input.value = value;
}
```

```
// hides all #creator_value inputs at #filters
showOnlySpecifiedCreatorInput();


// Populate filters if location.search has expected parameters
for (const [key, value] of searchMap) {
    switch (key)
    {
    case 'search':
        document.querySelector('input[name=search_query]').value =
searchMap.get('search');
        break;

    case 'creator':
        filters.querySelector('#creator_username').checked = true;
        // shows #creator_value[name=creator_username_value] and update its value
        showOnlySpecifiedCreatorInput('creator_username_value', value);
        break;

    case 'creator_id':
        filters.querySelector('#creator_id').checked = true;
        // shows #creator_value[name=creator_username_value] and update its value
        showOnlySpecifiedCreatorInput('creator_id_value', value);
        break;

    case 'country_code':
        filters.querySelector('#country_code').checked = true;
        filters.querySelector('#country_code_value').disabled = false;
        filters.querySelector('#country_code_value').value = value;
        break;
    }
}
```

```
// Make radio filters for #creator_value inputs work
const radios = filters.querySelectorAll('input[name=creator]');
    [...radios].map(radio => {
        radio.addEventListener('change', () => {
        if (radio.checked && radio.id != 'creator_empty') {
            // shows #creator_value input of filter option: #radio.id
            showOnlySpecifiedCreatorInput(radio.id + '_value');
        } else {
            // hides all filter: #creator_value, inputs
            showOnlySpecifiedCreatorInput();
        }
    });
});
```

```
// Toggle country code input's active state
let checkbox = filters.querySelector('#country_code');
checkbox.addEventListener('change', () => {
   if (checkbox.checked) {
      filters.querySelector('#country_code_value').disabled = false;
   } else {
      filters.querySelector('#country_code_value').disabled = true;
   }
});
```

📝 project_folder/app_name/**views.py** 🐍 views.py

```
...
def indexView(request):

    model_list = ModelName.objects.all()

    if request.method == 'POST':
        search = request.POST.get('search_query')
        if search:
            # Note: request.GET is immutable, hence we need to create a mutable copy.
            query_params = request.GET.copy()  # query_params is a mutable copy
            query_params['search'] = search    # add search parameter to request copy

            new_url = reverse('index') + "?" + query_params.urlencode()
            new_url = reverse('index') + "?" + request_search_filter_params(request)
            # return back to the previous render, with updated url
            return HttpResponseRedirect(new_url)
```

```
    for key, value in request.GET.items():
        if key == 'search':
            model_list = model_list.filter(title__icontains=search)
        elif key == 'country_code':
            model_list = model_list.filter(country=value)
...
```

NOTE: **request_search_filter_params()** is a custom function which is defined at the next page

📝 project_folder/app_name/**views.py** 🐍 views.py

```
...

def is_model_creator(model_instance, user_instance):
    return model_instance.creator == user_instance
```

```
def request_search_filter_params(request):
    """
    Converts posted form arguments, to permitted search url parameters.
    Additional parameters are filtered from the request copy: GET_copy.

    Returns:
        GET_copy (QueryDict) with valid parameters
    """
```

```
    # Note: requests are immutable, hence we need to create a mutable copy
    GET_copy = request.GET.copy()      # GET_copy is a mutable copy
    POST_copy = request.POST.copy() # POST_copy is a mutable copy

    # Remove 'creator_id_value' if 'creator_username_value' exists
    if request.POST.get('creator_id_value') and request.POST.get('creator_username_value'):
        POST_copy.pop('creator_id_value')
```

```
    # Add parameters to copy of request GET
    for key, value in POST_copy.items():

        if key == 'search_query':
            GET_copy['search'] = value

        elif key == 'creator_id_value':
            try: # Remove invalid 'creator_id' parameter
                GET_copy['creator_id'] = int(value)
            except ValueError:
                messages.error(request, 'Creator\'s ID must be an Integer!')

        elif key == 'creator_username_value':
            GET_copy['creator'] = value

        elif key == 'country_code_value':
            GET_copy['country_code'] = value
```

```
    return GET_copy.urlencode()
...
```

Place **request_search_filter_params** function somewhere above **indexView**

Right, although this code might work initially, there are a couple of issues.
I decided to implement faulty code as an example of deseption of a naming convention: **urlencode**()

GET_copy = request.GET.copy() → **QueryDict** (from django.http import QueryDict)

QueryDict('param1=Hello&param2=World') → <param1: [‘Hello’], param2: [‘World’]>

We can’t just pass this data in cases were: **QueryDict**('param=Hello World')
Because it includes unsupported characters upon return, like a space character.

Because unsupported string characters are present in our **GET_copy** QueryDict.
urlencode() is thus required to avoid errors. However, its encoding changes URL:

```
new_url = localhost:port/?param=Hello+World.
```

This is not a recognized URL encoding by JavaScript’s **decodeURIComponent**()
Hence, the + in ?param, will be ignored, introducing this “plus” character in our template form’s <input> data.

It gets worse when clients POSTS back this received param data to the server.

Let’s fix it

📝 project_folder/app_name/**views.py** 🐍 views.py

```
def get_request_with_valid_search_filter_parameters(request):
def request_search_filter_params(request):
    ...
    return GET_copy
```

Update function’s name to make it more semantic
Remove urlencode() **from** retun GET_copy

```
def get_encoded_parameters_from_request(request):
    """
    Returns: parameters (as string), in URI Encoded form of a request (QueryDict).
    E.g. IN: request items, OUT: item1=value1&item2=Hello%20World
    """
    parameters = '&'.join([f"{key}={quote(str(value))}" for key, value in request.items()])
    return parameters

def http_response_redirect_with_parameters(path_name, parameters):
    new_url = reverse(path_name) + '?' + parameters
    return HttpResponseRedirect(new_url)
```

Add both functions below **request_with_valid_search_filter_params**()

```
from urllib.parse import quote
```

Import **quote** (there is also **unquote** in cause you'd need it)

```
...
def indexView(request):

    model_list = ModelName.objects.all()

    # Handle POST request (search form submission)
    if request.method == 'POST':
        R = get_request_with_valid_search_filter_parameters(request)
        params = get_encoded_parameters_from_request(R)
        # Redirect to indexView with search filter parameters in URI
        return http_response_redirect_with_parameters('index', params)
    if request.method == 'POST':
        search = request.POST.get('search_query')
        if search:
            new_url = reverse('index') + "?" + request_search_filter_params(request)
            # return back to the previous render, with updated url
            return HttpResponseRedirect(new_url)
```

Update indexView's - if request.method == 'POST':

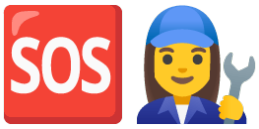
WARNING!

Test this search and especially the pagination.

This code might be faulty because I have documented the solution too soon, after couple of improvements.

IF the code is faulty, debug it and improve it. OR,
head to the Section - **Django HTMX - Infinite Scroll**

Contact Us View
(Support)



📝 project_folder/app_name/**forms.py** 🐍 forms.py

```
...
class ContactUsForm(forms.Form):

    TOPIC_CHOICES = [
        ('', ' --- Select a topic --- '),
        ('auth_failure', 'I can\'t access my account'),
        ('auth_failure', 'I can\'t log in with my email address'),
        ('auth_failure', 'I can\'t log in with my username'),
        ('auth_failure', 'I can\'t log in with my TFA code'),
        ('impersonation', 'Someone is impersonating me'),
        ('report_user', 'User violates terms and conditions'),
        ('bug_report', 'A feature on a website is broken'),
        ('other', 'Other')
    ]

    email = forms.EmailField(label='Email', max_length=255)

    subject = forms.ChoiceField(
        label='Subject',
        choices=TOPIC_CHOICES,
        required=True
    )

    message = forms.CharField(
        label='Message',
        widget=forms.Textarea,
        initial=''+
            'Hello, my name is: Forename Surname\n\n'+
            'I would like to report the following issue:',
        max_length=10000,
        min_length=250,
        required=True
    )
```

NOTE the use of: forms.**Form** , instead of , forms.**ModelForm**

ModelForm uses sub-class Meta to link **Model** and it's Fields

There is no need for a model. Hence, the use of a normal **Form**

📝 project_folder/app_name/**views.py** 🐍 views.py

```
...
from django.core.mail import send_mail, EmailMultiAlternatives
from django.conf import settings
from django.utils.html import escape
...
```

```
...


def email_client_and_support_team(email, subject, message):
    # Escape HTML tags to treat them as plain text
    escaped_message = escape(message)

    # Replace newline characters with <br> for the HTML content
    html_message = escaped_message.replace('\n', '<br>')

    recipient_message = (
      '<p style="color: rgb(95,95,95);font-family: &amp;quot;Indeed Sans&amp;quot; , &amp;quot;Noto
Sans&amp;quot; , Helvetica , Arial , sans-serif;font-size: 14.0px;font-weight: normal;line-height:
24.0px;margin: 0;padding: 0;direction: ltr;">'
      '<strong>You have sent the following message to our support
team:</strong><br><br>'
      f'{html_message}<br><br>'
      '<strong>Our support team will get back to you as soon as possible.</strong><br>'
      '<strong>Feel free to ignore this email if it wasn\'t you.</strong>'
      '</p>'
    )

    # Send HTML email to recipient
    email_to_recipient = EmailMultiAlternatives(
        subject=f"Support Request: {subject}",
        body=recipient_message,
        from_email=settings.EMAIL_HOST_USER,
        to=[email]
    )

    # Send email to recipient
    email_to_recipient.attach_alternative(recipient_message, "text/html")
    email_to_recipient.send()

    # Send email to support team
    send_mail(
        subject=f'Support Request: {subject}',
        message=f'{message}\n\nRequest from (Email): {email}',
        from_email=settings.EMAIL_HOST_USER,
        recipient_list=['support@walentynki.site']
    )
```

Let's **create** **contactFormView** **below** **email_client_and_support_team**

NOTE: **email_client_and_support_team** is our custom function at 🐍 views.py

📝 project_folder/app_name/**views.py** 🐍 views.py

```
...
from .forms import ModelForm, ContactUsForm
...
```

```
...


def contactFormView(request):

    if request.method == 'POST':
        form = ContactUsForm(request.POST)
```

```
        if form.is_valid():
            email = form.cleaned_data['email']
            subject = form.cleaned_data['subject']
            message = form.cleaned_data['message']

            email_client_and_support_team(email, subject, message)

            messages.success(request, 'Message sent successfully!')
            messages.info(request, f'We will contact you shortly at: {email}')

            # Reset some fields to their default values
            initial_data = form.cleaned_data.copy()
            initial_data['subject'] = ContactUsForm.TOPIC_CHOICES[0][0]
            initial_data['message'] = ContactUsForm.base_fields['message'].initial

            form = ContactUsForm(initial=initial_data)
        else:
            messages.error(request, 'Failed to send message!')
```

```
    else:
        form = ContactUsForm()

    return render(request, 'app_name/contact.html', {'form': form})
```

📝 project_folder/app_name/**urls.py** 🐍 urls.py

```
urlpatterns = [
    ...
    path('contact/', views.contactFormView, name='contact'),
]
```

📝 project_folder/**app_name**/templates/app_name/**contact.html** </> contact.html

```
{% extends 'app_name/base.html' %}

{% load static %}
{% load crispy_forms_tags %}
{% block title %}Contact Page{% endblock %}

---

{% block content %}
<form action="{% url 'contact' %}" method="POST">
    {% csrf_token %}
    {{ form|crispy }}
    <button type="submit" class="btn btn-warning">
        <span>Send Message</span>
    </button>
</form>
{% endblock %}
```

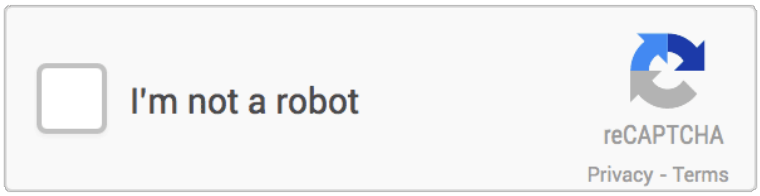
Secure Forms (reCAPTCHA) 🔐

Frequent requests from the server's bot (**noreply**@domain.com) may lead the external host provider, such as **Zoho**, to stop processing these requests.

Consequently, temporarily disable the EMAIL_HOST provider, classify the bot's messages as spam, and ensure that these messages do not land in recipients' inboxes.

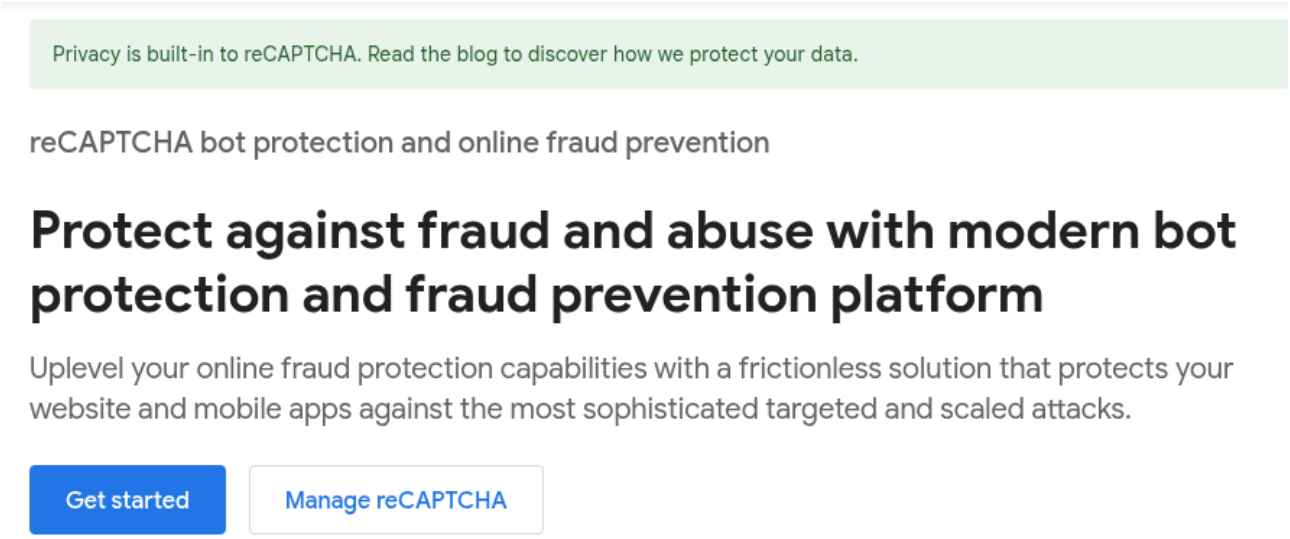
The use of **reCAPTCHA** deters spammers from abusing our **Forms**, significantly minimizing such incidents.

Let's employ it!



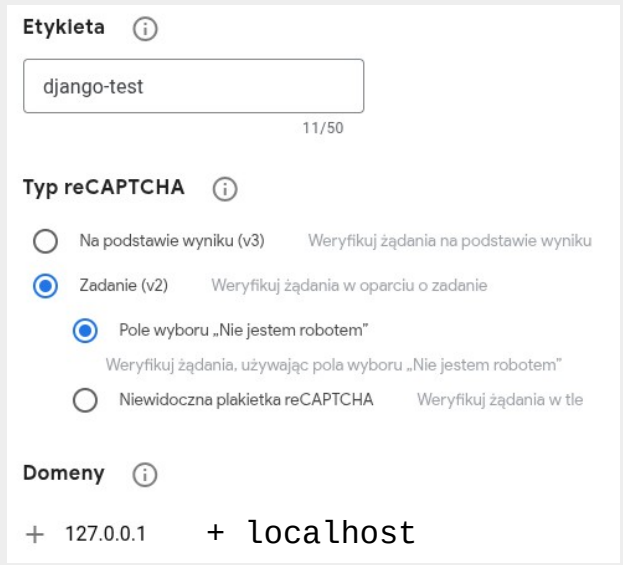
Create Google Account, and hit **Get started** at

http://google.com/recaptcha/about



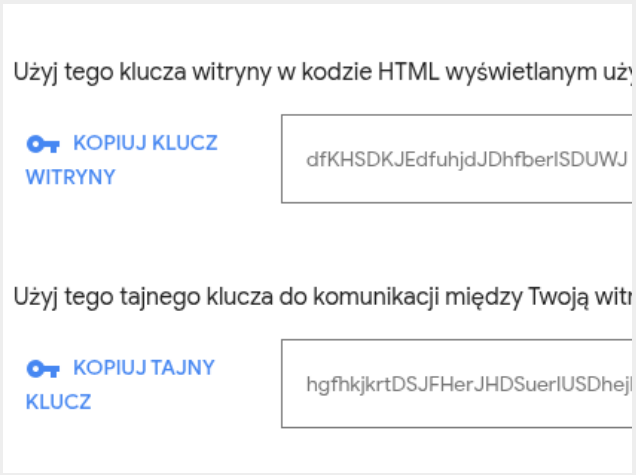
Manage existing reCAPTCHAS at
https://www.google.com/recaptcha/admin

I'm going to use reCAPTCHA v2 checkBox



ADD: 127.0.0.1 AND localhost TO Domains

Copy Public & Private keys



🖥️ (venv) @ project_folder 📚 pip library

```
pip install django-recaptcha
pip freeze > requirements.txt  # update requirements.txt
```

📝 project_folder/**.env** .env

```
# Google reCAPTCHA

RECAPTCHA_PUBLIC_KEY='public key here'
RECAPTCHA_PRIVATE_KEY='private key here'
```

📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
INSTALLED_APPS = [
    ...
    # Add libraries above apps
    'django_recaptcha',
]

...

RECAPTCHA_PUBLIC_KEY = os.getenv('RECAPTCHA_PUBLIC_KEY')
RECAPTCHA_PRIVATE_KEY = os.getenv('RECAPTCHA_PRIVATE_KEY')
```

📝 project_folder/app_name/**forms.py** (EXAMPLE) 🐍 forms.py

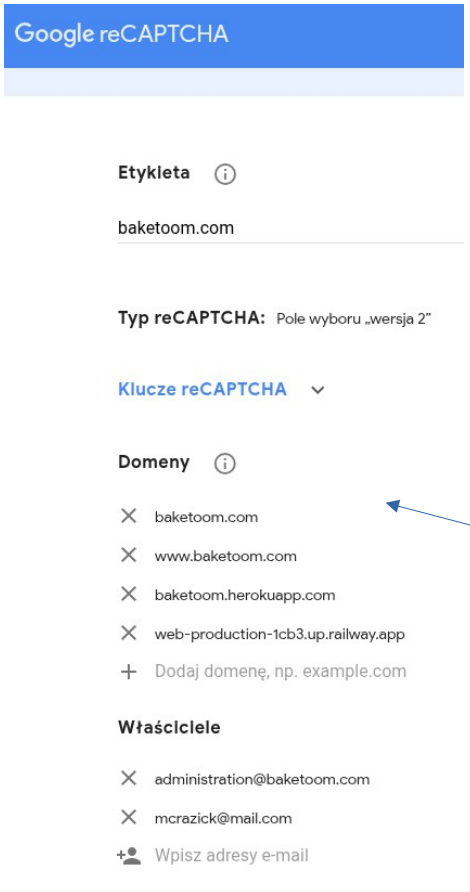
```python
from django import forms
from django_recaptcha.fields import ReCaptchaField

class MyForm(forms.Form):
    captcha = ReCaptchaField()
```

Just include and initialize **captcha** field to protect your **Form**

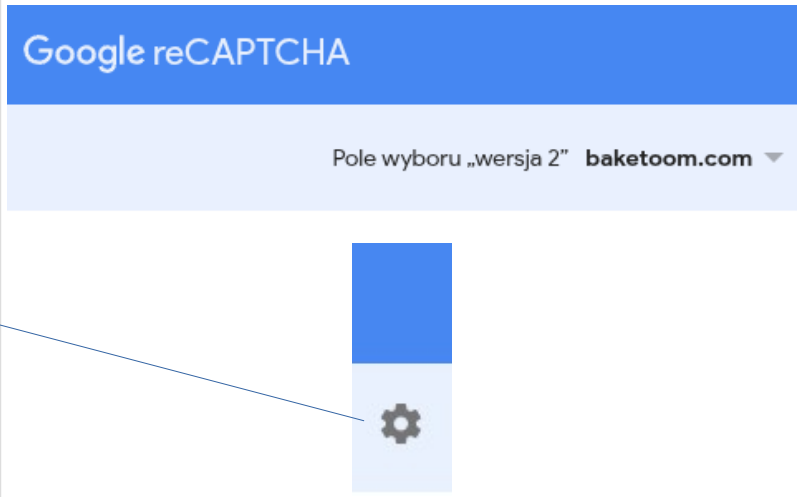
As of Feb/2025, there are 3 types of reCAPTCHA:

- **ReCaptchaV2Checkbox**
- **ReCaptchaV2Invisible**
- **ReCaptchaV3**

```python
from django_recaptcha.widgets import ReCaptchaV2Checkbox

ReCaptchaField(widget=ReCaptchaV2Checkbox) # ← is set by default
```



To ensure that your Django website **fully supports reCAPTCHA** in a **production environment**, it is highly recommended to register any domains that your website operates on.



learn more: [django_recaptcha](), [google docs recaptcha](), [advanced recaptcha docs]()

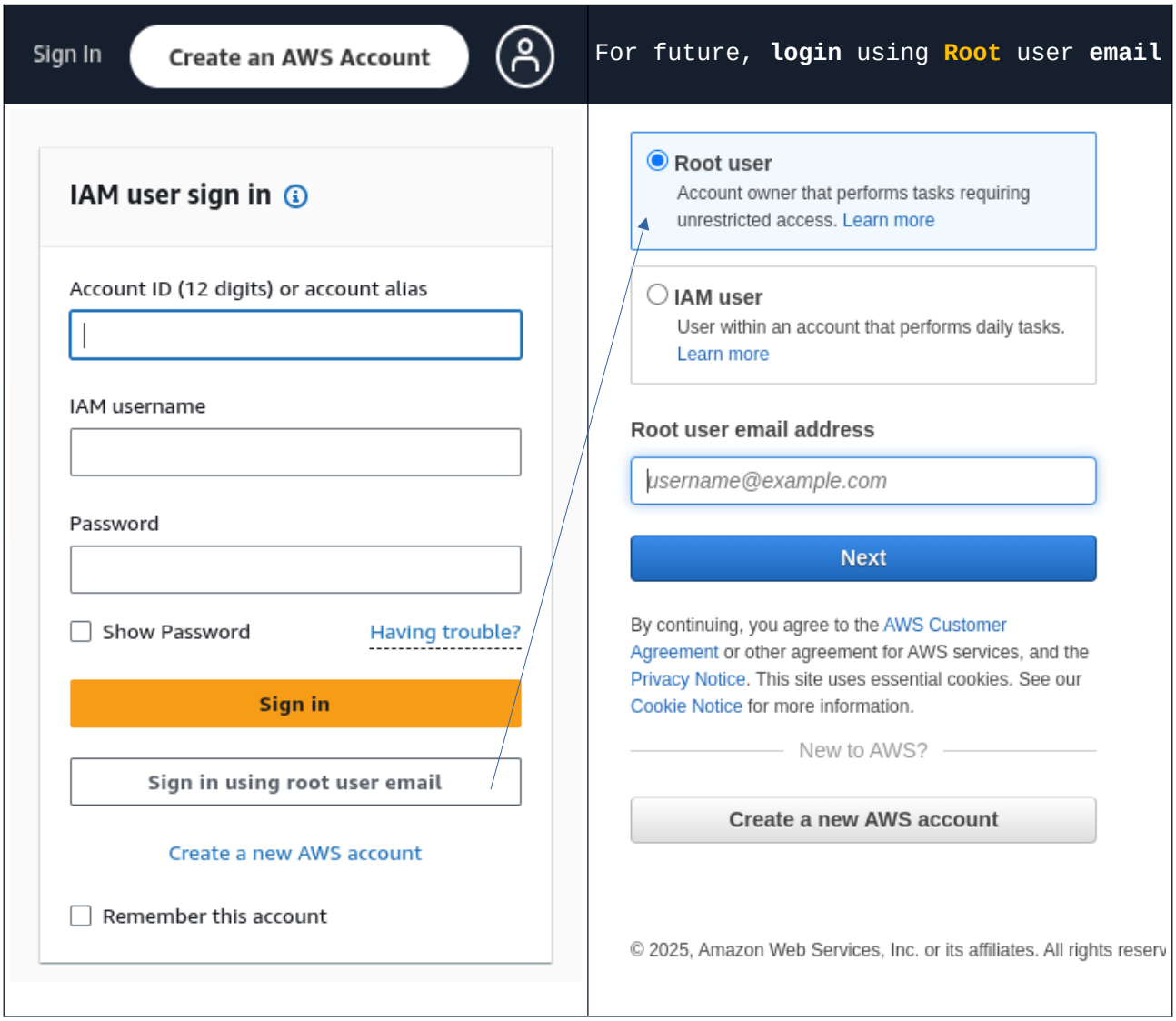
Amazon Web Services (s3 buckets) 🗄️🗃️

Managing user image storage on the server side becomes impractical as platform scales.

As of now, images accumulate in the hosting-service storage under the following directory: 📁 **`/media/profile_pics`**, restricting the website's growth potential, straining server performance while serving clients, and significantly increasing costs. This is because not all hosting platforms are designed to handle frequent resource updates.

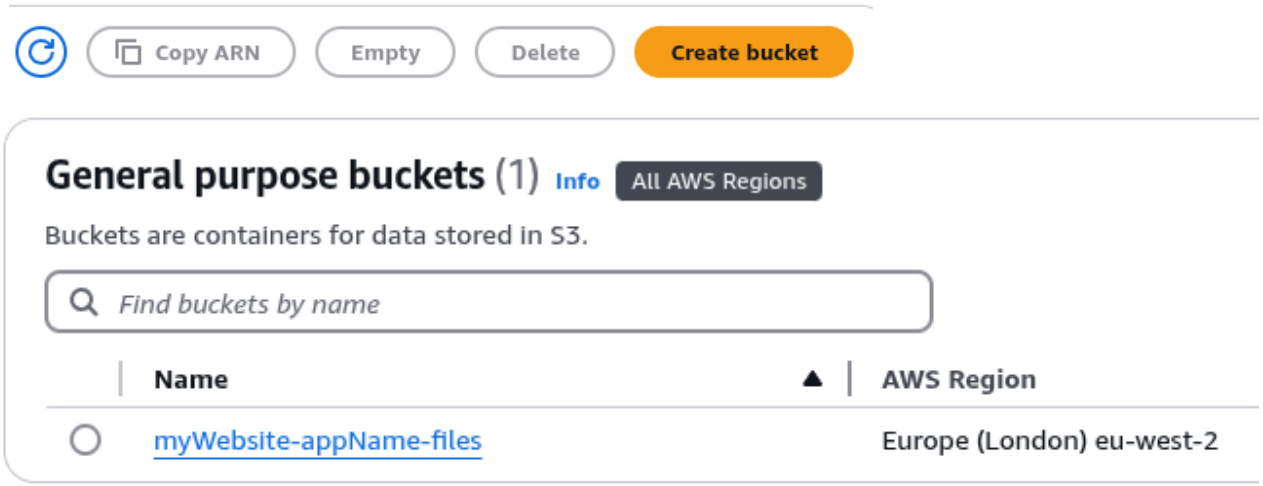
Let's utilize a service specializing in resource management, like AWS S3 buckets, to accommodate our platform's media assets, such as, user's images.

Create Account At - https://aws.amazon.com/s3/



Create General purpose **S3** Bucket at Europe Region: **eu-west-2**

[Official Tutorial]



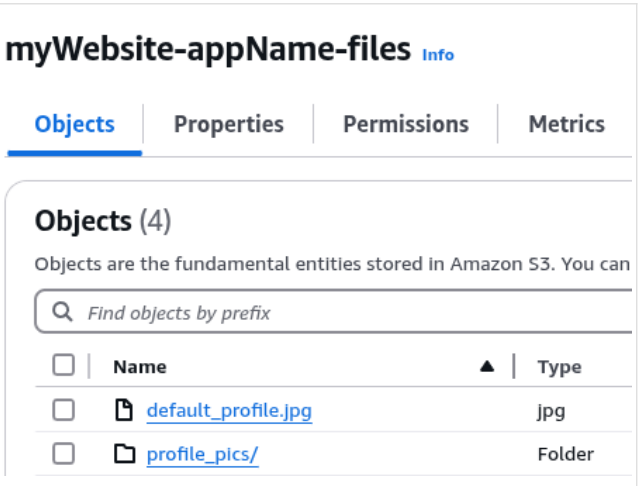
(Note: Bucket name must not contain uppercase characters, this is just example)

Accessing S3 bucket at:
eu-west-2.console.aws.amazon.com/s3

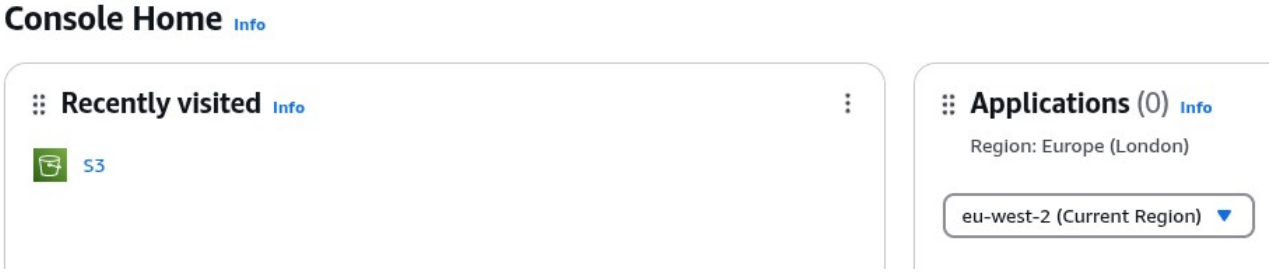
Create 📁 /profile_pics folder

And include your **default** profile picture for newly registered users

NOTE:
📁 /profile_pics
🖼️ default_profile.jpg
at: 📝 project_folder/users/**models.py**

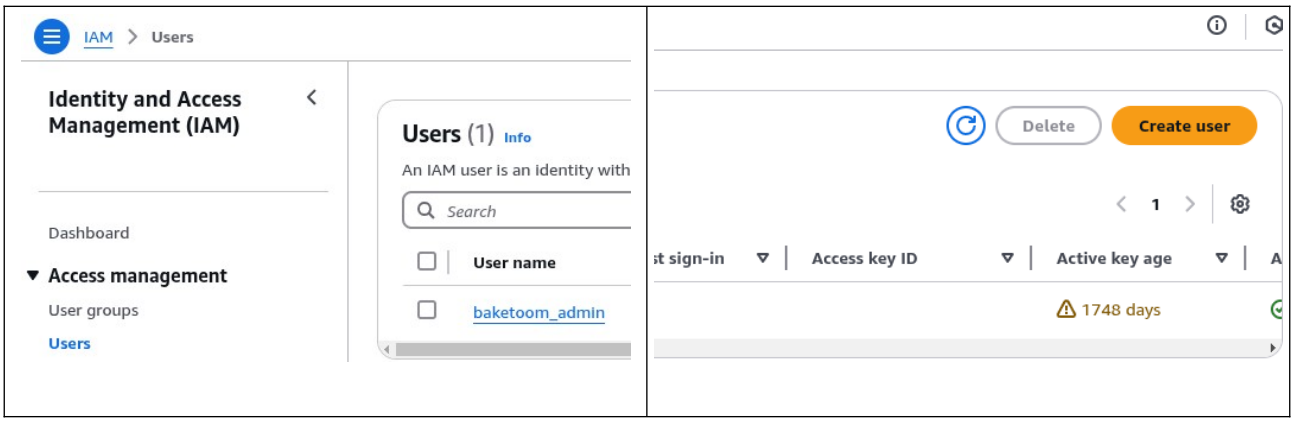


In future, once you login as Root user. You can access S3 bucket's by hitting the green S3 bucket icon, under section: **Recently visited**

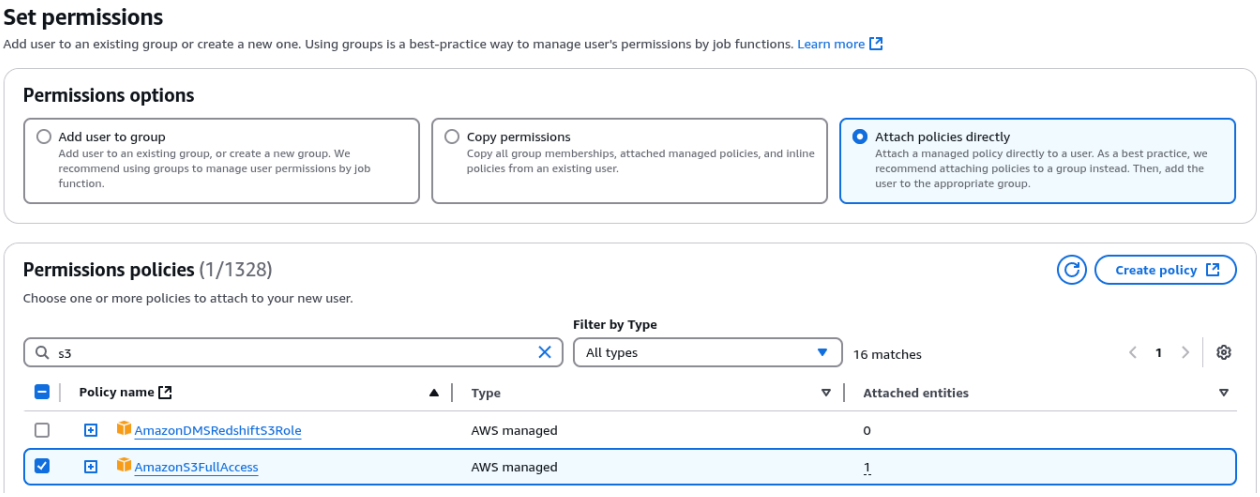


Head to AWS **IAM** (Identity and Access Management): https://us-east-1.console.aws.amazon.com/iamv2

Under **Access management**, head to **Users**, and hit **Create user**



Attach policies: **AmazonS3FullAccess**, to the new user

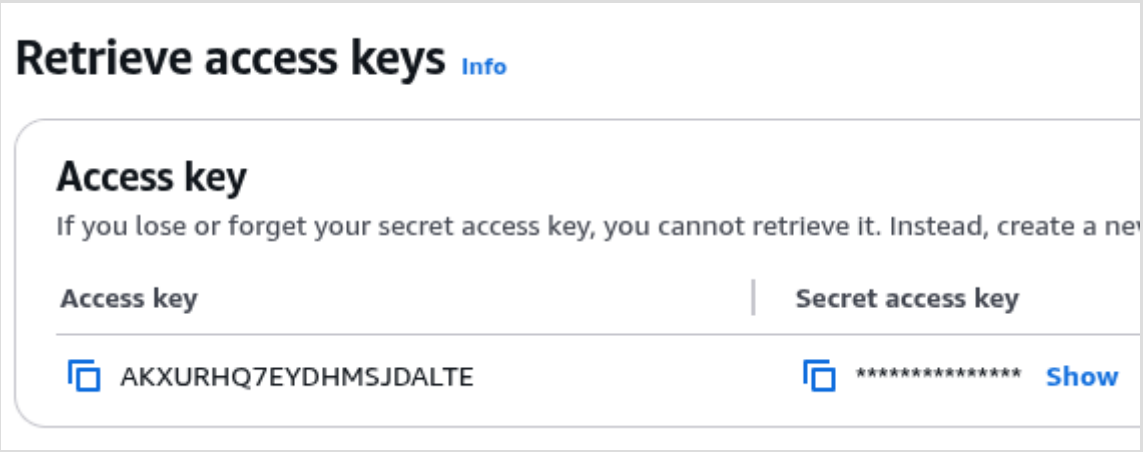


Access the user you've just created, and hit: **Create access key**

Connect to AWS S3 via django-storages

📝 project_folder/**.env** .env

```
...

# Amazon Web Services : s3 bucket for serving media files

AWS_ACCESS_KEY_ID='AKXURHQ7EYDHMSJDALTE'
AWS_SECRET_ACCESS_KEY='YdfudsfhsSJShfje4Jsd328ASDhsjWieuSdr58ap'
AWS_STORAGE_BUCKET_NAME='mywebsite-appname-files'
```



🖥️ (venv) @ project_folder 📚 pip library

```
pip install dj django-storages boto3
pip freeze > requirements.txt  # update requirements.txt
```

Follow this librarie's documentation: Amazon S3 (django-storages)

📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
INSTALLED_APPS = [
    ...
    # Add libraries above apps
    'storages',
]
```

```
# AWS S3 Bucket CONFIG

AWS_ACCESS_KEY_ID = os.getenv('AWS_ACCESS_KEY_ID')
AWS_SECRET_ACCESS_KEY = os.getenv('AWS_SECRET_ACCESS_KEY')
AWS_STORAGE_BUCKET_NAME = os.getenv('AWS_STORAGE_BUCKET_NAME')

AWS_S3_REGION_NAME = 'eu-west-2'
AWS_S3_FILE_OVERWRITE = False
AWS_DEFAULT_ACL = None
DEFAULT_FILE_STORAGE = 'storages.backends.s3boto3.S3Boto3Storage'

                    (...more below on next page)
```

```python
# Include STORAGES dictionary only if you're in Django version >= 4.2

STORAGES = {
    "default": {
        "BACKEND": DEFAULT_FILE_STORAGE,
        "OPTIONS": {
            "access_key": AWS_ACCESS_KEY_ID,
            "secret_key": AWS_SECRET_ACCESS_KEY,
            "bucket_name": AWS_STORAGE_BUCKET_NAME,
        },
    },
    "staticfiles": {
        "BACKEND": "django.contrib.staticfiles.storage.StaticFilesStorage",
        "OPTIONS": {
            "location": STATIC_ROOT,
        },
    },
}
```

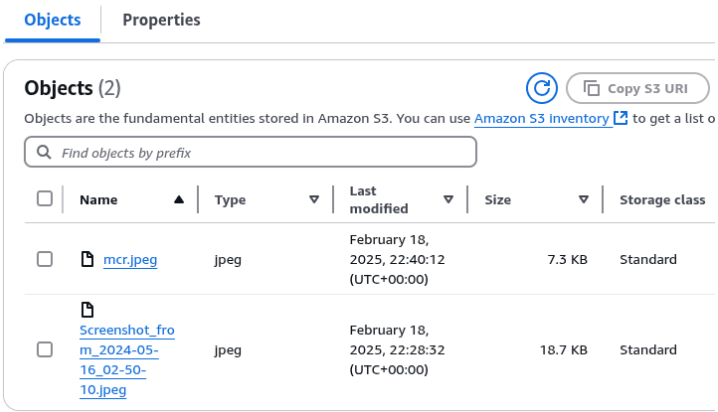
🖥️ (venv) @ project_folder — 🐍 manage.py (shell)

```
(InteractiveConsole)
>>> import boto3
>>> s3 = boto3.resource('s3')
>>> for bucket in s3.buckets.all():
...     print(bucket.name)
...
baketoom-recipes-files
mywebsite-appname-files
```

```
python manage.py shell

>>> import boto3
>>> s3 = boto3.resource('s3')
>>> for bucket in s3.buckets.all():
...     print(bucket.name)


← Should display buckets from AWS
  IF it does, it means it works
```

Now, create a user and update its profile picture. The newly added image should land in S3 bucket, instead of local 🗂️ `/media` directory.

profile_pics/



Profile + 📁 /recycle_pics
AWS S3 Buckets 🗄️🧰

Users can upload an image to set their profile picture. The issue is that every time a user uploads an image, it gets automatically added with a unique hashed name if there are duplicates.

Consequently, the 📁 /profile_pics directory in our S3 bucket will quickly fill up with images. This design flaw makes it difficult to identify and remove unused images, which can lead to limited storage space and increased expenses for maintaining the bucket.

We could re-design the model to replace the user's profile picture in the S3 bucket with the newly uploaded picture, which would be the most efficient solution. However, I propose a different approach.

We will create a new folder in our S3 bucket called 📁 /recycle_pics. This folder will store users' unused profile pictures once they update their profile picture in the 📁 /profile_pics folder of the S3 bucket.

This setup allows us to monitor the images used. In the future, we could even attach user IDs to these images and make the folder private. This would help us ensure compliance with our terms and services, particularly regarding the uploading of NSFW images. These files could also be used as evidence for law enforcement when requested in reasonable timeframe. Additionally, this approach will be useful if a user wishes to retrieve their past data.

The 📁 /recycle_pics folder can be maintained with different policies and configured to clear the pictures periodically and automatically directly via AWS.

Head to the next page

to learn how to mplement these solutions, and

feel free to integrate one that suits your ogrganization’s needs

📝 project_folder/users/**models.py** (**profile** users) 🐍 models.py

```
from django.conf import settings

from botocore.exceptions import ClientError
import boto3
```

```
s3 = boto3.client(
    's3',
    aws_access_key_id=settings.AWS_ACCESS_KEY_ID,
    aws_secret_access_key=settings.AWS_SECRET_ACCESS_KEY,
    region_name=settings.AWS_S3_REGION_NAME
)
```

```
def is_profile_pic(image_key):
    try:
        s3.head_object(
            Bucket=settings.AWS_STORAGE_BUCKET_NAME,
            Key=f"profile_pics/{image_key.split('/')[-1]}"
        )
        return True

    except ClientError as e:
        if e.response['Error']['Code'] == '404':
            return False
        else:
            raise e
```

Include the above imports and function: **is_profile_pic()**, as they are required for:

The functions: **remove_profile_pic** and **recycle_profile_pic**

```python
def remove_profile_pic(image_key):

    if is_profile_pic(image_key):

        # Delete the old image from the original location
        s3.delete_object(
            Key=f"profile_pics/{image_key.split('/')[-1]}",
            Bucket=settings.AWS_STORAGE_BUCKET_NAME
        )
```

```python
def recycle_profile_pic(image_key):

    if is_profile_pic(image_key):

        profile_pic_key = f"profile_pics/{image_key.split('/')[-1]}"
        recycle_pic_key = f"recycle_pics/{image_key.split('/')[-1]}"

        # Copy the image to the recycle_pics folder
        s3.copy_object(
            Key=recycle_pic_key,
            Bucket=settings.AWS_STORAGE_BUCKET_NAME,
            CopySource={
                'Key': profile_pic_key,
                'Bucket': settings.AWS_STORAGE_BUCKET_NAME
            }
        )
        # Delete the image from the original location
        s3.delete_object(
            Key=profile_pic_key,
            Bucket=settings.AWS_STORAGE_BUCKET_NAME
        )

    else:
        message = f'Image {image_key} not found in bucket: '
        message += f'{settings.AWS_STORAGE_BUCKET_NAME}'
        message += ', skipping copy and delete.'
        print(message)
```

NOTE: Implement one of the above functions

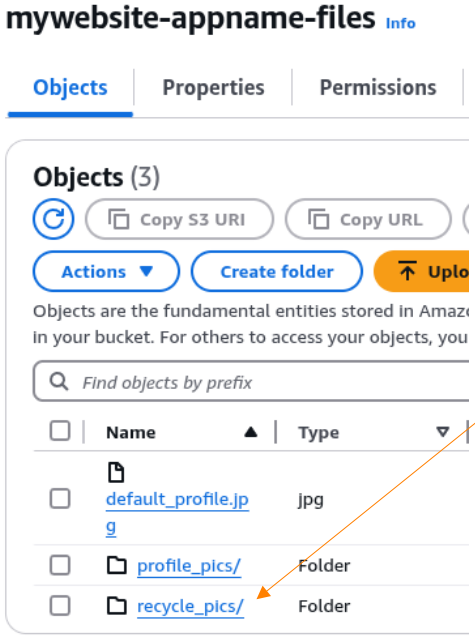
remove_profile_pic OR **recycle_profile_pic**

because you don’t need both

```python
class Profile(models.Model):
    user = models.OneToOneField(User, on_delete=models.CASCADE)
    phone_number = models.CharField(max_length=15)
    image = ResizedImageField(
        size=[300, 300],
        crop=['middle', 'center'],
        quality=75,
        force_format='JPEG',
        upload_to='profile_pics',
        default='default_profile.jpg'
    )
```

```python
    def save(self, *args, **kwargs):
        try:
            this = Profile.objects.get(user=self.user)
            # Only move the old image if there is an existing image
            # and it's different from the new image
            if this.image and this.image.name != self.image.name:
                recycle_profile_pic(this.image.name)
                remove_profile_pic(this.image.name)

        except Profile.DoesNotExist:
            pass # This is a new profile, so no need to move any image

        super().save(*args, **kwargs)
```

Include **recycle_profile_pic()** OR **remove_profile_pic()** only



IF you decided to use **recycle_profile_pic()**

THEN

You have to add new folder at AWS S3 Bucket:

📁 /recycle_pics

Filter **NSFW** (not safe for work) Profile 🖼️ **images** 🍑🍆

🖥️ (venv) @ project_folder 📚 pip library

```
pip install requests
pip freeze > requirements.txt  # update requirements.txt
```

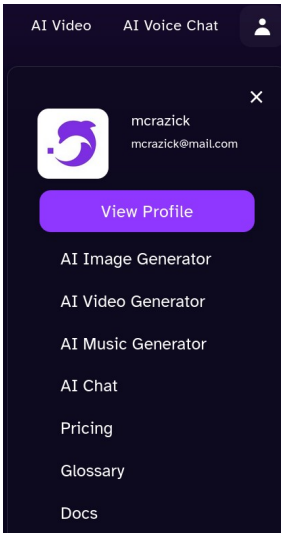
📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
Requests is just a pip library, it is not specifically a Django package
Hence, NO NEED to install it in the INSTALLED_APPS
```

```
# DeepAI for NSFW image detection

DEEPAI_API_KEY = os.getenv('DEEPAI_API_KEY')
DEEPAI_NSFW_DETECTOR_URL = 'https://api.deepai.org/api/nsfw-detector'
DETECT_NSFW_IMAGES = os.getenv('DETECT_NSFW_IMAGES', 'False').lower() in ['true', '1']
```

📝 project_folder/**.env** .env

```
# Deepai for NSFW

DETECT_NSFW_IMAGES='True'
DEEPAI_API_KEY='DEEPAI_API_KEY'
```



Head to the deepai.org, create an account → View Profile

I will continue with a free plan account

Scroll Down to API Keys, and copy your API into

DEEPAI_API_KEY at .env file

NOTE: Free Plan has limited number of API requests per month
Reconsider upgrading plan in future, like to: Pay as you Go

📝 project_folder/users/**utils.py** (**profile** users) 🐍 utils.py

```python
import requests
from django.core.files.uploadedfile import UploadedFile
from django.conf import settings

---

def is_image_nsfw(image_file: UploadedFile):

    # Push image to DeepAI API, to get NSFW score ( deepai.org/docs#Python )
    response = requests.post(
        url=settings.DEEPAI_NSFW_DETECTOR_URL,
        files={'image': image_file.open('rb')},
        headers={'api-key': settings.DEEPAI_API_KEY}
    )

    result = response.json()

    # Check for status and handle errors
    if result.get('status') != 'success':
        message = "API request failed with status:"
        message += f" {result.get('status')} -"
        message += f" {result.get('error', 'No error message provided')}"
        raise ValueError(message)

    nsfw_score = result.get('output', {}).get('nsfw_score')
    if nsfw_score is None:
        raise ValueError("Unexpected response format: 'output' or 'nsfw_score' key missing.")

    # Adjust the threshold as needed (0.5 = 50%)
    return nsfw_score > 0.5
```

📝 project_folder/users/**signals.py** (**profile** users) 🐍 signals.py

```python
from django.db.models.signals import pre_save
from django.dispatch import receiver
from .models import Profile
from .utils import is_image_nsfw

---

@receiver(pre_save, sender=Profile)
def check_nsfw_image(sender, instance, **kwargs):

    if instance.image:
        if is_image_nsfw(instance.image):
            raise ValueError('NSFW images are not allowed.')
```

📝 project_folder/users/**apps.py** (**profile** users) 🐍 apps.py

```python
from django.apps import AppConfig
from django.conf import settings


class UsersConfig(AppConfig):
    default_auto_field = 'django.db.models.BigAutoField'
    name = 'users'

    def ready(self):
        if settings.DETECT_NSFW_IMAGES:
            from users.signals import check_nsfw_images
```

Register your signals at apps.py of your app

Signals

In Django, signals are a way to allow certain events to notify other parts of your application when certain actions have occurred. They help in decoupling your application by allowing different components to communicate with each other without direct dependencies. Common signals include actions like model instance saving, deleting, or creating, where you can attach custom behavior to these events.

Utils (Utilities)

Django provides various utilities to assist with common tasks, making development more efficient. These utilities are helper functions or modules that simplify operations such as text processing, timezone handling, cryptographic operations, and more. They enhance readability and maintainability of your code by abstracting complex or repetitive tasks into reusable functions.

NOTE - We've created our own, cutsom:

signal: check_for_nsfw_image(), and **util**: is_image_nsfw() function

---

And custom setting options, to manage our NSFW functionality:

DEEPAI_API_KEY
DEEPAI_NSFW_DETECTOR_URL
DETECT_NSFW_IMAGES

Class-based views:

list, form, detail,
create, update and delete

Class-based views (CBVs) in Django provide a more structured and object-oriented approach to handling HTTP requests compared to function-based views. They offer a way to encapsulate and reuse view logic by defining views as classes. Here's an overview of CBVs:

Types of Class-Based Views

- **Base Views**: The simplest form, used as a foundation for more complex views. Example: **View**, **TemplateView**. (@ django/views/generic/base.py)

- **Generic Views**: Pre-built views that provide common functionality. Example:

1. **ListView:** Displays a list of objects.
2. **DetailView:** Displays a single object.
3. **CreateView:** Handles the creation of a new object.
4. **UpdateView:** Handles updating an existing object.
5. **DeleteView:** Handles the deletion of an object.

Advantages of CBVs

- **Code Reuse**: By using inheritance, common functionality can be shared across multiple views.
- **Organization**: Encapsulating logic within a class provides a clean and organized structure.
- **Extensibility**: Easily extend and customize functionality by overriding class methods.

Key Components of CBVs

- **Mixin Classes**: Reusable classes that provide specific functionality and can be combined to create complex behavior.
- **HTTP Methods**: Class-based views have methods for handling different HTTP requests (GET, POST, etc.).
- **Attributes and Methods**: Use attributes (like **template_name**, **model**) and methods (like **get_context_data**, **form_valid**) to customize view behavior.

Example - Import class-based-views

class-based views are under **django.contrib.auth.views** module:

📝 project_folder/app_name/**views.py** 🐍 views.py

```
from django.views.generic import (
    ListView,
    UpdateView,
    DetailView,
    ...
)
```

📝 project_folder/app_name/**urls.py** 🐍 urls.py

```
path('pathname/', MyClassBasedView.as_view(), name='path-name')
```

NOTE:

MyClassBasedView is a **class**. Hence, use **as_view**() to convert it to a supported format.

We've used some build-in views before, with some mixins, when creating user
Register and Login new Users

I decided to introduce class-based views at this stage so that we can understand the usecase of functional-views and to experience the struggles of its inclusion, all in order to appreciate the class-based views.

They can become complicated when we decide to overwrite their behaviour without understanding their inherited classes. Hence, I advice to study Django's codebase of class-based views at: https://github.com/django/django/tree/main/django/views/generic

Example - UpdateView

This means, we don't have to constantly write, for example:

```
def updateUserView(request, user_id):
    user_instance = get_object_or_404(User, pk=user_id)

    if request.method == 'POST':
        form = MyForm(request.POST, instance=user_instance)
        if form.is_valid():
            form.save()
            message.success(request, 'Updated profile')
            redirect('index')
        else:
            message.error(request, 'Failed to update profile')
    else:
        form = MyForm(instance=user_instance)

    context = {'form': form}
    return render(request, 'template.html', context)
```

Instead, we can do:

```
from django.urls import reverse_lazy


class UpdateUserView(UpdateView):
    model = User
    form_class = MyForm
    template_name = 'template.html'
    success_url = reverse_lazy('index')
    # error_url = reverse_lazy('index')
    context_object_name = 'context'

    def get_object(self, queryset=None):
        return get_object_or_404(User, pk=self.kwargs['user_id'])

    def form_valid(self, form):
        messages.success(self.request, 'Updated profile')
        return super().form_valid(form)

    def form_invalid(self, form):
        messages.error(self.request, 'Failed to update profile')
        return super().form_invalid(form)
```

Notice how a class-based view is comprehensive and semantic. (Eliminates boiler-plate)

(**NOTE**: class in django is in **PascalCase**)

(**NOTE**: kwargs, stands for - keyword arguments)

{‘**form**’: form} is created and passed automatically.
Use: **get_context_data**, to update context data:

```
...

    def get_context_data(self, **kwargs):
        context = super().get_context_data(**kwargs)

        context['custom_message'] = 'custom data for template.html'
        context['extra_info'] = 'another custom data for template.html'

---------------------------------------------------------------------

        # IF URI = localhost:port/?param1=Hello&param2=World

        # Extract query parameters from the URL
        param1 = self.request.GET.get('param1') # ← Hello
        param2 = self.request.GET.get('param2') # ← World

---------------------------------------------------------------------

        return context
```

super() : A Python feature used to call inherited methods from its parent class

Example - ListView

```
from django.views.generic import ListView
from django.urls import reverse_lazy
from .models import ModelName
from .forms import FormName
```

```
class ModelNameListView(ListView):
    model = ModelName
    template_name = 'template.html'
    context_object_name = 'context'
    # paginate_by = 10

    def get_queryset(self):
        queryset = super().get_queryset()
        form = FormName(self.request.GET or None)

        if form.is_valid():
            # Get <input name="my_input"> values from template's form
            search_query = form.cleaned_data.get('search_query')
            country_code = form.cleaned_data.get('country_code')
            creator_id = form.cleaned_data.get('creator_id')
            creator = form.cleaned_data.get('creator')

            if search_query:
                queryset = queryset.filter(title__icontains=search_query)
            if country_code:
                queryset = queryset.filter(country=country_code)
            if creator_id:
                queryset = queryset.filter(creator=creator_id)
            if creator:
                queryset = queryset.filter(creator__username__icontains=creator)

        return queryset
```

```
    def get_context_data(self, **kwargs):
        context = super().get_context_data(**kwargs)
        context['form'] = FormName(self.request.GET or None)
        return context
```

HTMX ☕❤️‍🔥

🖥️ (venv) @ project_folder 📚 pip library

```
pip install django-htmx
pip freeze > requirements.txt  # update requirements.txt
```

</> htmx

📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
INSTALLED_APPS = [
    # Add libraries above apps
    'django_htmx',
]
```

```
MIDDLEWARE = [
    'django.middleware.common.CommonMiddleware',
    'django_htmx.middleware.HtmxMiddleware',
    'django.middleware.csrf.CsrfViewMiddleware',
]
```

🖥️ (venv) @ project_folder/app_name/**static**/app_name/**js** (**app_name** static/js)

```
wget https://unpkg.com/htmx.org@latest/dist/htmx.min.js
```

This Linux command will **download** the **HTMX** to current terminal location

OR download manually from https://unpkg.com/browse/htmx.org@latest/dist/
argument @latest is not always the most recent available version.

📝 project_folder/**app_name**/templates/app_name/**base.html** </> base.html

```
{% load django_bootstrap5 %}
{% load static %}
<!DOCTYPE html>
   <html lang="en">
   <head>
       <meta charset="UTF-8">
       <meta name="viewport" content="width=device-width, initial-scale=1.0">
       <title>{% block title %}{% endblock %}</title>
       {% bootstrap_css %}
       <script src="{% static 'app_name/js/lib/htmx.min.js' %}" defer></script>
       {% block head %}{% endblock %}
   </head>
<body>
```

Official HTMX Documentation: https://htmx.org/docs/

Please read the documentation of HTMX, I will show basic options only:

hx-post & hx-get	form's attribute: action="" with method=""
hx-trigger	submit, click, keyup, keydown, load, change, focus, blur, resize, revealed, mouseenter, mouseleave, **delay** (optional) → click delay:1s (or delay:500ms) **throttle** (optional) → click throttle:1s (waits after request)
hx-targer	document.querySelector → #id, .class [attribute="value"] … Server response is send directly to the target
hx-swap	beforebegin, beforeend, afterbegin, afterend, innerHTML, outerHTML, none Server response replaces the target's content
hx-swap-oob (out of band)	Server side only feature. Has same keywords as hx-swap. (The use case of `hx-swap-oob` is demonstrated in the **chat** app) The `hx-swap-oob` attribute replaces the content of any target with the same ID as the HTML element. The target element must have an ID for the `hx-swap-oob` operation to work.

Example

```
<div id="target"></div>

<input type="button" ...
    hx-post="/url-path"
    hx-trigger="click delay:1s"
    hx-target="#target"
    hx-swap="innerHTML">
```

Avoid adding multiple <elements> with **hx** attribute inside the <form> because the responses may repeat unnecessarlly! Also, use delay as it minimizes spam responses (throttling), improving server's performance. Do this instead:

```
<form
    hx-post="/url-path"
    hx-trigger="keyup delay:500ms"
    hx-target="#target"
    hx-swap="innerHTML">
    <input type="text" name="forename">
    <input type="text" name="surname">
</form>
```

Response is made to the server for each input updation.

Infinite Scroll - **Update** index.html AND **Extension** models_list.html

(Continuation of - **Search** for users' **models** 🔎)

📝 project_folder/**app_name**/templates/app_name/**index.html** </> index.html

```
<form action="{% url 'index' %}" enctype="multipart/form-data" method="POST"
   hx-post="{% url 'index' %}"
   hx-target="#models"
   hx-trigger="keyup delay:500ms"
   hx-swap="innerHTML"
   hx-include="[name='search_query'], [name='creator_value'],
[name='country_code_value']"
>
  ...
```

```
</form>

<hr class="pt-3">

{% if models %}
   <ul id="models" class="list-group pb-3">
      {% include 'app_name/extensions/models_list.html' %}
   </ul>
{% endif %}
```

NOTE: <form> dosen't need - **action**, nor **method** with HTMX

We will include them anyways, to show additional functionality: parse request with URL parameters on <button type="submit">

Update <form> with action to indexView, and include **models_list.html** below it

NOTE: models_list.html is defined at the next page
NOTE: app_name/extensions/models_list.html (optional path)

```
<a href="{% url 'form' %}" class="float-start">add model</a>
<a href="{% if request.user.is_authenticated %}{% url 'profile' request.user.id %}{%
else %}{% url 'login' %}{% endif %}" class="float-end">
   <button type="submit" class="btn btn-primary ms-3">profile</button>
</a>
<form action="{% url 'logout' %}" method="POST" class="float-end">
   {% csrf_token %}
   <button type="submit" class="btn btn-warning">logout</button>
</form>

<form action="{% url 'index' %}" enctype="multipart/form-data" method="POST"  ...
```

It's better to hoist the other optoins, since we gonna scroll infinitelly.
Also, wrap logout <form> with `{% if request.user.is_authenticated %}{% endif %}`

📝 project_folder/**app_name**/templates/app_name/**extensions/models_list.html** </>

```
{% if models %}
   {% for model in models %}
      <li class="list-group-item">
         <h2>{{ model.title }}</h2>
         <p>{{ model.country }}</p>
         <small class="text-muted">{{ model.created_at }}</small>
         <section class="d-flex justify-content-between" aria-label="model-options">
            <a href="{% url 'edit_model' model.id %}">
               <button class="btn btn-secondary" aria-label="edit-model">Edit</button>
            </a>
            <a href="{% url 'delete_model' model.id %}">
               <button class="btn btn-danger" aria-label="delete-model">Delete</button>
            </a>
         </section>
      </li>
   {% endfor %}
{% endif %}
```

```
{% if models %}
   <div class="loader mx-auto my-5"
      hx-trigger="revealed"
      hx-swap="outerHTML"
      hx-get="{% url 'index' %}?page={{ next_page_number }}{% if
search_filter_params %}&{{ search_filter_params }}{% endif %}">
   </div>
{% else %}
   <p class="text-center mx-auto my-5">No more models to load</p>
{% endif %}
```

📝 project_folder/**app_name**/static/app_name/css/extensions/**model_list.css**

```
#models li {
   animation: linear 0.5s fadeIn;
}

@keyframes fadeIn {
   0% {
      opacity: 0;
   }
   100% {
      opacity: 100;
   }
}                    Fade-In animation when models are included in indexView
```

```
                Custom Loader / Spinning Circle  .spinner-border in bootstrap5
.loader {
    width: 48px;
    height: 48px;
    border-radius: 50%;
    position: relative;
    animation: rotate 1s linear infinite;
}

.loader:before {
    content: "";
    box-sizing: border-box;
    position: absolute;
    inset: 0px;
    border-radius: 50%;
    border: 5px solid gray;
    animation: prixClipFix 2s linear infinite;
}

@keyframes rotate {
    100% {
        transform: rotate(360deg);
    }
}

@keyframes prixClipFix {
    0% {
        clip-path: polygon(50% 50%, 0 0, 0 0, 0 0, 0 0, 0 0);
    }
    25% {
        clip-path: polygon(50% 50%, 0 0, 100% 0, 100% 0, 100% 0, 100% 0);
    }
    50% {
        clip-path: polygon(50% 50%, 0 0, 100% 0, 100% 100%, 100% 100%, 100% 100%);
    }
    75% {
        clip-path: polygon(50% 50%, 0 0, 100% 0, 100% 100%, 0 100%, 0 100%);
    }
    100% {
        clip-path: polygon(50% 50%, 0 0, 100% 0, 100% 100%, 0 100%, 0 0);
    }
}
```

📝 project_folder/**app_name**/templates/app_name/**index.html** </> index.html

```
{% block head %}
    <link rel="stylesheet" href="{% static 'app_name/css/extensions/model_list.css' %}">
{% endblock %}
```

Infinite Scroll - Update indexView

📝 project_folder/app_name/**views.py** 🐍 views.py

Update **indexView**. You may even scrap it and replace it with the following code

```python
def indexView(request):

    model_list = ModelName.objects.all()

    context = {}
    R = request.GET

    # Handle POST request (search form submission)
    if request.method == 'POST':
        R = get_request_with_valid_search_filter_parameters(request)
        params = get_encoded_parameters_from_request(R)
        request.session['search_filter_params'] = params
        # Redirect to indexView with search filter parameters in URI
        return http_response_redirect_with_parameters('index', params)

    # Retrieve search parameters from session
    if 'search_filter_params' in request.session:
        context['search_filter_params'] = request.session['search_filter_params']
```

NOTE: **context** and **R.** Hoisting them, allows us to apply changes at any time

NOTE: indexView() is called, when POST or GET request is sent via template

---

Therefore, **R** will be overwritten at - if request.method == 'POST'. However,
updated **R** has no effect on the rest of the codebase due to a **return** keyword

We can remove the return http_response_redirect_with_parameters() and the code will still work, however, the client will no longer be able to parse the whole website with the new request containing search filter query parameters. (localhost:port/**?param1**=Hello%20World**&param2**=Hi)

NOTE: request.session['search_filter_params']. Think of it as a cookie, it saves value locally on a client

---

This value, can be accessed at later point, such as when we call **indexView**() again.
Hence, if 'search_filter_params' in request.session: .

search_filter_params is set in **context**, so that it can be sent to the **models_list.html** - hx-get request

Django automatically initializes an expiry event for sessions.
Session is removed upon browser's termination. (For example; when client closes the browser)

```
# Get all models ordered by title
model_list = ModelName.objects.all().order_by('title')

# Filter search_models based on request parameters
search_models = model_list
```

```
for key, value in R.items():
    if not value:
        continue
    if key == 'search':
        search_models = search_models.filter(title__icontains=value)
    elif key == 'country_code':
        search_models = search_models.filter(country=value)
    elif key == 'creator_id':
        search_models = search_models.filter(creator=value)
    elif key == 'creator':
        search_models = search_models.filter(creator__username__icontains=value)
```

```
# Get other_models (irrelevant to search)
search_models_ids = search_models.values_list('id', flat=True)
other_models = model_list.exclude(id__in=search_models_ids)
```

Update `filtered` **model** `to` **search_models**

Models that are NOT relevant to the search, will be stored in **other_models**
we will render them, after all **search_models** in **models_list.html** template extension

```
paginator = Paginator(model_list, 5) # Show 5 models per page
page_number = request.GET.get('page', 1) # Get ‘page’ from request’s query:

try:
    models = paginator.page(page_number)
except PageNotAnInteger:
    # If page is not an integer, deliver the first page
    models = paginator.page(1)
except EmptyPage:
    # If page is out of range (e.g., 9999), delive
    models = paginator.page(paginator.num_pages)
```

Remove `old model paginator`

```
# Paginate 'search_models' and 'other_models'
paginator_search = Paginator(search_models, 5)
paginator_other = Paginator(other_models, 5)
```

```
# Get page number from request
try:
    page_number = int(request.GET.get('page', 1))
except ValueError:
    page_number = 1
```

```
Paginate - search_models, and other_models

NOTE: page_number - localhost:port/?page=N - page_number = N
```

---

hx-get in **div.loader**, at **models_list.html** template extension, will request 5 models from **indexView**()

```
# Start of - Determine which paginator to use ----------------------------------------

if page_number <= paginator_search.num_pages:
    # Get relevant to search results. (models = search_models)
    models = paginator_search.get_page(page_number)
    models_type = 'search_relevant'

elif page_number <= paginator_search.num_pages + paginator_other.num_pages:
    # Get irrelevant to search results. (models = other_models)
    page_number_other = page_number - paginator_search.num_pages
    models = paginator_other.get_page(page_number_other)
    models_type = 'search_irrelevant'

else:
    models = False
    models_type = False
    next_page_number = False

# END of - Determine which paginator to use ----------------------------------------
```

```
Prepare models for template's context data.
```

```
NOTE: IF page_number exeeds total page count of paginated search_models,
THEN other_models will be served until their page count is also exeeded.
```

```
    # Update context
    context.update({
        'models': models,
        'models_type': models_type,
        'next_page_number': page_number + 1,
    })

    # Render the appropriate template
    template = 'app_name/extensions/models_list.html' if request.htmx else
'app_name/index.html'

    return render(request, 'app_name/index.html', {'models': models})
    return render(request, template, context)
```

```
NOTE: page_number is incremented, and served as next_page_number
```

```
NOTE: models_list.html extension, makes a HTMX response using context data:
localhost:port/?page={{ next_page_number }}&{{ search_filter_params }}
```

```
NOTE: IF request has been made by the HTMX,
THEN models_list.html extension template, is returned back to the client.
```

Great Job!

That was a lot, though minor improvement is needed. Let’s show the client their search result relevancy.

Infinite Scroll - Models relevency message

📝 project_folder/app_name/**views.py** 🐍 views.py

```
def indexView(request):
...

    elif page_number <= paginator_search.num_pages + paginator_other.num_pages:
        # Get irrelevant to search results. (models = other_models)
        page_number_other = page_number - paginator_search.num_pages
        models = paginator_other.get_page(page_number_other)
        models_type = 'search_irrelevant'

        # One time message - End of relevant search results
        if page_number == paginator_search.num_pages + 1:
            context.update({'start_other_models_message': True})

    else:
        models = False
        models_type = False
...
```

Add following statement for a one time message, at **indexView**()

📝 project_folder/**app_name**/templates/app_name/**extensions/models_list.html** </>

```
{% if models and start_other_models_message %}
    <p class="text-center bg-dark my-4 mx-auto w-100 p-3 fs-4 text-white">
        Irrelevant models will start to appear
    </p>
{% endif %}

...
```

Add the following statement **at the top** of the modesl_list.html extension

Chat Rooms 💬💥📝💭

made with: HTMX + Dafne ASGI WebSockets

This is the most complicated part of the documentation. It's best to proceed with 3 months of active Django development experience. Additionally, this section is based of a following

YouTube tutorial - Chat App with Django Channels by Andreas Jud
(Accessed: 10 March 2025)

Please watch the tutorial before commiting to this chat-app development.

Terminology

Client	In this context, a browser prompting **requests** to the server
Request	Method: POST, GET, UPDATE, DELETE, **HTMX**, **WS** etc… made by the **client**, which then is sent to the **server**
Response	Content-Type: text / html / json / xml / csv / application etc… made by the **server**, which then serves it to the **client**
WebSocket	Communication protocol. Provides consistent **connection** between **client** & **server**
Web Server Gateway Interface (WSGI)	Handles **requests** and **responses**, **synchronously**. (like **procedurally**, where a task must finish before another can start) Is configured by default @ settings.py
Asynchronous Server Gateway Interface (ASGI)	Handles **requests** and **responses**, **synchronously** & **asynchronously**. (like **concurrently**, where tasks are being proccessed idependently) And is requried for processing **WebSocket** connections. Can be configured as default @ settings.py Like WSGI, it relies on a: **request response cycle** Additionally includes a: **handshake**, (hashed keys) to establish a secure connection between **client** & **server**

<table>
<tr><td>Channel</td><td>Django extension for handling real-time functionality & protocols like WebSockets</td></tr>
<tr><td>Channel Layers</td><td>Enables communication between different parts of an app & Handles, asynchronous tasks and real-time features for: consumers

- Has to be configured @ settings.py
- Can broadcard message to multiple consumers

For production-based applications,
initialize Channel Layers with in-memory data structure, like:
<table><tr><th>Redis</th><th>Valkey</th></tr><tr><td>Redis is a multi-purpose tool: a cache, a database (RAM storage with RDB snapshots), and a message broker (publish/subscribe).

Once open-source, it was later acquired, and license changes diminished user trust in it.</td><td>A Redis version predating the policy changes.

Many Redis open-source developers shifted to Valkey, ensuring a trustworthy, open-source alternative.

Numerous companies impacted by Redis policies now financially back Valkey.</td></tr></table></td></tr>
<tr><td>Consumer</td><td>Similar to a Django View, but it supports asynchronous communication and real-time events.</td></tr>
<tr><td>Routing</td><td>Django Channels - routing.py, is like urls.py, where we can define paths(), in this context for ASGI protocols. We will use this file to define WebSocket routs/paths only.

urls.py defines URL routing only for HTTP requests</td></tr>
<tr><td>Out of Band

(OOB)

Ignore this note</td><td>Security testing technique that focuses on identifying and detecting security vulnerabilities through external interactions, such as; blind routing code executions

HTMX includes OOB, for example: hx-swap-oob
However, it is just a naming convension.

In this context, it focuses on updating parts of the DOM that are not the direct target of the request.</td></tr>
</table>

Create **Chat** App 💬📝

🖥️ (venv) @ project_folder — 🐍 manage.py

```
python manage.py startapp chat
```

Register Chat **App** and it's **Urls** to Django Website

📝 project_folder/my_website/**settings.py** — 🐍 settings.py

```
INSTALLED_APPS = [
    'django.contrib.admin',
    ...

    # Add libraries above apps
    'crispy_forms',
    'crispy_bootstrap5',
    ...

    # Add apps below
    'app_name.apps.AppNameConfig',
    'chat.apps.ChatConfig',
]
```

app_name > apps.py

```
from django.apps import AppConfig


Codeium: Refactor | Explain
class AppNameConfig(AppConfig):
    default_auto_field = 'django.db.models.BigAutoField'
    name = 'app_name'
```

📝 project_folder/my_website/**urls.py** — 🐍 urls.py

```
urlpatterns = [
    ...
    path('', include('app_name.urls')),

    # imports URLs from my_website/users/urls.py
    path('chat/', include('chat.urls')),
]
```

📝 project_folder/chat/**urls.py** — 🐍 urls.py

```
from django.urls import path
from . import views

urlpatterns = [
    path('', views.roomView, name='room'),
]
```

📝 project_folder/chat/**models.py** (**Room** & **Message**) 🐍 models.py

```python
from django.db import models

class Room(models.Model):
    name = models.CharField(max_length=128, unique=True)

    def __str__(self):
        return self.name

class Message(models.Model):
    room = models.ForeignKey(
        Room,
        related_name='messages',
        on_delete=models.CASCADE
    )
    author = models.ForeignKey('auth.User', on_delete=models.CASCADE)
    message = models.CharField(max_length=1000)
    created_at = models.DateTimeField(auto_now_add=True)

    class Meta:
        ordering = ['-created_at']

    def __str__(self):
        return f'{self.author.username}: {self.message}'
```

NOTE: **User** = ‘auth.User’, and
does NOT require: django.contrib.auth.models import **User**

NOTE: class Meta - **ordering** includes: “-”, this will make a DESCENDING order

related_name in **Message** models.ForeignKey(…)
allows you to access all **Message** instances of related **Room** instances

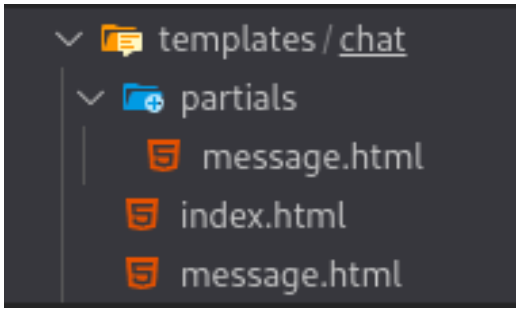
room = get_object_or_404(...)
room.messages → All instance_**message** of instance_**room**

📝 project_folder/chat/**admin.py** (Register **Room** & **Message**) 🐍 admin.py

```python
from django.contrib import admin
from .models import Room, Message


# Register your models here.
admin.site.register(Room)
admin.site.register(Message)
```

📝 project_folder/chat/**forms.py** (Chat index.html <input>) 🐍 forms.py

```python
from .models import Message
from django import forms


class MessageForm(forms.ModelForm):
    class Meta:
        model = Message
        fields = ['message']
```



CREATE:

templates/chat/partials/**message**.html

templates/chat/**message**.html

templates/chat/**index**.html

📝 project_folder/chat/**views.py** 🐍 views.py

```python
from django.shortcuts import render, redirect, get_object_or_404
from django.contrib.auth.decorators import login_required
from django.http import HttpResponse
from django.utils import timezone

from .forms import MessageForm
from .models import Room
```

```python
@login_required
def roomView(request):

    room = get_object_or_404(Room, name='public')
    form = MessageForm()
```

```python
    if request.htmx:
        form = MessageForm(request.POST)

        if form.is_valid():
            message = form.save(commit=False)
            message.author = request.user
            message.room = room
            message.save()

            context = {
                'msg': message,
                'user': message.author,
                'today': timezone.now().date().strftime("%Y-%m-%d")
            }
            return render(request, 'chat/partials/message.html', context)
```

```python
    context = {
        'form': form,
        'user': request.user,
        'room_name': room.name,
        'room_messages': room.messages.all()[:30],
        'today': timezone.now().date().strftime("%Y-%m-%d")
    }

    return render(request, 'chat/index.html', context)
```

Create **Room** with name “public” in the **database** (localhost:port/admin)

📝 project_folder/chat/templates/chat/**index.html** </> index.html

```
{% extends 'app_name/base.html' %}
{% load static %}
{% load crispy_forms_tags %}


{% block content %}

---

<h1>{{ room_name|title }}</h1>
<hr>

---


{% if request.user.is_authenticated %}

  <section id="chat-messages" class="overflow-auto" style="height: 50vh">
    {% if room_messages %}
      {% for msg in room_messages reversed %}
        {% include 'chat/message.html' %}
      {% endfor %}
    {% endif %}
  </section>

  <hr class="my-5">

  <form id="chat-form"
    hx-post="{% url 'room' %}"
    hx-trigger="submit delay:500ms"
    hx-target="#chat-messages"
    hx-swap="beforeend">
    {% csrf_token %}
    {{ form|crispy }}
  </form>

{% endif %}


---

{% endblock %}
```

NOTE: **reversed** in - {% for msg in **room_messages** ... %} - iterates backwards

NOTE: custom variable - **msg**, is usable in **templates/chat/partials/message.html**

📝 project_folder/chat/templates/chat/**partials/message.html** </> message.html

```
{% include 'chat/message.html' %}
```

📝 project_folder/chat/**templates**/chat/**message.html** </> message.html

```
<message>
---
  <div style="width: clamp(350px, 32vw, 500px)" class="msg-container
    {% if user == msg.author %} text-white bg-info ms-auto
    {% else %} bg-light me-auto
    {% endif %} text-white my-4 p-3">

    <p class="msg-body fw-bold">{{ msg.message }}</p>

    <label class="msg-author fw-bold
      {% if user == msg.author %} text-end{% else %} w-100{% endif %}">
      {% if user == msg.author %}Me{% else %}{{ msg.author }}{% endif %}
    </label>
  </div>
---
  <div class="msg-date
    {% if user == msg.author %} text-end{% else %} text-start{% endif %}">
    {% if today == msg.created_at|date:"Y-m-d" %}
      {{ msg.created_at|date:"H:i" }}
    {% else %}
      {{ msg.created_at|date:"d M Y, H:i" }}
    {% endif %}
  </div>
---
</message>
```

NOTE: Additional spaces are added to the `class` attributes because of the way this code is spaced out with the **IF-ELSE** statements.

The HTML template works. However, extra spacing may obfuscate the `class` attribute, worsening debugging experience in developer tools

We can enhance the template response by stripping off these extra, unneccesary space characters.

Let's implement **CUSTOM {% strip %}** template tag (OPTIONAL)

📝 project_folder/app_name/**templatetags/strip_spaces.html** 🐍 strip_spaces.py

```
from django import template
import re # regular expression


---


register = template.Library()

class StripSpacesNode(template.Node):
    def __init__(self, nodelist):
        self.nodelist = nodelist

    def render(self, context):
        output = self.nodelist.render(context)
        return re.sub(r'\s+', ' ', output).strip()

    @register.tag(name='strip')
    def do_strip_spaces(parser, token):
        nodelist = parser.parse(('endstrip',))
        parser.delete_first_token()
        return StripSpacesNode(nodelist)
```

```
Create new directory, templatetags inside app: app_name, and

Include empty file named: __init__.py inside templatetags directory

NOTE: @register.tag(name='strip') → {% strip %}, and
      parser.parse(('endstrip',)) → {% endstrip %}
```

You can create **templatetags** folder in any of the apps, like **chat**. I decided to implement it in **app_name**, because it is the main app.

Once the template tag is registered, it is then accessible across all applications of the **project_folder** directory, regardles of which application contains the **templatetags** folder.

📝 project_folder/chat/**templates**/chat/**message.html** </> message.html

```
{% load strip_spaces %}
{% strip %}
<message>...</message>
{% endstrip %}
```

Include - HyperScript (OPTIONAL)

📝 project_folder/chat/templates/chat/**index.html** </> index.html

```
...

  <hr class="my-5">
  <form
    hx-post="{% url 'room' %}"
    hx-trigger="submit delay:500ms"
    hx-target="#chat-messages"
    hx-swap="beforeend"
    _="on htmx:afterRequest reset() me"    ← clears <input> after submit
  >
    {% csrf_token %}
    {{ form|crispy }}
  </form>

...
```

NOTE: "_" is HyperScript. Include CDN @ app_name/templates/app_name/**base**.html

```
<script name="hyperscript.js"
        src="{% static 'app_name/js/lib/hyperscript.min.js' %}" defer></script>
```

HyperScript is compatable with **HTMX** because both have been created by the same developer: "Carson Gross".

HyperScript is a JavaScript library that provides different approach to programming. Like jQuery, it minimizes lengthy JavaScript syntax into a more compact base.

HyperScript can be used in a script tag: `<script name="text/hyperscript">`

The HyperScript syntax is not yet fully adopted by the large AI models (As of 11/March/2025).

Therefore, you should follow the official documentation instead, if you plan on using this library.

```
...

{% block base %}
<script name="chat-messages.js" type="text/javascript">

---

    const chatForm = document.getElementById('chat-form');
    const chatMessages = document.getElementById('chat-messages');

    const scrollToBottom = () => {
        chatMessages.scrollTop = chatMessages.scrollHeight;
    }

---

    const observer = new MutationObserver(scrollToBottom);
    observer.observe(chatMessages, { childList: true });

---

    document.addEventListener('htmx:afterRequest', scrollToBottom);
    scrollToBottom();

---

</script>
{% endblock %}
```

IF you are **NOT** using **HyperScript**, **THEN** extend htmx:afterRequest EventListener

```
...

    const observer = new MutationObserver(scrollToBottom);
    observer.observe(chatMessages, { childList: true });

    document.addEventListener('htmx:afterRequest', () => {
        chatForm.reset();
        scrollToBottom();
    });

    scrollToBottom();

</script>
{% endblock %}
```

NOTE: This script is essential to scroll the client to the newest message.
NOTE: hx-swap="beforeend scroll:bottom" can be used to display newest message.

However, we will use **WebSockets** to support real-time conversations.
hx-swap unfortunately, is not a viable option when using **WebSockets**.

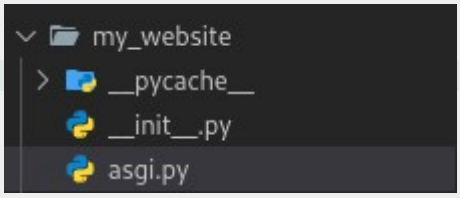
Chat with Django Channels 💬📝

🖥️ (venv) @ project_folder — 📚 pip library

```
pip install -U 'channels[daphne]'
pip freeze > requirements.txt # update requirements.txt
```

📝 project_folder/my_website/**settings.py** — 🐍 settings.py

```
INSTALLED_APPS = [
    'daphne', # Add to the top
    'django.contrib.admin',
    ...
]
```




```
# WSGI_APPLICATION = 'my_website.wsgi.application' ← comment out the WSGI setup
ASGI_APPLICATION = 'my_website.asgi.application'
```

📝 project_folder/my_website/**asgi.py** — 🐍 asgi.py

```
...
For more information on this file, see
https://docs.djangoproject.com/en/5.1/howto/deployment/asgi/
"""

import os

from django.core.asgi import get_asgi_application
from channels.auth import AuthMiddlewareStack
from channels.routing import ProtocolTypeRouter, URLRouter
from channels.security.websocket import AllowedHostsOriginValidator
from chat import routing # routing.py in chat application

os.environ.setdefault('DJANGO_SETTINGS_MODULE', 'my_website.settings')

application = get_asgi_application()
application = ProtocolTypeRouter({
    "http": get_asgi_application(),
    "websocket": AllowedHostsOriginValidator(
        AuthMiddlewareStack(URLRouter(routing.websocket_urlpatterns))
    )
})
```

Update **ASGI** application to rout **WebSocket** connections

📝 project_folder/my_website/**routing.py** 🐍 routing.py

```python
from django.urls import path
from .consumers import *

websocket_urlpatterns = [
    path('ws/chatroom/<str:room_name>/', ChatroomConsumer.as_asgi()),
]
```

Think of **routing** AS urls.py - These are **WebSocket** connections instead of **HTTP**

📝 project_folder/my_website/**consumers.py** 🐍 consumers.py

```python
from channels.generic.websocket import WebsocketConsumer
from django.shortcuts import get_object_or_404
from django.template.loader import render_to_string
from django.utils import timezone

from .models import Message, Room
import json

---

class ChatroomConsumer(WebsocketConsumer):

    def connect(self):
        self.user = self.scope['user']
        self.room_name = self.scope['url_route']['kwargs']['room_name']
        self.room = get_object_or_404(Room, name=self.room_name)
        self.accept()

    def receive(self, text_data):
        text_data_json = json.loads(text_data)

        message = Message.objects.create(
            room=self.room,
            author=self.user,
            message=text_data_json['message']
        )
        context = {
            'msg': message,
            'today': timezone.now().date().strftime("%Y-%m-%d"),
            'user': self.user
        }

        html = render_to_string('chat/partials/message.html', context)
        self.send(text_data=html)
```

NOTE: WebSocket Views/Consumers **DO NOT** have **request** Object

NOTE: Consumers uses different functions for responding back to the client(s)

NOTE: We **can't use**: **{% url 'websocket_pathname' %}**
because it is handled by HTTP Django Channel

Use `self.scope` **object**
to retrieve data, such as, user or path's parameters: `path('chat/<str:parameter>', …)`

Some differences between **Views** & **Consumers**

views.py	consumers.py
HttpResponse() sends response data to client: HTML, XML, JSON…	**render_to_string**(template, context) similar to **render**() in views.py, and does NOT require **request** object
render(request, template, context) renders templates {% if … %}{% else %} , before sending them using **HttpResponse**() with **context** data	
def myView(request, **parameter**) to retrieve data, such as path's params: path('chat/<str:**parameter**>', views.myView, name…)	self.scope['url_route']['kwargs']['**ID**'] to retrieve data, such as path's params: path('ws/<int:**ID**>', myConsumer.as_asgi())
form.cleanned_data['input_name'] is used to **get POST data** like <form>'s <input> when **form.is_valid**()	**json.loads**(text_data) at def receive() like **form.cleanned_data**, is used to **get POST data**. `json.loads(text_data)['input_name']`
return **HttpResponse**() return **render**()	self.send(text_data=**render_to_string**())

📝 project_folder/**app_name**/templates/app_name/**base.html** </> base.html

NOTE: HTMX does NOT support WebSockets by default

Hence, include HTMX WebSockets Extension from:
https://v1.htmx.org/extensions/web-sockets/

```
...

<script name="htmx.js" src="{% static 'app_name/js/lib/htmx.min.js' %}" defer></script>
<script name="htmx-websockets.js" src="{% static 'app_name/js/lib/htmx_websockets.js' %}"
defer></scri...
<script name="hyperscript.js" src="{% static 'app_name/js/lib/hyperscript.min.js' %}"
defer></script>
{% block head %}{% endblock %}

...
```

POST message via WebSocket Channel

📝 project_folder/chat/templates/chat/**index.html** </> index.html

```
...
  <form id="chat-form"
    hx-post="{% url 'room' %}"
    hx-trigger="submit delay:500ms"
    hx-target="#chat-messages"
    hx-swap="beforeend">
    {% csrf_token %}
    {{ form|crispy }}
  </form>
...

...
addEventListener('htmx:afterRequest'
...
```

```
...
  <form id="chat-form"
    hx-ext="ws"
    ws-connect="/ws/chatroom/public/"
    ws-send>
    {% csrf_token %}
    {{ form|crispy }}
  </form>

...

...
addEventListener('htmx:wsAfterSend'
...
```

NOTE: “public” at ws-connect, is the created **Room** model with name=”public”

This form POSTs <input> message TO → **ChatroomConsumer** at 🐍 customers.py

📝 project_folder/**chat**/templates/chat/**partials/message.html** </> message.html

```
<div id="chat-messages" hx-swap-oob="beforeend">
    {% include 'chat/message.html' %}
</div>
```

NOTE: hx-swap-oob (out of band)
is used only with a server-response. Hence, the use of a message.html partial

---

It targets any DOM element with id: #chat-messages, and in this context;

It appends, the wrapped innerHTML, at the end of the target

Broadcast message to **Consumers** with **Channel Layers**

📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
CHANNEL_LAYERS = {
    'default': { 'BACKEND': 'channels.layers.InMemoryChannelLayer' }
}
```

InMemoryChannelLayer is **NOT** suitable in **production**!
Use it in DEBUG=True ONLY. For production USE Redis or **Valkey**

📝 project_folder/my_website/**consumers.py** 🐍 consumers.py

```
...
from channels.generic.websocket import WebsocketConsumer # ← AsyncWebs...
from asgiref.sync import async_to_sync    # ← you can also import sync_to_async
...
```

```
class ChatroomConsumer(WebsocketConsumer):

    def connect(self):
        self.user = self.scope['user']
        self.room_name = self.scope['url_route']['kwargs']['room_name']
        self.room = get_object_or_404(Room, name=self.room_name)

        async_to_sync(self.channel_layer.group_add)(
            self.room_name, self.channel_name
        )

        self.accept()
...
```

NOTE: **async_to_sync()** → Allows asynchronous calls in synchronous functions

NOTE: **group_add()** → Connects **channel** to the **group** = **room_name**

Alternatively, you can replace: **WebsocketConsumer** TO **AsyncWebsocketConsumer**

```
class ChatroomConsumer(AsyncWebsocketConsumer):

    async def connect(self):
        await self.user = self.scope['user']
        await self.room_name = self.scope['url_route']['kwargs']['room_name']
        await self.room = get_object_or_404(Room, name=self.room_name)
        await self.channel_layer.group_add(self.room_name, self.channel_name)
        await self.accept()
```

```
    def disconnect(self, close_code):
        async_to_sync(self.channel_layer.group_discard)(
            self.room_name, self.channel_name
        )
```

ADD **disconnect**() method TO LEAVE the **group** when the **channel** DISCONNECTS

```
    def receive(self, text_data):
        text_data_json = json.loads(text_data)

        message = Message.objects.create(
            room=self.room,
            author=self.user,
            message=text_data_json['message']
        )
        context = {
            'msg': message,
            'today': timezone.now().date().strftime("%Y-%m-%d"),
            'user': self.user
        }

        html = render_to_string('chat/partials/message.html', context)
        self.send(text_data=html)

        event = {
            'type': 'message_handler',
            'message_id': message.id
        }
        async_to_sync(self.channel_layer.group_send)(
            self.room_name, event
        )
```

NOTE: **group_send**() → sends **response** TO all connected **Consumers**
Create **message_handler**() method below **receive**() method

```
    def message_handler(self, event):
        message_id = event['message_id']
        message = Message.objects.get(id=message_id)
        context = {
            'msg': message,
            'today': timezone.now().date().strftime("%Y-%m-%d"),
            'user': self.user
        }

        html = render_to_string('chat/partials/message.html', context)
        self.send(text_data=html)
```

Online Status (Offline ⚪ 5 Online 🟢)

📝 project_folder/chat/**models.py** (**Room** & **Message**) 🐍 models.py

```python
from django.db import models
from django.contrib.auth.models import User

---

class Room(models.Model):
    name = models.CharField(max_length=128, unique=True)
    users_online = models.ManyToManyField(
        User,
        related_name='online_in_rooms',      ← user_instance.online_in_rooms
        blank=True
    )

    def __str__(self):
        return self.name

---

class Message(models.Model):
    room = models.ForeignKey(
        Room,
        related_name='messages',
        on_delete=models.CASCADE
    )
    author = models.ForeignKey(User, on_delete=models.CASCADE)
    message = models.CharField(max_length=1000)
    created_at = models.DateTimeField(auto_now_add=True)

---

    class Meta:
        ordering = ['-created_at']

    def __str__(self):
        return f'{self.author.username}: {self.message}'
```

Update **DATABASE**: python manage.py makemigrations **THEN** python manage.py migrate

📝 project_folder/my_website/**consumers.py** 🐍 consumers.py

```python
...

class ChatroomConsumer(WebsocketConsumer):

    def connect(self):
        ...

        # ADD User TO online list, AND UPDATE online count
        if self.user not in self.room.users_online.all():
            self.room.users_online.add(self.user)
            self.update_online_count()

        self.accept()
```

```python
    def disconnect(self, close_code):
        async_to_sync(self.channel_layer.group_discard)(
            self.room_name, self.channel_name
        )
        # REMOVE User FROM online list, AND UPDATE online count
        if self.user in self.room.users_online.all():
            self.room.users_online.remove(self.user)
            self.update_online_count()
```

```python
    def update_online_count(self):
        online_count = self.room.users_online.count()
        event = {
            'type': 'online_count_handler',
            'online_count': online_count
        }
        async_to_sync(self.channel_layer.group_send)(
            self.room_name, event
        )
```

```python
    def online_count_handler(self, event):
        online_count = event['online_count']
        partial = 'chat/partials/online_count.html'

        html = render_to_string(partial, {'online_count': online_count})
        self.send(text_data=html)
```

📝 project_folder/**chat**/templates/chat/**partials**/**online_count.html** </>

```
{% with online_count|add:"-1" as online_count %}
{% load strip_spaces %}
{% strip %}

<div id="online-status" hx-swap-oob="outerHTML">
    <span class="icon">
        {% if online_count > 0 %}🟢
        {% else %}⚪
        {% endif %}
    </span>
    <span class="online-count
      {% if online_count > 0 %} text-success
      {% else %} text-secondary
      {% endif %}">
        {% if online_count > 0 %} {{ online_count }}
        {% else %} 0
        {% endif %} Online
    </span>
</div>
{% endstrip %}
{% endwith %}
```

📝 project_folder/**chat**/templates/chat/**index.html** </> index.html

```
...

<h1>{{ room_name|title }}</h1>
<hr>
<div id="online-status" class="text-primary">
    <span class="spinner-grow spinner-grow-sm"></span>
    <span role="status">Connecting...</span>
</div>
<hr>

...
```

(Next step requires a break… Take a break from the **Chat** app!)

Optimize **Chat** app with **Valkey** TO improve server performance

In this tutorial, **Valkey** is used as a, **Message Broker**:

Message Broker

A software component that facilitates communication between different applications or services by translating, routing, and managing messages. It acts as an intermediary, ensuring that messages are delivered reliably and efficiently, even if the sender and receiver are not directly connected or use different protocols.

Redis: While primarily an in-memory data store;
It can act as a lightweight message broker using its **Pub/Sub** (Publish/Subscribe) feature.
It allows messages to be published to **channels** and received by subscribers in real-time.

(AI Generated: Copilot @ copilot.microsoft.com, 18/Mar/2025)

Django + Redis, Architecture

```
Client requests App FOR a resource

---

THEN App searches for the resource IN Redis

IF resource IS FOUND IN Redis
  THEN Redis sends resource to App which passes it to the Client

---

ELSE IF resource IS NOT FOUND IN Redis
  THEN Redis searches for the resource IN Database

    IF resource IS FOUND IN Database
      THEN Redis FETCHES resource AND sends it to App → Client
```

NOTE: Application in this context is: **chat**

NOTE: Fetching resource to **Redis**, allows us to access it when needed directly from **Redis**, instead of the **Database**

Chat with Valkey Channels

🖥️ (venv) @ project_folder 📚 pip library

```
pip install channels-valkey
pip freeze > requirements.txt # update requirements.txt
```

📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
CHANNEL_LAYERS = {}

if DEBUG:
    CHANNEL_LAYERS = {
        'default': { 'BACKEND': 'channels.layers.InMemoryChannelLayer' }
    }
else:
    CHANNEL_LAYERS = {
        'default': {
            'BACKEND': 'channels_valkey.pubsub.ValkeyPubSubChannelLayer',
            'CONFIG': {
                'hosts': [(os.getenv('VALKEY_HOST_URL'))],
            },
        },
    }
```

NOTE:

InMemoryChannelLayer is **NOT** suitable in **production**! Hence, the integration of **Valkey**

`"BACKEND": "channels_valkey.core.ValkeyChannelLayer",`
is the **original** layer, and implements channel and group handling itself.

`"BACKEND": "channels_valkey.pubsub.ValkeyPubSubChannelLayer",`
is newer and leverages Valkey Pub/Sub for message dispatch. This layer is currently at ***Beta*** status, meaning **it may be subject to breaking** changes whilst it matures.

📝 project_folder/**.env** .env

```
DEBUG='False' ← Set the DEBUG to False, in order to, test the Valkey channel
                NOTE: You should always set DEBUG to False in production
...

# Railway App | deploy valkey in railway.com

VALKEY_HOST_URL='create redis app at railway.com, and paste redis_url here'
```

Private Chat Rooms 💬📝🔒

🖥️ (venv) @ project_folder 📚 pip library

```
pip install shortuuid
pip freeze > requirements.txt # update requirements.txt
```

Short UUID generates random string of unique set of characters.
It's not a standard build-in library hence, we have to install it.

📝 project_folder/chat/**models.py** (**Room** & **Message**) 🐍 models.py

```
from django.db import models
from django.contrib.auth.models import User
import shortuuid

---


class Room(models.Model):
    name = models.CharField(
        max_length=128,
        unique=True,
        unique=shortuuid.uuid)
    users_online = models.ManyToManyField(
        User,
        related_name='online_in_rooms',
        blank=True
    )
    members = models.ManyToManyField(
        User,
        related_name='chat_rooms',
        blank=True
    )
    is_private = models.BooleanField(default=False)


    def __str__(self):
        return self.name

...
```

Update **DATABASE**: python manage.py makemigrations **THEN** python manage.py migrate

Usecase example of chat room models with related_name property

In your Django models, **related_name** defines the reverse relationship name when accessing related objects.

Here’s how it works in your case:

```
users_online = models.ManyToManyField(User,
related_name='online_in_rooms')
```

This means a **User** instance can access all rooms where they are currently online using `user.online_in_rooms.all()`.

```
members = models.ManyToManyField(User, related_name='chat_rooms')
```

A **User** instance can access all rooms they are a member of using `user.chat_rooms.all()`.

```
room = models.ForeignKey(Room, related_name='messages',
on_delete=models.CASCADE)
```

A **Room** instance can access all messages associated with it using `room.messages.all()`.

Get or create private chatroom (utility)

📝 project_folder/chat/**utils.py** 🐍 utils.py

```python
from .models import Room

---


def get_or_create_chatroom_for_users(User_A, User_B):
    """
    This utility searches for an existing private chatroom between
    the provided user instances. If chatroom is not found,
    then a new private chatroom is created for those users.
    """

    if User_A == User_B:
        print('Cannot create chatroom for the same user!')
        return None

    my_chat_rooms = User_A.chat_rooms.filter(is_private=True)
    room_instance = None

    # GET private chatroom OF User_A and User_B
    if my_chat_rooms.exists():
        for room in my_chat_rooms:
            if User_B in room.members.all():
                room_instance = room
                break

    # Otherwise, create new private chatroom for them
    if room_instance is None:
        room_instance = Room.objects.create(is_private=True)
        room_instance.members.add(User_B, User_A)

    return room_instance
```

📝 project_folder/chat/**views.py** 🐍 views.py

```python
from django.shortcuts import render, redirect, get_object_or_404
from django.contrib import messages
from django.contrib.auth.models import User
from django.contrib.auth.decorators import login_required
from django.http import Http404 # Replaced HttpResponse with Http404
from django.utils import timezone

from .utils import get_or_create_chatroom_for_users
from .forms import MessageForm
from .models import Room
```

Update **room** View

```
... ← imports


@login_required
def roomView(request, room_name='public'): #added room_name parameter
```

```
    room = get_object_or_404(Room, name=room_name) #set name to room_name
    form = MessageForm()
    other_user = None

    # GET other_user IF room is private

    if room.is_private:
        members = room.members.all()

        if request.user not in members:
            raise Http404()

        for member in members:
            if member != request.user:
                other_user = member
                break
```

```
... ← if request.htmx:


    context = {
        'form': form,
        'user': request.user,
        'other_user': other_user,
        'room_name': room.name,
        'room_messages': room.messages.all()[:30],
        'today': timezone.now().date().strftime("%Y-%m-%d")
    }

    return render(request, 'chat/index.html', context)
```

NOTE: **roomView** provides context of **public** chatroom (**Room**) by default

NOTE: **other_user** is defined only when a provided chatroom (**Room**) **is_private**

Create **chat with** View

```
... ← roomView()

@login_required
def chatWithView(request, username):

    logged_in_user = request.user
    chat_with_user = User.objects.get(username=username)

    room_instance = get_or_create_chatroom_for_users(
        logged_in_user, chat_with_user
    )

    if room_instance is None:
        messages.error(request, 'You cannot chat with yourself!')
        return redirect('public-chatroom')

    return redirect('chatroom', room_instance.name)
```

NOTE: **chatWithView** redirects to path(…, name='chatroom') which is **roomView**

NOTE: **roomView's** parameter - room_name='public' becomes room_instance.name

Update urlpatterns

📝 project_folder/chat/**urls.py** 🐍 urls.py

```
from django.urls import path
from . import views

urlpatterns = [
    path('', views.roomView, name='public-chatroom'), #renamed path-name
    path('room/<str:room_name>', views.roomView, name='chatroom'),
    path('with-user/<username>', views.chatWithView, name='chat-with'),
]
```

Summary: 'chatroom' **path** requires - the chatroom's name. For example: 'public' (default). Accessing 'chat-with' **path** requires - the NOT logged-in user's username.

- IF there is already existing room between NOT logged-in user & the logged-in user. THEN client is sent TO 'chatroom' **path** with that room's name AS **room_name** arg.
- ELSE new room is created for those users with, generated by **shortuuid**, name instead before the client is sent TO 'chatroom' **path**.

My chats Dropdown

Let's create a dropdown with available chat rooms that the logged-in user is a part of. Use `{% include %}` tag to implement it in needed templates, such as user's profile.

In future, consider using DynamicSelect instead TO include images of private chatrooms.

📝 project_folder/**chat**/templates/chat/includes/**my_chats.html** </>

```
{% load strip_spaces %}
{% strip %}
<div class="dropdown {{ div_class }}">

    <button type="button"
        id="dropdownMenuButton1"
        class="btn dropdown-toggle
          {% if button_class %} {{ button_class }}
          {% else %} btn-light
          {% endif %}"
        data-bs-toggle="dropdown"
        aria-expanded="false">
          My Chats
    </button>

    <ul class="dropdown-menu {{ ul_class }}"
        aria-labelledby="dropdownMenuButton1">
        {% for room in user.chat_rooms.all %}
            {% if room.is_private %}
                {% for member in room.members.all %}
                    {% if member != user %}
                        <li>
                            <a class="dropdown-item"
                               href="{% url 'chatroom' room.name %}">
                               {{ member }}
                            </a>
                        </li>
                    {% endif %}
                {% endfor %}
            {% endif %}
        {% endfor %}
    </ul>
</div>
{% endstrip %}
```

```
{% include 'chat/includes/my_chats.html' with div_class="" ul_class="" %}
```

📝 project_folder/**users**/templates/users/**profile.html** (users profile) **</>**

```
{% extends 'app_name/base.html' %}
{% load static %}
{% load crispy_forms_tags %}

{% block title %}Profile Page{% endblock %}

{% block content %}

<div class="container">
  <div class="row">
    <aside class="col-md-4">
      <div class="p-3 bg-secondary text-white">
        <img width="100%" src="{{ profile_user.profile.image.url }}">
      </div>
      {% if profile_user != request.user %}
          <a class="btn btn-secondary rounded-0 border-top w-100 mb-3"
             href="{% url 'chat-with' profile_user.username %}">
             <span>Direct Message</span>
          </a>
      {% else %}
          {% include 'chat/includes/my_chats.html' with
             button_class="btn-secondary border-top rounded-0 w-100"
             ul_class="w-100"
          %}
      {% endif %}
    </aside>
...
```

IF profile **IS** that of a logged-in user **THEN** show chats dropdown.

ELSE show button **TO** start a direct chat **WITH** the owner of that profile.

NOTE: {% include %} tag must be fully inline.

The above example contains organized **{% include %}** template tag.
However, this would not work in real Django application anytime soon.

This is because a template tag including argument **with** requires the variables to be set inline within the tag's scope.

Hence the unexpected error when linebreaks are present in an **{% include %}** tag

Update index template for one-to-one chatrooms

📝 project_folder/**chat**/templates/chat/**index.html** </> index.html

```
{% extends 'app_name/base.html' %}
{% load static %}
{% load crispy_forms_tags %}

---

{% block content %}

{% include 'chat/includes/my_chats.html' with div_class="float-end" %}

---

{% if other_user %}
    <a class="float-start" href="{% url 'profile' other_user.id %}">
        <img width="75px"
             class="rounded-circle bg-light me-2"
             src="{{ other_user.profile.image.url }}">
    </a>
    <h2>{{ other_user.username }}</h2>
{% else %}
    <h1>{{ room_name|title }}</h1>
    <hr>
    <div id="online-status" class="text-primary">
        <span class="spinner-grow spinner-grow-sm"></span>
        <span role="status">Connecting...</span>
    </div>
    <hr>
{% endif %}
<hr>
```

NOTE: **{% else %}** tag contains previously implemented code. & <hr> was remove

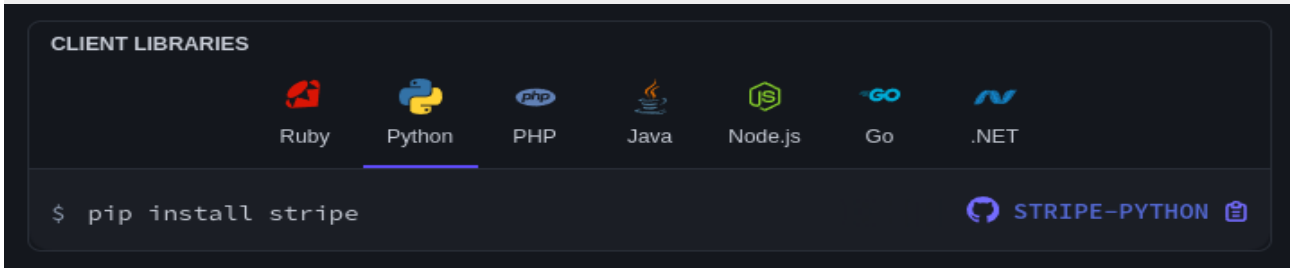
```
{% if request.user.is_authenticated %}
...

    <form id="chat-form"
        hx-ext="ws"
        ws-connect="/ws/chatroom/public/"
        ws-connect="/ws/chatroom/{{ room_name }}/"
        ws-send>
        {% csrf_token %}
        {{ form|crispy }}
    </form>

{% endif %}
```

Install **Stripe** 💳💸🏦

🖥️ (venv) @ project_folder 📚 pip library

```
pip install stripe
pip freeze > requirements.txt # update requirements.txt
```

→ We will explore **Payment Element** (stripe UI elements) after **Card Element**
→ **Payment Element** and **Card Element** differences: click me
→ **Dummy Cards** used for Testing: https://docs.stripe.com/testing#cards
→ **Stripe** API: https://docs.stripe.com/api



📝 project_folder/app_name/**views.py** (Stripe API **Example**) 🐍 views.py

```
import stripe
stripe.api_key = 'secret key (sk)' # https://dashboard.stripe.com/test/apikeys
```

```
@login_required
def paymentView(request):

    basket_instance = get_object_or_404(BasketModel, owner=request.user)
    if request.method == 'POST':
```

```
        # Below code makes the purchase.
        # The successful transaction is saved at your stripe account.

        customer = stripe.Customer.create(
            email=request.POST['email'],
            name=request.POST['username'],
            source=request.POST['stripeToken']
        )
        charge = stripe.Charge.create(
            customer,
            amount=int(basket_instance.totalCost * 100), # amount=500 → $5.00
            currency='USD',
            description='My description'
        )
```

NOTE: Stripe's attribute: 'amount', can't accept float-type-numbers (decimals)
Stripe API **works only** in certified with **SSL** & **TLS** domains (**https://** protocol)

Initialize **API Keys**

📝 project_folder/**.env** .env

```
# Stripe API Keys

STRIPE_PUBLIC_KEY='pk_live_FldsSDFjkasdASd…'
STRIPE_SECRET_KEY='sk_live_dSDlasdWEpdI3Iw…'

STRIPE_PUBLIC_TEST_KEY='pk_test_oREsdkAWEj…'
STRIPE_SECRET_TEST_KEY='pk_test_SDerEjWEs0…'
```

API KEYS: https://dashboard.stripe.com/test/apikeys

📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
# Stripe Payment System API keys

STRIPE_PUBLIC_KEY =
os.getenv('STRIPE_PUBLIC_TEST_KEY') if DEBUG else os.getenv('STRIPE_PUBLIC_KEY')

STRIPE_SECRET_KEY =
os.getenv('STRIPE_SECRET_TEST_KEY') if DEBUG else os.getenv('STRIPE_SECRET_KEY')
```

NOTE: STRIPE_PUBLIC_KEY Are custom variables out of preference
STRIPE_SECRET_KEY **DO NOT USE** TEST_KEYs in production!

Follow Stripe’s best practices:
https://docs.stripe.com/payments/payment-element/best-practices

Study the below article before implementing Stripe API
https://support.stripe.com/questions/prohibited-and-restricted-businesses-list-faqs

PCI and **Data Protection** Compliance ⚖️

To ensure compliance with **PCI DSS**, **Stripe** helps safeguard sensitive payment data and adheres to local regulations. By handling and storing sensitive payment information, **Stripe** provides tokens for secure payment processing, protecting both clients and the company.

It is essential to transparently **inform clients** about where their data is stored and processed. **Stripe's** terms and **policies must be included on payment forms**, allowing clients to review and agree before proceeding with any transactions.

For additional protection and verification, implementing 3D Secure (e.g., **two-factor** authentication) is recommended. This helps prevent fraud and protects the company from liability for chargebacks due to fraudulent claims.

We must comply with **GDPR**, the **Data Protection Act 2018**, **RODO**, and similar laws to build trust, protect client data, and enhance our credibility. Clients should know where their data is stored, how it is processed, and that no unnecessary information is collected beyond what is required for our services.

To align with data protection regulations, **users** must be allowed to **deactivate** and permanently **delete** their data. This should be handled within a reasonable timeframe (30–90 days), during which payments can be processed, and checks for unlawful activities can be completed if requested by local authorities. Beyond this timeframe, all user data must be removed when possible, respecting clients' rights and fostering trust.

Finally, collaborating with legal advisors or consultants specializing in payment and data protection laws can ensure comprehensive compliance and anticipate potential challenges, reducing risks for both the company and its clients.

Payment System **Vat Tax** ⚖️

VAT Compliance: (Make OWN RESEARCH! Info may change)

If your business exceeds the VAT threshold in the UK but your clients are based in France, the VAT rules depend on the nature of your transactions:

1. **Business-to-Business (B2B)**: If you're providing services or goods to VAT-registered businesses in France, the "place of supply" is considered to be France. In this case, the reverse charge mechanism often applies, meaning your French clients account for the VAT on their end. You wouldn't need to register for VAT in France, but you must ensure proper documentation, such as your client's VAT number, and include the reverse charge statement on your invoices.
2. **Business-to-Consumer (B2C)**: If you're selling to individual consumers in France, you may need to register for VAT in France. This is because the "place of supply" rules for B2C transactions often require VAT to be charged in the customer's country. The threshold for VAT registration in France is typically much lower than in the UK, or it may not exist at all for cross-border sales.

If you're selling digital services, you might also need to use the VAT One Stop Shop (OSS) to simplify VAT compliance across EU countries. To comply with VAT rules, **you may need to collect multiple pieces of evidence** to determine the customer's location. For example

1. **IP Address**: Approximate location of the customer.
2. **Billing Address**: Provided during checkout.
3. **Card Issuing Country**: Based on the card's BIN.

If your, registered in UK online service-based business, exceeds the VAT threshold (e.g. £90,000 turnover), you would need to register for VAT in the relevant country (e.g. in France, if your primary online customers are from this country) & remit taxes accordingly.

Practical Steps

1. **Collect Evidence**:
   Use **Stripe**'s (an online service that we will use to create checkout form) tools to gather IP address, billing address, and card issuing country.
2. **Automate VAT Calculation**:
   Integrate a VAT calculation tool to automatically apply the correct tax rate based on the customer's location.
3. **Consult a Tax Professional**:
   Ensure compliance with international VAT rules to avoid penalties.

Stripe's **Customer** 🪪

We will use **stripe**'s API, to create a **Customer**

The **Customer** is going to be our registered **User**

We will also use stripe's API - **Payment Intent** TO mount **Card Element UI** in our <form>

It is important to use stripe's UI elements, in order to, NOT store client's sensitive payment data, on our server. Stripe's UI elements will give us the TOKENIZED client's payment method, which we can use to make payments.

📝 project_folder/**users/utils.py** 🐍 utils.py

```python
from django.core.files.uploadedfile import UploadedFile
from django.conf import settings

import requests, stripe
stripe.api_key = settings.STRIPE_SECRET_KEY
```

```python
def get_or_create_stripe_customer(user):

    stripe_customer_id = None

    if hasattr(user, 'profile'):
        # Retrieve the user's Stripe customer ID from its profile
        stripe_customer_id = getattr(user.profile, 'stripe_customer_id', None)

    if stripe_customer_id is None:
        # Create a new Stripe customer
        customer = stripe.Customer.create(
            name=user.username,
            email=user.email,
            metadata={'user_id': str(user.id)}
        )
        stripe_customer_id = customer.id

        if hasattr(user, 'profile'):
            # Update the user's profile with the new Stripe customer ID
            user.profile.stripe_customer_id = stripe_customer_id
            user.profile.save()

    return stripe_customer_id
```

📝 project_folder/**users/models.py** 🐍 models.py

```python
from django.db import models
from django.contrib.auth.models import User
from django_resized import ResizedImageField
from django.conf import settings

from .utils import get_or_create_stripe_customer

from botocore.exceptions import ClientError
import boto3


class Profile(models.Model):
    user = models.OneToOneField(User, on_delete=models.CASCADE)
    stripe_customer_id = models.CharField(
        max_length=255, blank=True, null=True, unique=True, editable=False)
    phone_number = models.CharField(max_length=15)
    image = ResizedImageField(
        size=[300, 300],
        crop=['middle', 'center'],
        quality=75,
        force_format='JPEG',
        upload_to='profile_pics',
        default='default_profile.jpg'
    )

    def save(self, *args, **kwargs):
       try:
          this = Profile.objects.get(user=self.user)

          # Create Stripe customer for new Profile. (used for payments)
          if not self.stripe_customer_id:
             self.stripe_customer_id = get_or_create_stripe_customer(self.user)

          # Only move the old image if there is an existing image and it's...
          if this.image and this.image.name != self.image.name:
             #recycle_profile_pic(this.image.name) ← AWS S3 bucket
             remove_profile_pic(this.image.name)   ← AWS S3 bucket

       except Profile.DoesNotExist:
          # This is a new profile, so no need to move any image.
          pass

       super().save(*args, **kwargs)
```

python manage.py **makemigrations** users → python manage.py **migrate** users

📝 project_folder/**users/views.py** 🐍 views.py

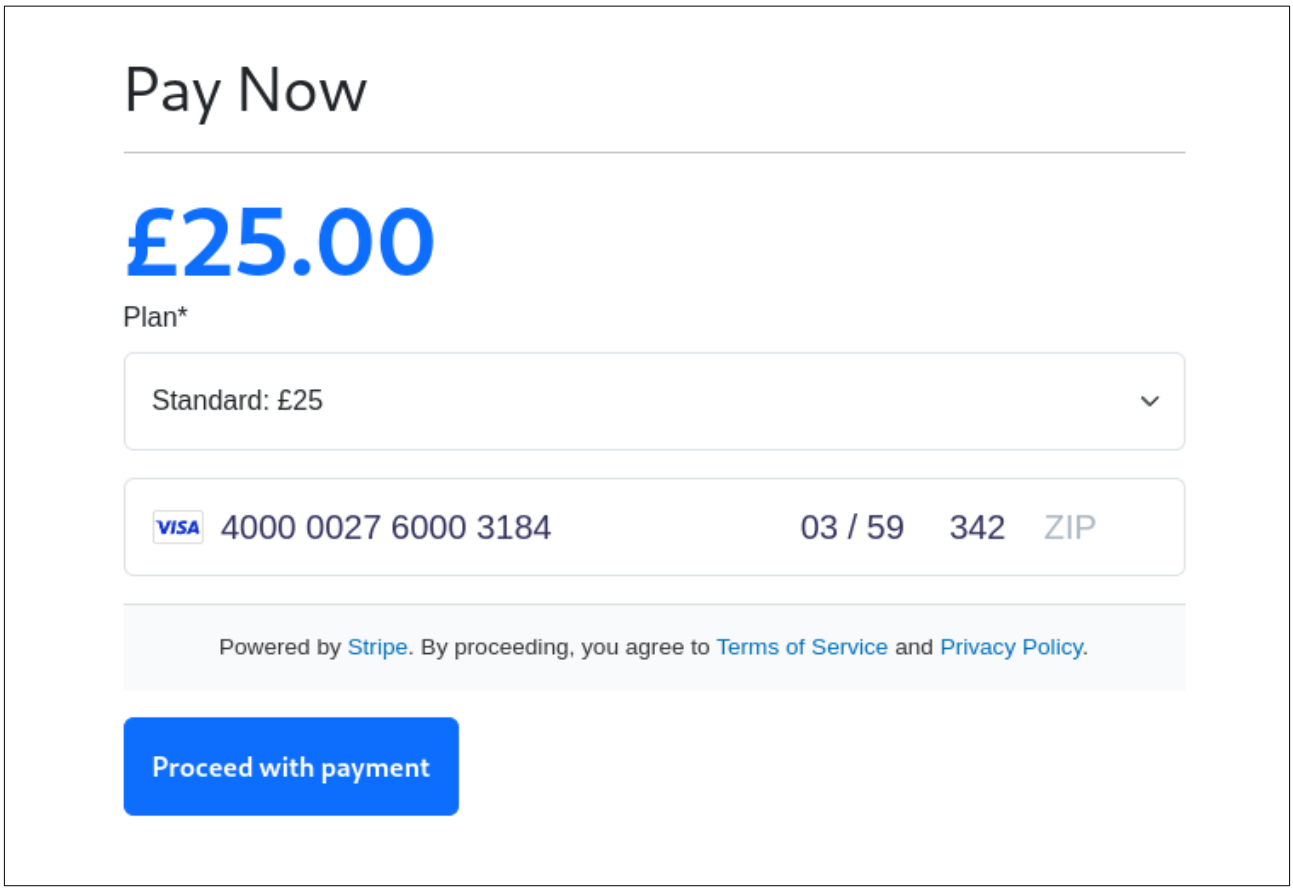
```
...
from django.conf import settings
from .models import Profile
from .forms import UserRegisterForm, UserUpdateForm, ProfileForm

import stripe
stripe.api_key = settings.STRIPE_SECRET_KEY


---

@login_required
def profileView(request, user_id):
    user_instance = get_object_or_404(User, pk=user_id)
    ...
---

        if form_user.is_valid() and form_profile.is_valid():
            confirm_password = form_user.cleaned_data.get('confirm_password')
            if check_password(confirm_password, user_instance.password):
                form_user.save()
                form_profile.save()
                stripe.Customer.modify(
                    user_instance.profile.stripe_customer_id,
                    name=user_instance.username,
                    email=user_instance.email
                )
               ...
```

User's Stripe Customer's data: **name** and **email**, is also being updated

📝 project_folder/**users/admin.py** 🐍 admin.py

```
from django.contrib import admin
from .models import Profile

---


class ProfileAdmin(admin.ModelAdmin):
    readonly_fields = ('stripe_customer_id',)
    list_display = [field.name for field in Profile._meta.fields]


# Register your models here.
admin.site.register(Profile, ProfileAdmin)   ← Added ProfileAdmin
```

Buy Plan with Stripe's **Card Element UI** 💳



📝 project_folder/**app_name/forms.py** 🐍 forms.py

```python
class PlanForm(forms.Form):
    UNIT = '£'
    PLANS = {
        'basic': 12.25, # Hence, £12.25
        'standard': 25,
        'premium': 50
    }
    OPTION = [
        ('', '--- Select a plan ---'),
        ('basic', f'Basic: {UNIT}{PLANS.get('basic')}'),
        ('standard', f'Standard: {UNIT}{PLANS.get('standard')}'),
        ('premium', f'Premium: {UNIT}{PLANS.get('premium')}')
    ]

    plan = forms.ChoiceField(
        label='Plan',
        choices=OPTION,
        required=True
    )
```

📝 project_folder/**app_name/views.py** 🐍 views.py

```python
...
from django.http import HttpResponseRedirect, JsonResponse ← Added JsonResponse

from django.views.generic import ListView
from users.utils import get_or_create_stripe_customer
from .forms import ModelForm, ContactUsForm, PlanForm ← Added PlanForm
from .models import ModelName

import stripe, json
stripe.api_key = settings.STRIPE_SECRET_KEY

---

@login_required
def buyPlanView(request):

    context = {
        'form': PlanForm(),
        'plans': PlanForm.PLANS,
        'payment_unit': PlanForm.UNIT,
        'display_price': 0, # initial price to be displayed
        'stripe_public': settings.STRIPE_PUBLIC_KEY
    }

    return render(request, 'app_name/buy_plan.html', context)
```

```python
@login_required
def buyPlanPaymentIntentView(request):

    form = PlanForm(request.POST)
```

```python
    # Validate plan from POST request
    if request.method == 'POST' and form.is_valid():
        plan = request.POST.get('plan')
    else:
        return JsonResponse(
          {'error': 'Invalid form, try refreshing the page'}, status=400)

    if plan not in PlanForm.PLANS.keys():
        return JsonResponse(
          {'error': 'Selected plan is not registered, please report this issue'}, status=400)
```

```python
    # Retrieve the user's Stripe customer ID from its profile
    stripe_customer_id = get_or_create_stripe_customer(request.user)
    # Stripe's amount is in pennies. Hence, amount=500 → £5.00
    amount = int(PlanForm.PLANS.get(plan) * 100)
```

```python
    intent = stripe.PaymentIntent.create(
        amount=amount,
        currency="gbp",
        customer=stripe_customer_id,
        payment_method_types=["card"],
        description=f"Purchased '{plan}' plan",
        metadata={"purchased_plan": str(plan)}
    )

    return JsonResponse({'client_secret': intent.client_secret})
```

NOTE: **client_secret** is required for security reasons, and to proceed a charge

```python
def paymentSuccessView(request):
    return render(request, 'app_name/payment_success.html')
```

📝 project_folder/**app_name/urls.py** 🐍 urls.py

```
urlpatterns = [
    . . .
    path('buy-plan/', views.buyPlanView, name='buy_plan'),
    path('buy-plan/intent/', views.buyPlanPaymentIntentView,
name='buy_plan_intent'),
    path('payment-success/', views.paymentSuccessView,
name='payment_success'),
]
```

📝 project_folder/**app_name/buy_plan.html** </> buy_plan.html

```
{% extends 'app_name/base.html' %}
{% load static %}
{% load crispy_forms_tags %}
{% block title %}Checkout Page{% endblock %}

{% block head %}
<style>

form * {
    font-family: "Helvetica Neue", Helvetica, sans-serif;
}

.stripe-agreement {
    text-align: center;
    font-size: 0.85rem;
    color: #333;
    padding: 15px 20px;
    background-color: #f9fafb;
    border-top: 1px solid #ddd;
}
.stripe-agreement a {
    color: #0070ba;
    text-decoration: none;
}
.stripe-agreement a:hover {
    text-decoration: underline;
}
.stripe-agreement p {
    margin: 0;
}

</style>
<script name="stripe.js" src="https://js.stripe.com/v3/"></script>  ← Stripe API in JavaScript
{% endblock %}
```

```
{% block content %}

<h1>Pay Now</h1>
<hr>
<h2 id="total-cost" class="display-3 fw-bold text-primary mb-0">
{{ payment_unit }}{{ display_price|floatformat:2 }}
</h2>

<form id="payment-form"
        action="{% url 'buy_plan' %}"
        method="POST"
        data-secret="{{ client_secret }}">
   {% csrf_token %}
   {{ form|crispy }}
   <div id="card-element" class="form-control p-3">
      <!-- Elements will create form elements here -->
   </div>

   <section class="stripe-agreement mt-3">
      <p>
         Powered by
         <a href="https://stripe.com" target="_blank">Stripe</a>.
         By proceeding, you agree to
         <a href="https://stripe.com/legal" target="_blank">Terms of Service</a>
         and
         <a href="https://stripe.com/privacy" target="_blank">Privacy Policy</a>.
      </p>
   </section>

   <button type="submit" id="submit-button" class="btn btn-primary fw-bold my-3 p-3">
      Proceed with payment
   </button>
   <div id="card-errors" role="alert" class="text-danger">
      <!-- Display error message to your customers here -->
   </div>

</form>

{% endblock %}
```

```
DO NOT RENAME: payment-form, card-element and card-errors  ← (stripe elements)
```

```
{% block base %}

---

<script name="select-plan-form" type="text/javascript">

const objPlans = {{ plans|safe }};
let elmTotalCost = elmSelectPlan = undefined;

document.addEventListener('DOMContentLoaded', () => {

    elmTotalCost = document.getElementById('total-cost');
    elmSelectPlan = document.querySelector('select[name="plan"]');
    elmSelectPlan.classList.add('p-3');

    elmSelectPlan.addEventListener('change', (event) => {
        const totalCost = objPlans[event.target.value] || 0;
        elmTotalCost.innerHTML = `{{ payment_unit }}${totalCost.toFixed(2)}`;
    });

});

</script>

---

<script name="stripe-payment-form" type="text/javascript">

// Initialize Stripe with your publishable key
const stripe = Stripe('{{ stripe_public }}');
// Create an instance of Elements
const elements = stripe.elements();

// Options for customizing the Card Element styles
const style = {
    base: {
        color: "#32325d",
        fontFamily: '"Helvetica Neue", Helvetica, sans-serif',
        fontSmoothing: "antialiased",
        fontSize: "20px",
        "::placeholder": { color: "#aab7c4", },
    },
    invalid: {
        color: "#fa755a",
        iconColor: "#fa755a",
    },
};

// Create an instance of the Card Element  &  Add the Card Element to the page
const card = elements.create("card", { style });
card.mount("#card-element");
```

```
const form = document.getElementById("payment-form");
const errorElement = document.getElementById("card-errors");

// Handle real-time validation errors
card.on("change", (event) => {
    errorElement.textContent = (event.error) ? event.error.message : "";
});

// Handle form submission
form.addEventListener("submit", async (event) => {
    event.preventDefault();

    const formData = new FormData();
    formData.append("plan", elmSelectPlan.value);

    // Send the selected plan to the backend
    const response = await fetch("{% url 'buy_plan_intent' %}", {
        method: "POST",
        headers: {
            "X-CSRFToken": "{{ csrf_token }}",
        },
        body: formData,
    });

    const data = await response.json();

    if (!response.ok) {
        // Handle errors returned from the backend
        errorElement.textContent = data.error;
    }

    const clientSecret = data.client_secret;
```

NOTE: card.on(“change”) - adds realtime validation errors for **.card-errors**

NOTE: **response**, sends **request** with **plan** input’s value TO **buyPlanIntentView**

NOTE: IF **plan** passes a validation at the backend, THEN we get **clientSecret**

NOTE: **clientSecret** is required TO **make/confirm** the payment

```
    // Confirm the card payment
    const { error } = await stripe.confirmCardPayment(clientSecret, {
        payment_method: {
            card: card,
        },
    });

    if (error) {
        // Handle errors from the stripe card payment
        errorElement.textContent = error.message;
    } else {
        // The card has been paid successfully
        // Reset form inputs
        card.clear();
        form.reset();
        // Redirect to the success page
        window.location.href = "{% url 'payment_success' %}";
    }

});
```

```
</script>
{% endblock %}
```

NOTE: **card** is a stripe element, mounted as: **#card-element** <input>

NOTE: **client** is **redirected** TO **payment_success.html**
template on a successful payment transaction

📝 project_folder/**app_name/payment_success.html** </> payment_success.html

```
{% extends 'app_name/base.html' %}
{% block head %}
<style>
body {
    text-align: center;
    padding: 40px 0;
}
h1 {
    color: #88B04B;
    font-family: "Nunito Sans", "Helvetica Neue", sans-serif;
    font-weight: 900;
    font-size: 40px;
    margin-bottom: 10px;
}
p {
    color: #404F5E;
    font-family: "Nunito Sans", "Helvetica Neue", sans-serif;
    font-size:20px;
    margin: 0;
}
i {
    color: #9ABC66;
    font-size: 100px;
    line-height: 200px;
    margin-left:-15px;
}
.card {
    padding: 60px;
    display: inline-block;
    border: 0;
    margin: 0 auto;
    animation: pop-in 1s;
}
.btn-success {
    animation: pop-in 1s, 1s scale-up 1s ease;
}
@keyframes pop-in {
    0% { opacity: 0; transform: scale(0.1); }
    100% { opacity: 1; transform: scale(1); }
}
@keyframes scale-up {
    0% { transform: scale(1); }
    50% { transform: scale(1.5); }
    100% { transform: scale(1); }
}
</style>
{% endblock %}
```

```
{% block content %}
<div class="card">
    <div style="
        border-radius: 200px;
        height: 200px;
        width: 200px;
        background: #F8FAF5;
        margin:0 auto;">
        <i class="checkmark">✓</i>
    </div>
    <h1 class="mt-5">Success</h1>
    <p>We have successfully received your purchase</p>
    <a href="{% url 'index' %}">
        <button class="btn btn-success my-3">
            Continue to
            <strong>Home Page</strong>
        </button>
    </a>
</div>
{% endblock %}
```

DonateView - Modifiable **Payment Element UI** 💳

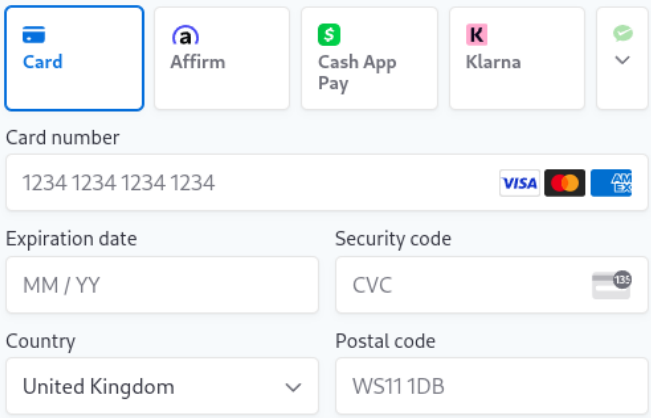
Payment Element is a **recommended** implementation of stripe.

Similar to **Card Element**, **Payment Element** must be created in backend to get essential key: **client_secret** (used only in **frontend**)

intent has property **intent_id**, which can be used to modify the Payment Intent. (**NEVER** send **indent_id** to the **frontend**)

Many payment method types, such as; **paypal**, **p24**, **klarna**… require a **Hook**, to verify transaction state of a third-party service. (To ease the tutorial, **DonateView** will include default payment method only)

Payment Element Form is **mounted** from the **frontend** and **requires client_secret**, and the state of new **Payment Element** is added on stripe, even if client hasn't finished their form.



Backend View

```python
intent = stripe.PaymentIntent.create(
    # amount of 100 → $1.00
    amount=100,
    currency="pln", # ← Polish złoty
    #customer=stripe_customer_id,
    payment_method_types=[
        "card",
        "paypal",
        "p24",
    ],
    description=f"Donation",
    #metadata={ "key": value }
)
```

```python
context = {
    'client_secret': intent.client_secret,
    'stripe_public':
settings.STRIPE_PUBLIC_KEY
}
```

Frontend Template

```javascript
const stripe = Stripe('{{ stripe_public }}'),
const options = {
    clientSecret: '{{ client_secret }}',
    appearance: { theme: 'tabs', /* stripe | tabs | night */ },
};
const elements = stripe.elements(options);
```

```javascript
const paymentElementOptions = {
    layout: {
        type: 'tabs', // accordion | tabs | auto
        defaultCollapsed: false,
    },
};
const paymentElement = elements.create(
    'payment', paymentElementOptions
);
paymentElement.mount('#payment-element');
```

```javascript
let url  = window.location.origin + "{% url
'payment_success' %}"

const {error} = await stripe.confirmPayment({
    elements, // If form is valid → redirect client
    confirmParams: {  return_url: url, },
});

if (error) { /* confirmPayment failed, print error */  }
```

Create DonateView - Template + Payment Element

📝 project_folder/**app_name/views.py** 🐍 views.py

```python
@login_required
def donateView(request):
```

```python
    min_value = 5 # 5 -> 5,00zł

    context = {
        'locale': 'pl',
        'payment_unit': 'zł',
        'display_price': min_value, # 5 -> 5,00zł
        'stripe_public': settings.STRIPE_PUBLIC_KEY
    }

    # Retrieve the user's Stripe customer ID from its profile
    stripe_customer_id = get_or_create_stripe_customer(request.user)
```

```python
    intent = stripe.PaymentIntent.create(
        amount=int(min_value * 100), # 5 -> 0.05zł
        currency="pln",
        customer=stripe_customer_id,
        payment_method_types=["card"],
        description=f"Donation",
    )

    context.update({
        'client_secret': intent.client_secret
    })

    return render(request, 'app_name/donate.html', context)
```

NOTE: **donateView** is made for Polish customers

📝 project_folder/**app_name/urls.py** 🐍 urls.py

```python
urlpatterns = [
    ...
    path('donate/', views.donateView, name='donate'),
]
```

📝 project_folder/**chat**/templates/chat/**donate.html** </> donate.html

```
{% extends 'app_name/base.html' %}
{% load static %}
{% load crispy_forms_tags %}
{% block title %}Strona Dotacji{% endblock %}

{% block head %}
<script name="stripe.js" src="https://js.stripe.com/v3/"></script>
{% endblock %}
```

```
{% block content %}
<h1>Wesprzyj Nas</h1>
<hr>
<h2 id="total-cost" class="display-3 fw-bold text-primary mb-0">
   <span class="value">{{ display_price|floatformat:2 }}</span>{{ payment_unit }}
</h2>
```

```
<form id="payment-form" data-secret="{{ client_secret }}">
   {% csrf_token %}
   <div id="payment-element">
      <!-- Elements will create form elements here -->
   </div>
```

```
   <section class="stripe-agreement mt-3">
      <p>
         Obsługiwane przez
         <a href="https://stripe.com" target="_blank">Stripe</a>.
         Kontynuując, akceptujesz
         <a href="https://stripe.com/legal" target="_blank">Warunki korzystania z usługi</a>
         i
         <a href="https://stripe.com/privacy" target="_blank">Politykę prywatności</a>.
      </p>
   </section>
```

```
   <button type="submit" id="submit-button" class="btn btn-primary fw-bold my-3 p-3">
      Kontynuuj płatność
   </button>
   <div id="error-message" role="alert" class="text-danger">
      <!-- Display error message to your customers here -->
   </div>
</form>
{% endblock %}
```

```
{% block base %}
<script name="stripe-payment-form" type="text/javascript">

/* --- 3. Collect payment details --- */

// https://docs.stripe.com/payments/checkout/customization/appearance?payment-ui=embedded-components#all-rules

// Set your publishable key: remember to change this to your live publishable key in production
// See your keys here: https://dashboard.stripe.com/apikeys
const stripe = Stripe('{{ stripe_public }}');

const options = {
    clientSecret: '{{ client_secret }}',
    locale: '{{ locale }}',
    // Fully customizable with appearance API.
    appearance: {
        theme: 'tabs', // stripe | tabs | night (NOTE: variables modify the theme)
        variables: {
            colorPrimary: '#0570de',
            colorBackground: '#ffffff',
            colorText: '#30313d',
            colorDanger: '#df1b41',
            fontFamily: 'Ideal Sans, system-ui, sans-serif',
            spacingUnit: '6px',
            borderRadius: '4px',
        },
    },
};

---

// Set up Stripe.js and Elements to use in checkout form,
// passing the client secret obtained in a previous step
const elements = stripe.elements(options);

// Create Payment Element
const paymentElementOptions = {
    layout: {
        type: 'tabs', // accordion | tabs | auto
        defaultCollapsed: false,
    }
};

const paymentElement = elements.create('payment', paymentElementOptions);

// Mount/Show the Payment Element
paymentElement.mount('#payment-element');
```

```
/* --- 4. Submit the payment to Stripe --- */

const form = document.getElementById('payment-form');
const errorElement = document.querySelector('#error-message');

// Handle form submission
form.addEventListener("submit", async (event) => {
    event.preventDefault();

    const {error} = await stripe.confirmPayment({
        //`Elements` instance that was used to create the Payment Element
        elements,
        confirmParams: {
            return_url: window.location.origin + "{% url 'payment_success' %}",
        },
    });

    if (error) {
        // This point will only be reached if there is an immediate error when
        // confirming the payment. Show error to your customer (for example, payment
        // details incomplete)
        errorElement.textContent = error.message;
    }
    else {
        // Your customer will be redirected to your `return_url`. For some payment
        // methods like iDEAL, your customer will be redirected to an intermediate
        // site first to authorize the payment, then redirected to the `return_url`.
    }

});


</script>
{% endblock %}
```

📝 project_folder/**app_name**/templates/app_name/**base.html** </> base.html

```
{% load django_bootstrap5 %}
{% load static %}
<!DOCTYPE html>
    <html lang="{% if locale %}{{ locale }}{% else %}en{% endif %}">
...
```

Including **Payment Element** is straightforward, but modifying it presents challenges regarding security. Let's integrate a **custom form** with a **donation field**, allowing clients to specify their own amount.

Synchrononously mounted, custom **donation** field

📝 project_folder/**app_name/forms.py** 🐍 forms.py

```python
class DonateForm(forms.Form):
    locale = 'pl' # code e.g. 'pl', 'gb', 'de'
    UNIT = 'zł'

    min_value = 5 # 5 -> 500 groszy (pennies)
    max_value = 100

    donation = forms.DecimalField(
        label='Kwota donacji',
        initial=min_value,
        min_value=min_value,
        max_value=max_value,
        decimal_places=2,
        required=True,
        widget=forms.NumberInput(attrs={
            'placeholder': f'{min_value} do {max_value} zł',
            'aria-required': 'true',
            'title': '',
        })
    )
```

NOTE: The **amount** property of the **Payment Intent** object must be defined and cannot be 0. We've set it to 500 (5.00 zł) at the backend in **donateView**.

To maintain consistency and prevent conflicts, let's initialize the Payment Intent's **amount** using the **min_value** from **DonateForm** before serving it to the client.

We will do the same for the **UNIT** of the currency,
and for the **locale** to translate **Payment Element**.

Additionally, restrict client from providing absurd amount of money to mitigate a probable mistake.

NOTE: **decimal_places** is primarily used for visual clarity and streamlined backend processing.

To ensure transparency, the client must be clearly informed of the exact amount they are about to pay before finalizing the transaction.

📝 project_folder/**app_name/views.py** 🐍 views.py

```python
...
from .forms import (
    ModelForm,
    ContactUsForm,
    PlanForm,
    DonateForm
)

...
```

```python
@login_required
def donateView(request):
```

```python
    form = DonateForm()
    min_value = form.fields['donation'].min_value

    context = {
        'form': form,
        'locale': DonateForm.locale,
        'payment_unit': DonateForm.UNIT,
        'display_price': min_value, # 5 -> 5,00zł
        'stripe_public': settings.STRIPE_PUBLIC_KEY
    }

    # Retrieve the user's Stripe customer ID from its profile
    stripe_customer_id = get_or_create_stripe_customer(request.user)
```

```python
    intent = stripe.PaymentIntent.create(
        amount=int(min_value * 100), # 5 -> 0.05zł
        currency='pln',
        customer=stripe_customer_id,
        payment_method_types=['card'],
        description=f'Donation',
    )

    context.update({
        'client_secret': intent.client_secret
    })

    return render(request, 'app_name/donate.html', context)
```

NOTE: imported forms are wrapped inside a tuple to tidy up the codebase

📝 project_folder/**app_name**/templates/app_name/**donate.html** </> donate.html

```
...
<form id="payment-form" data-secret="{{ client_secret }}">
  {% csrf_token %}
  {{ form|as_crispy }}
  <div id="payment-element">
    <!-- Elements will create form elements here -->
  </div>
...
```

The **donation** field should only be displayed once the **Payment Element** is fully mounted. However, currently, it loads beforehand, which is unintuitive.

Suppose the stripe API **fails to load the Payment Element**. In that case, the client should know that the form is currently unavailable.

In this tutorial, I will only show how to mount both forms at the same time

```
/* --- Show custom <input> "Donation" --- */

// NOTE: This is NOT part of Stripe's documentation

// Mount Donation (Field), once paymentElement is ready
paymentElement.on('ready', () => {

    // Mount/Show the crispy_form divs
    const crispyFormDivs = document.querySelectorAll('[id^="div_id_"]');

    [...crispyFormDivs].map(div => {
        // Add class mounted
        div.classList.add('mounted');
    });

});

// Mount/Show the Payment Element
paymentElement.mount('#payment-element');
```

NOTE: elements with id: “div_id_...” are generated by crispy forms |filter

```
{% block head %}
<style>[id^="div_id_"]:not(.mounted) { display: none; }</style>
<script name="stripe.js" src="https://js.stripe.com/v3/"></script>
{% endblock %}
```

```
...
/* --- Show custom <input> "Donation" --- */

// NOTE: This is NOT part of Stripe's documentation

// Update #total-cost (label) when price is changed on input[name="donation"]
const labelTotal = document.getElementById('total-cost'),
      valueTotal = labelTotal.querySelector('.value'),
      parentDonation = document.querySelector('#div_id_donation'),
      inputDonation = parentDonation.querySelector('input[name="donation"]');

inputDonation.addEventListener('input', () => {
    let value = parseFloat(inputDonation.value);

    value = isNaN(value) ? 0 : value;
    valueTotal.innerText = value.toFixed(2).replace('.',',');

    inputDonation.classList.contains('Input--invalid')
        ? labelTotal.classList.add('text-danger')
        : labelTotal.classList.remove('text-danger');
    });

// Mount Donation (Field), once paymentElement is ready
...
```

Summary: added event listener for **donation** input TO update **#total-cost** (Label)

NOTE: **.Input--invalid** is stripe's CSS style & **.text-danger** is Bootstrap v5 CSS

NOTE: This code does not work yet because it relies on **.Input--invalid** class, which is toggled by **field_error.html** extension which we're about to implement

---

Let's update our donation field to support these stripe styles

```
{% block head %}
<link name="stripe.css" rel="stylesheet" href="{% static 'app_name/css/stripe.css' %}">
<style>

[id^="div_id_"]:not(.mounted) { display: none; }

.form-control {
   height: 56.39px !important;
}

</style>
<script name="stripe.js" src="https://js.stripe.com/v3/"></script>
{% endblock %}
```

Stripe CSS **and** field_error.html extension

This extension implements essential, real-time validation, feedback for the custom fields. However, it relies on stripe CSS and ID naming convension: **#Field-Type, .p-FieldError**...

We will implement only the essential styles. All of these styles were imported directly from generated Payment Element's <iframe>, some of them were also modified.

📝 `project_folder/app_name/static/app_name/css/stripe.css` stripe.css

```
:root {
    --p-spacing1: 6px;
    --p-spacing3: 18px;
    --borderRadius: 4px;
    --colorText: #30313d;
    --colorDanger: #df1b41;
    --colorBackground: #ffffff;
    --p-colorBackgroundDeemphasize10: #e6e6e6;
    --colorIconLoadingIndicator: #999999;
    --fontSizeSm: 0.93rem;
    --c-inputPaddingRight: 18px;
}
form * {
    font-family: "SF Pro Text",-apple-system,BlinkMacSystemFont,"Segoe UI","Roboto","Helvetica
Neue","Ubuntu",sans-serif;
    color: var(--colorText);
}
input.Input::placeholder {
    color: gray !important;
    opacity: 1;
}
.Input {
    padding: var(--p-spacing3);
    background-color: var(--colorBackground);
    border-radius: var(--borderRadius);
    transition: background 0.15s ease, border 0.15s ease, box-shadow 0.15s ease, color 0.15s ease;
    border: 1px solid var(--p-colorBackgroundDeemphasize10);
    box-shadow: 0px 1px 1px rgba(0, 0, 0, 0.03), 0px 3px 6px rgba(0, 0, 0, 0.02);
}
.Input--invalid {
    color: var(--colorDanger) !important;
    border-color: var(--colorDanger);
    box-shadow: 0px 1px 1px rgba(0, 0, 0, 0.03), 0px 3px 6px rgba(0, 0, 0, 0.02), 0 0 0 1px var(--colorDanger);
}
```

```css
.p-Input-input {
    -webkit-animation: native-autofill-out 1ms;
    animation: native-autofill-out 1ms;
    display: block;
    width: 100%;
}

/* Field select */

.p-Select-select {
    padding-right: calc(var(--c-inputPaddingRight) + 1em) !important;
}

/* Label above Field input */

.Label, .form-label {
    /* Note .form-label is from bootstrap5 |crispy */
    margin-bottom: var(--p-spacing1);
    font-size: var(--fontSizeSm);
    transition: transform 0.5s cubic-bezier(0.19, 1, 0.22, 1), opacity 0.5s cubic-bezier(0.19, 1, 0.22, 1);
}


/* Field--Error (label under input) */

.Error {
    margin-top: var(--p-spacing1);
    color: var(--colorDanger);
    font-size: var(--fontSizeSm);
}
.AnimateSinglePresenceItem {
    transition: transform 0.35s ease-in-out;
}
.AnimateSinglePresenceItem > p {
    opacity: 1;
    transition: opacity 0.35s ease-in-out;
}
.AnimateSinglePresenceItem > p.Field--hide {
    opacity: 0;
    height: 0;
}
.AnimateSinglePresenceItem:has(p.Field--hide) {
    transform: scale(1.25);
}


/* Stripe terms and policies CSS */

.stripe-agreement {
    text-align: center;
    font-size: 0.85rem;
    color: #333;
    padding: 15px 20px;
    background-color: #f9fafb;
    border-top: 1px solid #ddd;
}
.stripe-agreement a {
    color: #0070ba;
    text-decoration: none;
}
.stripe-agreement a:hover {
    text-decoration: underline;
}
.stripe-agreement p {
    margin: 0;
}
```

As you may have noticed in the example picture, an **Error Label** IS **translated** TO **Polish**. For that, we need a custom function: **translateValidity()**

📝 project_folder/**app_name**/static/app_name/js/**translate_validity_pl.js** JS

```
// AI Generated @ copilot.microsoft.com 26/Mar/2025 & edited by McRaZick

const validityTranslations = {
    valueMissing: "To pole jest wymagane.",
    typeMismatch: "Wprowadź poprawny typ danych (np. email lub URL).",
    patternMismatch: "Wartość nie pasuje do wzorca.",
    tooShort: "Wprowadź co najmniej {minLength} znaków.",
    tooLong: "Wartość przekracza maksymalną liczbę znaków ({maxLength}).",
    rangeUnderflow: "Wprowadź wartość większą lub równą {min}.",
    rangeOverflow: "Wprowadź wartość mniejszą lub równą {max}.",
    stepMismatch: "Wartość musi być zgodna z krokiem {step}.",
    customError: "To pole zawiera błąd niestandardowy.",
    valid: ""
};

const translateValidity = (validity, input) => {
    for (let [key, message] of Object.entries(validityTranslations)) {
        if (validity[key]) {
            // Replace placeholders dynamically if applicable
            message = message
                .replace("{minLength}", input.minLength || "")
                .replace("{maxLength}", input.maxLength || "")
                .replace("{min}", input.min || "")
                .replace("{max}", input.max || "")
                .replace("{step}", input.step || "");
            return message;
        }
    }
    return "";
};
```

NOTE: The application of a custom error **is demonstrated later** in the implementation of postal code field

📝 project_folder/**app_name**/templates/app_name/**donate.html** </> donate.html

```
...
</style>
<script name="stripe.js" src="https://js.stripe.com/v3/"></script>
<script name="translate-validity-pl.js" src="{% static 'app_name/js/translate_validity_pl.js' %}"></script>
{% endblock %}
...
```

📝 .../templates/**app_name**/**extensions**/stripe/**field_error.html** </>

```
<div class="AnimateSinglePresence" aria-live="polite">
    <div class="AnimateSinglePresenceItem">
        <p id="Field-{{ id_type }}" class="p-FieldError Error" role="alert" aria-live="polite">
            {{ content }}
        </p>
    </div>
    <script type="text/javascript">
        // private scope wrapper is used to prevent polluting global scope
        (() => {
            const target = document.querySelector("{{ target }}"),
                  script = document.currentScript,
                  parent = script.parentElement,
                  field  = parent.querySelector("#Field-{{ id_type }}"),
                  input  = ("{{ id_type }}" === 'selectError')
                         ? target.querySelector('select')
                         : target.querySelector('input');
```

```
            input.addEventListener('input', () => {
                let validity = input.validity;

                if (!validity.valid) {
                    input.classList.add('Input--invalid');
                    field.classList.remove('Field--hide');
                    field.textContent = translateValidity(validity, input);
                    return;
                }

                // Valid
                input.classList.remove('Input--invalid');
                field.classList.add('Field--hide');
            });
```

```
            // Append this .AnimateSinglePresence to Target
            target.appendChild(parent);
            // Remove this script
            script.remove();
        })();
    </script>
</div>
```

NOTE: id_type, content, and target. We will import them in **{% include %}** tag

Also, we will NOT be using **content** in this tutorial. It is there as an option

📝 project_folder/**app_name**/templates/app_name/**donate.html** </> donate.html

```
...
</style>
<script name="stripe.js" src="https://js.stripe.com/v3/"></script>
<script name="translate-validity-pl.js" src="{% static 'app_name/js/translate_validity_pl.js'
%}"></script>
{% endblock %}
...
```

```
...
<form id="payment-form" data-secret="{{ client_secret }}">
  {% csrf_token %}
  {{ form|as_crispy }}
  {{ form.donation|as_crispy_field }}
  <div id="payment-element">
    <!-- Elements will create form elements here -->
  </div>
  {% include 'app_name/extensions/stripe/field_error.html' with id_type="numberError"
target="#div_id_donation" %}
  <section class="stripe-agreement mt-3">
...
```

```
NOTE: |as_crispy is NOT supported for specific fields. Hence, |as_crispy_field
NOTE: id_type and target are passed to the field_error.html extension.

NOTE: You can include many field_error.html extensions for many fields,
      as long as, the field itself, is an <input> or <select> element.

NOTE: SET id_type TO “selectError” TO target <select> element.
      Anything else targets the <input> element.
```

```
The extension will be included in this HTML template before it is served to
client. Its <script> self-envokes: (() => {...})(), to apply an event listener
used for real-time, input validation feedback functionality for Polish clients.

In this case, the validation functionality is applied for the donation input,
which is located in target parent: #div_id_donation.
```

Almost done…

Let’s add initial stripe styles to the **donation** field from the **DonateForm**

📝 project_folder/**app_name/forms.py** 🐍 forms.py

```python
class DonateForm(forms.Form):
    locale = 'pl' # code e.g. 'pl', 'gb', 'de'
    UNIT = 'zł'

    min_value = 5 # 5 -> 500 groszy (pennies)
    max_value = 100

    donation = forms.DecimalField(
        label='Kwota donacji',
        initial=min_value,
        min_value=min_value,
        max_value=max_value,
        decimal_places=2,
        required=True,
        widget=forms.NumberInput(attrs={
            'placeholder': f'{min_value} do {max_value} zł',
            'class': 'p-Input-input Input Input-input--empty p-DonationAmountInput-input',
            'inputmode': 'numeric',
            'aria-required': 'true',
            'title': '',
            'id': 'Field-donationAmountInput',
        })
    )
```

NOTE: Defined in widget attribute: “**id**”, is not used in this tutorial.
It’s only an example of stripe fields naming convension.

Now, real-time **feedback should be triggered** when the **donation** input is **invalid**

Take note that the input does not receive the **.text-danger** class when its value is empty unless the **required** attribute is provided

This is because we rely on the **.Input--invalid** class, which is added via **field_error.html**

However, validation from the **field_error.html** only applies when the input is genuinely invalid. By adding the **required** attribute, the input is considered invalid when its value is missing, ensuring proper validation

Stripe API handles POST validation for us on **confirmPayment**(). However, **donation** field originates from **DonateForm** (in forms.py). Thereby, it requires custom validation on POST request at the backend TO correctly handle the updation of client’s payment **intent**.

Proceed transaction, with modified by client, amount

```
NOTE: intent_id is required TO update the amount of client's payment intent

NOTE: intent_id is generated by payment intent

NOTE: intent_id can't be exposed to other clients
```

Hence, register new property for all users: **stripe_last_intent_id**

📝 project_folder/**users/models.py** **(users app)** 🐍 models.py

```
...

class Profile(models.Model):
    user = models.OneToOneField(User, on_delete=models.CASCADE)
    stripe_customer_id = models.CharField(max_length=255, blank=True, null=True, unique=True, editable=False)
    stripe_last_intent_id = models.CharField(max_length=255, blank=True, null=True, unique=True, editable=False)
...
```

Display **stripe_last_intent_id** AS read-only in **admin** panel (OPTIONAL)

📝 project_folder/**users/admin.py** **(users app)** 🐍 admin.py

```
from django.contrib import admin
from .models import Profile


class ProfileAdmin(admin.ModelAdmin):
    readonly_fields = (
        'stripe_customer_id',
        'stripe_last_intent_id'
    )
    list_display = [field.name for field in Profile._meta.fields]

# Register your models here.
admin.site.register(Profile, ProfileAdmin)
```

Finally, let's update the **amount** of client's payment **intent** via a POST request in the backend, and address additional errors on failed validation of **DonateForm**

📝 project_folder/**app_name/views.py** **(app_name app)** 🐍 views.py

```
...

@login_required
def donateView(request):

---

...
    request.user.profile.stripe_last_intent_id = intent.id
    request.user.profile.save()

    context.update({
        'client_secret': intent.client_secret
    })

    return render(request, 'app_name/donate.html', context)
...
```

SET client's **stripe_last_intent_id** at **donateView** (TO **target** client's **intent**)

```
...

@login_required
def donateUpdatePaymentIntentView(request):


---

  if request.method != 'POST':
    return JsonResponse({'error': 'Invalid request, expected POST'}, status=400)

  form = DonateForm(request.POST)

  if not form.is_valid():
    return JsonResponse({'error': 'Invalid form', 'form_errors': form.errors}, status=400)


---

  donation = form.cleaned_data.get('donation')

  # Note: amount is in groszy (PLN)
  intent = stripe.PaymentIntent.modify(
    id=request.user.profile.stripe_last_intent_id,
    amount=int(donation * 100),
    metadata={'donation': str(donation)}
  )

  return JsonResponse({'success': 'Updated payment intent', 'donation': donation}, status=200)
...
```

Create **donateUpdatePaymentIntentView** (TO update **amount** of client's **intent**)

📝 project_folder/**app_name/urls.py** **(app_name app)** 🐍 urls.py

```
urlpatterns = [
   ...
   path('donate/', views.donateView, name='donate'),
   path('donate/update-intent/', views.donateUpdatePaymentIntentView,
name='donate_update_intent'),
]
```

```
Register new path route: donateUpdatePaymentIntentView
```

Utilize HTMX to send POST request and retreive back a JSON response from the backend

📝 project_folder/**app_name**/templates/app_name/**donate.html** </> donate.html

```
...
<button type="submit" id="submit-button" class="btn btn-primary fw-bold my-3 p-3"
   hx-post="{% url 'donate_update_intent' %}"
   hx-trigger="click delay:500ms"
   hx-swap="none">
      Kontynuuj płatność
</button>
<div id="error-message" role="alert" class="text-danger">
   <!-- Display error message to your customers here -->
</div>
...
```

```
...
/* --- 4. Submit the payment to Stripe --- */

const form = document.getElementById('payment-form');
const errorElement = document.querySelector('#error-message');

form.addEventListener("submit", async (event) => {
   event.preventDefault();
document.addEventListener('htmx:afterRequest', async (event) => {

   // Receive response from the backend
   let responseText = await event.detail.xhr.responseText,
      response = JSON.parse(responseText),
      formErrors = response.form_errors;

... continues on next page
```

```
  // Display error labels for invalid <input>(s) of DonateForm
  if (formErrors) {
    const inputNames = [...form.querySelectorAll('input')].map(input => input.name);

    inputNames.forEach(name => {
      if (!formErrors.hasOwnProperty(name)) return;

      let parent = document.querySelector(`#div_id_${name}`),
          field = parent.querySelector('.p-FieldError'),
          input = parent.querySelector(`input[name="${name}"]`);

      field.innerText = formErrors[name][0];
      field.classList.remove('Field--hide');
      input.classList.add('Input--invalid');
    });
  }
```

```
  if (response.error) {
    // Failure of Payment Intent's modification in the backend.
    // Hence, it is important to prevent further code executions.
    // Otherwise, client may proceed with the initial donation price,
    errorElement.textContent = response.error;
    throw new Error(response.error);
  }
```

```
  const {error} = await stripe.confirmPayment({
    //`Elements` instance that was used to create the Payment Element
    elements,
    confirmParams: {
      return_url: window.location.origin + "{% url 'payment_success' %}",
    },
  });
```

```
  if (error) {
    // This point will only be reached if there is an immediate error when
    // confirming the payment. Show error to your customer (for example, payment
    // details incomplete)
    errorElement.textContent = error.message;
  }
  else {
    // Your customer will be redirected to your `return_url`. For some payment
    // methods like iDEAL, your customer will be redirected to an intermediate
    // site first to authorize the payment, then redirected to the `return_url`.
  }

});
```

Stripe loader extension and exemption of asterisks (*)

Stripe's API requires time to parse essential elements, necessitating a loading indication. To optimize the user experience. This part of the tutorial demonstrates implementation of a loader for the donation field, ensuring seamless loading feedback during the parsing state.

NOTE: Labels for Payment Element fields do not include an asterisk (*).
NOTE: Django fields and Crispy Forms, by default, include an asterisk for required fields.

📝 .../templates/**app_name**/**extensions**/stripe/**extended_mounting.html** </>

```
<div id="mounting" style="margin-bottom: 18px !important;">
  <div style="">
    <div style="height: 12.8204px !important; background-color: rgba(47, 48, 60, 0.04) !important; position: relative !important; overflow: hidden !important; will-change: transform !important; border-radius: 4px !important; width: 65.1407px !important; box-sizing: border-box !important; margin-bottom: 10.2735px !important; box-shadow: rgba(0, 0, 0, 0.03) 0px 1px 1px 0px, rgba(0, 0, 0, 0.02) 0px 3px 6px 0px !important;">
      <div class="loader" style="position: absolute !important; top: 0px !important; left: 0px !important; height: 100% !important; width: 50% !important; transform: translateX(200%); will-change: transform !important; background: linear-gradient(to right, rgba(47, 48, 60, 0), rgba(47, 48, 60, 0.05) 50%, rgba(47, 48, 60, 0)) !important; transition: transform 3000ms;"></div>
    </div>
    <div style="height: 56.3906px !important; padding: 20.1367px !important; box-sizing: border-box !important; background-color: rgb(255, 255, 255) !important; position: relative !important; overflow: hidden !important; border-radius: 4px !important; box-shadow: rgba(0, 0, 0, 0.03) 0px 1px 1px 0px, rgba(0, 0, 0, 0.02) 0px 3px 6px 0px !important; border-width: 1px !important; border-color: rgb(230, 230, 230) !important; border-style: solid !important;">
      <div style="height: 12.8204px !important; background-color: rgba(47, 48, 60, 0.04) !important; position: relative !important; overflow: hidden !important; will-change: transform !important; border-radius: 4px !important; width: 65.1407px !important; box-sizing: border-box !important;">
        <div class="loader" style="position: absolute !important; top: 0px !important; left: 0px !important; height: 100% !important; width: 50% !important; transform: translateX(200%); will-change: transform !important; background: linear-gradient(to right, rgba(47, 48, 60, 0), rgba(47, 48, 60, 0.05) 50%, rgba(47, 48, 60, 0)) !important; transition: transform 3000ms;"></div>
      </div>
    </div>
  </div>
</div>
```

📝 project_folder/**app_name**/templates/app_name/**donate.html** </> donate.html

```
<style>

#mounting:not(.mounted), [id^="div_id_"]:not(.mounted) { display: none; }
...
```

```
...
<form id="payment-form" data-secret="{{ client_secret }}">
    {% csrf_token %}
    {% include 'app_name/extensions/stripe/extended_mounting.html' %}
    {{ form.donation|as_crispy_field }}
    <div id="payment-element">
        <!-- Elements will create form elements here -->
    </div>
...
```

Add Style: #mounting:not(.mounted), **Include Extension:** extended_mounting.html

```
...
function refreshLoaderAnimation() {
    const loaders = [...document.querySelectorAll('.loader')];

    loaders.map(loader => {
        // Get clone of the loader with initial X position: -100%
        const parent = loader.parentNode;
        const clone = loader.cloneNode(true);
              clone.style.transform = 'translateX(-100%)';

        // Remove the original 'loader' element and re-attach it
        parent.removeChild(loader);
        parent.appendChild(clone);

        // Start slide-transition animation after 1 second
        setTimeout(() => {
            clone.style.transform = 'translateX(200%)';
        }, 0);
    });
}

// Mount Donation (Field), once paymentElement is ready
... continues on the next page
```

Add function at section: /* --- Show custom <input> “Donation” --- */

NOTE: This function is used to start the loaders’ animation

```
... function refreshLoaderAnimation() {...} is above

// Select the target node
const targetNode = document.getElementById('payment-element');

// Create an instance of MutationObserver
const observer = new MutationObserver((mutationsList) => {
   mutationsList.forEach((mutation) => {
      const privateStripeLoader = targetNode.querySelector('.__PrivateStripeElementLoader');
      if (!privateStripeLoader) return;

      // Start the loader animation at #mounting
      refreshLoaderAnimation();
      setInterval(refreshLoaderAnimation, 3500);
         document.getElementById('mounting').classList.add('mounted');
         observer.disconnect();
   });
});

observer.observe(targetNode, {childList: true, subtree: true });
...
```

```
Observe: #payment-element FOR .__PrivateStripeElementLoader

This observer .mounts (displays) Extension: extended_mounting.html (loader)
when .__PrivateStripeElementLoader IS parsed in: #payment-element
```

```
...
// Mount Donation (Field), once paymentElement is ready
paymentElement.on('ready', () => {

    // Remove #mounting with .loader(s)
    document.getElementById('mounting').remove();
    clearInterval(refreshLoaderAnimation);

    // Mount/Show the crispy_form divs
    const crispyFormDivs = document.querySelectorAll('[id^="div_id_"]');

    [...crispyFormDivs].map(div => {
        // Remove '*' from label
        let label = div.querySelector('label');
        label.innerText = label.innerText.replace('*', '');
        // Add class mounted
        div.classList.add('mounted');
    });
});
```

```
Interval: refreshLoaderAnimation IS unrequired WHEN paymentElement IS parsed

Let's also REMOVE: the asterisks (*) FROM: the additional fields' <label>
```

📝 project_folder/**app_name/forms.py** 🐍 forms.py

```python
class DonateForm(forms.Form):
    locale = 'pl' # code e.g. 'pl', 'gb', 'de'
    UNIT = 'zł'

    min_value = 5 # 5 -> 500 groszy (pennies)
    max_value = 100

    donation = forms.DecimalField(...)

    class Meta:
        # Disclude the '*' suffix from the fields
        # NOTE: This does not work for crispy forms
        # Because crispy filters alter the, altered by Meta class, fields
        label_suffix = ''
```

NOTE: This is an **OPTIONAL SOLUTION** for REMOVING **asterisk** (and other suffixes) FROM the fields' <label>.

NOTE: Crispy filters, such as (form**|as_crispy** & form.field**|as_crispy_field**) include asterisk (*) FOR fields containing **requried** attribute.

Now, additional **loading feedback should be displayed only** during the parsing phase of the Payment Element

The initial appearance of the loader extension seems to be synchronous with the loaders generated by the Stripe API in the Payment Element Form. However, it isn't perfect on a slow internet connection and during intensive throttling.

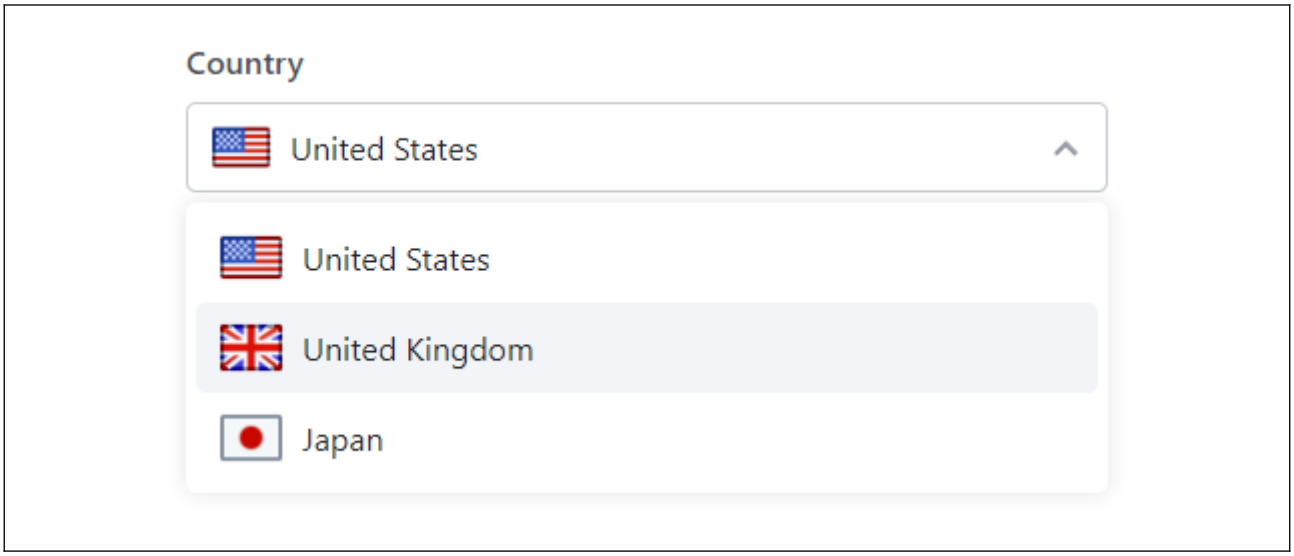
Additionally, Stripe is an external service, which may be prone to change in the future, adding unnecessary maintenance requirements in terms of frontend design. Therefore, it's best not to include additional loaders entirely.

Dynamic Select Images **with** Flag Icons 🇵🇱 🇯🇵 🇰🇷

The main functionality is successfully implemented. However, the default country field in Stripe API lacks visual distinction, as it does not display country flags. This makes it harder for users to quickly identify and select their desired country option.

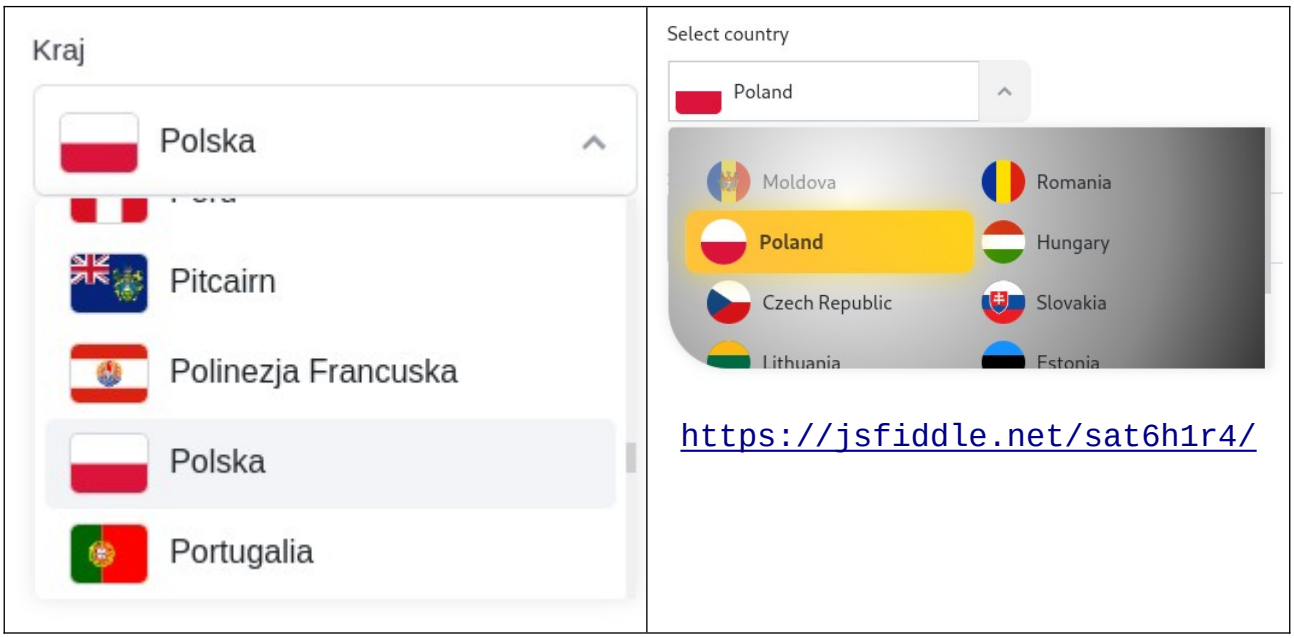
Flag Icons: https://github.com/lipis/flag-icons/
Download Flags from: https://flagicons.lipis.dev/

Dynamic Select Images created by "David Adams" (JS Library)
https://codeshack.io/dynamic-select-images-html-javascript/

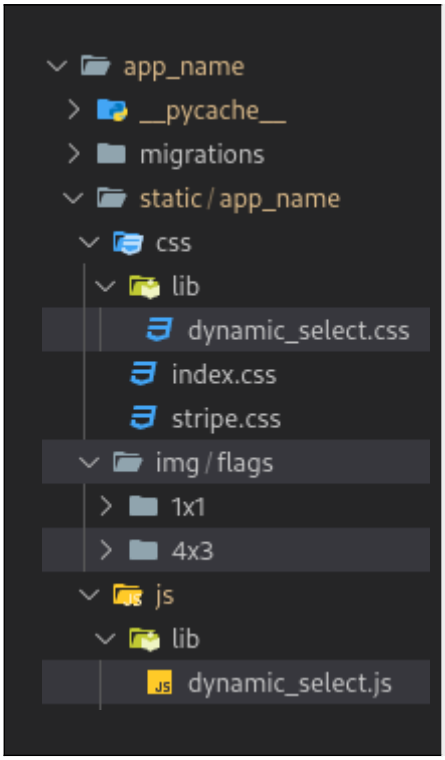


This tutorial utilizes **Dynamic Select Images** with additional "Accessability" functionality.

Dynamic Select Images created by "David Adams" and modified by "McRaZick"
https://github.com/gubrus50/dynamic-select-images-js



https://jsfiddle.net/sat6h1r4/



Install dynamic_select.css

https://raw.githubusercontent.com/gubrus50/dynamic-select-images-js/refs/heads/main/DynamicSelect.css

Install dynamic_select.js

https://raw.githubusercontent.com/gubrus50/dynamic-select-images-js/refs/heads/main/DynamicSelect.js

---

Install flag-icons-main.zip (4x3)

https://flagicons.lipis.dev/

Install django-countries

Countries and territories evolve over time, with some gaining international recognition while others remain disputed due to geopolitical factors. Stripe's API includes an object listing the countries where its services are available. However, making frequent requests for this data at scale is inefficient. Maintaining a custom list of countries presents its own challenges, requiring regular updates.

A more practical approach is to use the django-countries library, which provides an up-to-date list of recognized countries and territories. While some entries in this dataset may lack international recognition, we can filter them out if necessary. Additionally, Stripe's API can validate country data when processing a POST request on **confirmPayment**(), ensuring only supported locations are accepted.

🖥️ (venv) @ project_folder 📚 pip library

```
pip install django-countries
pip freeze > requirements.txt # update requirements.txt
```

📝 project_folder/**app_name/forms.py** 🐍 forms.py

```python
from django_recaptcha.fields import ReCaptchaField
from django_countries import countries

from django import forms
from .models import ModelName


---


class DonateForm(forms.Form):
    locale = 'pl' # code e.g. 'pl', 'gb', 'de'
    UNIT = 'zł'

    min_value = 5 # 5 -> 500 groszy (pennies)
    max_value = 100

    donation = forms.DecimalField(...)

    # CHOICES = [('PL', 'Poland'), ('GB', 'Great Britain') ...]
    country = forms.ChoiceField(
    label='Kraj',
    choices=[(code, name) for code, name in countries],
    widget=forms.Select(attrs={
        'class': 'Input p-Select-select',
        'inputmode': 'text',
        'aria-required': 'true',
        'autocomplete': 'billing country',
        'title': '',
        'id': 'Field-countryInput',
    }),
    required=True
    )

    class Meta:
        # Disclude the '*' suffix from the fields
        # NOTE: This does not work for crispy forms
        # Because crispy filters alter the, altered by Meta class, fields
        label_suffix = ''
```

NOTE: choices=[] list is populated with django_countries.
However, it should contain country names in Polish.

📝 project_folder/**app_name**/templates/app_name/**donate.html** </> donate.html

```
...

.dynamic-select img {
   border-radius: 5px;
   border: 1px solid #d4d7da;
}

</style>
<script name="stripe.js" src="https://js.stripe.com/v3/"></script>
<script name="DynamicSelect.js" src="{% static 'app_name/js/lib/dynamic_select.js'
%}"></script>
<script name="translate-validity-pl.js" src="{% static 'app_name/js/translate_validity_pl.js'
%}"></script>
{% endblock %}
...
```

Insert “dynamic_select.js” FROM {% static %} libraries directory

```
...
<form id="payment-form" data-secret="{{ client_secret }}">
    {% csrf_token %}
    {% include 'app_name/extensions/stripe/extended_mounting.html' %}

---

    {{ form.donation|as_crispy_field }}
    <div id="payment-element">
        <!-- Elements will create form elements here -->
    </div>
    {{ form.country|as_crispy_field }}

---

    {% include 'app_name/extensions/stripe/field_error.html' with
id_type="numberError" target="#div_id_donation" %}
    {% include 'app_name/extensions/stripe/field_error.html' with
id_type="selectError" target="#div_id_country" %}
     <section class="stripe-agreement mt-3">
...
```

Include country field **AND** provide real-time validation feedback

```
// Mount Donation & Billing Address (Fields), once paymentElement is ready
paymentElement.on('ready', () => {

    // --- Include flag-icons TO <select> country (using DynamicSelect)

    const __flags = "{% static 'app_name/img/flags/4x3' %}",
          country = document.querySelector('#div_id_country > select'),
          options = country.querySelectorAll('option');

    [...options].map(option => { // NOTE: 'xx' is empty/white flag
        let countryCode = (option.value || 'xx').toLowerCase();
        option.dataset.img = __flags + `/${countryCode}.svg`;
    });

    // https://github.com/gubrus50/dynamic-select-images-js
    new DynamicSelect('#div_id_country > select', {
        class: 'form-control px-0',
        selectedStyle: 'border: 0',
        onChange: function updateAndValidatePostalCode(value, text, option) {

            // Hide invalid field of <dynamic-select> and danger highlight
            let input = document.querySelector('#div_id_country input');
            if (input && input.value.length) {

                let parent = document.querySelector('#div_id_country'),
                    select = parent.querySelector('dynamic-select'),
                     field = parent.querySelector('.p-FieldError');

                select.classList.remove('Input--invalid');
                field.classList.add('Field--hide');
            }
        }
    });

    // Remove #mounting with .loader(s)
    ... previously implemented code
});
```

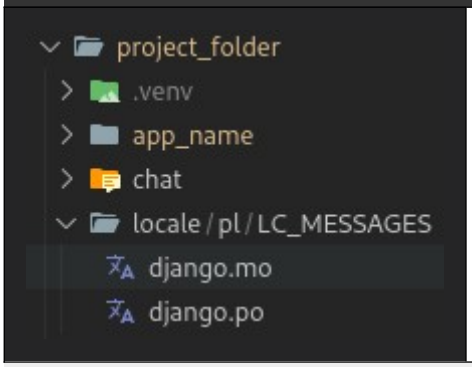
NOTE: new DynamicSelect creates new instance of <dynamic-select> element
Learn about DS: https://github.com/gubrus50/dynamic-select-images-js

Now you should be able to see a country field with flags.

Let's **include translated countries** TO the **country** field.

Translate country names **with** Polish locale messages

(venv) @ project_folder (Linux)




```
← Create tree for locale folder

mkdir -p locale/pl/LC_MESSAGES

← Create messages  django.po template for locale PL

django-admin makemessages -l pl
```

```
NOTE: django.po file IS USED TO generate django.mo
      django.mo is USED FOR translation purposes.
```

DOCS - Internalization & localization:
https://docs.djangoproject.com/en/5.1/topics/i18n/

project_folder/my_website/**settings.py** settings.py

```
LOCALE_PATH = [
    os.path.join(BASE_DIR, 'locale')
]
```

```
LANGUAGES = [
    ('en', 'English'),
    ('pl', 'Polish'),
]
```

```
LANGUAGE_CODE = 'en-us'
```

```
USE_I18N = True
```

```
NOTE: LANGUAGE_CODE defines the global language setting.
      However, only donateView is specifically designed for Polish clients.
      Therefore, LANGUAGE_CODE remains set to English.
```

Edit file **django.po** to translate countries (**remove** `# ,fuzzy` at `.po` TO indicate finalized file).

OR - Download template: [django5-tutorial - PL locale - django.po countries and territories]

NOTE: providing both **msgid** with same value results in compilors failure.

📝 project_folder/**locale/pl**/LC_MESSAGES/**django.po** 🔤 django.po

INVALID	VALID

`msgid "Poland"`
`msgstr "Polska"`
 	
`msgid "Poland"`
`msgstr "Polonia"`
	`msgid "Netherlands"`
	`msgstr "Holandia"`
	
	`msgid "Holland"`
	`msgstr "Holandia"`

🖥️ (venv) @ project_folder (Linux)

```
# (All) Recommended when manage.py is initialized.

python manage.py compilemessages
```

```
# (All) Recommended when manage.py is NOT initialized.

django-admin compilemessages
```

```
# (Linux) This option provides a detailed output in terminal, in case something goes wrong.

msgfmt django.po -o django.mo
```

GENERATE django.mo file used for translating

📝 project_folder/**.gitignore** .gitignore

```
# Optional ignore rule for any file with domain .mo at locale/ directory.

locale/*.mo
```

EXCLUDE django.mo files when deploying a project to platforms like GitHub.

These files, similar to compiled SASS/SCSS (output → CSS), do not need to be stored in the repository since they can be generated as needed during development or when the project is served live in a production environment.

📝 project_folder/**app_name/forms.py** 🐍 forms.py

```python
from django_recaptcha.fields import ReCaptchaField
from django.utils.translation import activate, gettext_lazy as _
from django_countries import countries

from django import forms
from .models import ModelName


class DonateForm(forms.Form):
...
    # CHOICES = [('PL', 'Poland'), ('GB', 'Great Britain') ...]
    country = forms.ChoiceField(
    label='Kraj',
    choices=[],
...


    class Meta:
        # Disclude the '*' suffix from the fields
        # NOTE: This does not work for crispy forms
        # Because crispy filters alter the, altered by Meta class, fields
        label_suffix = ''

    def __init__(self, *args, **kwargs):
        super().__init__(*args, **kwargs)

        # Generate country list in the correct language
        activate(self.locale)
        # Manually translate country names using Django's gettext
        self.fields['country'].choices = [
            (code, _(name)) # Wrap country name in gettext_lazy
            for code, name in countries
        ]

        # Select initial county (currently selected)
        self.fields['country'].initial = self.locale.upper()
```

WARNING!

Utility: **active** changes locale for ALL forms.
Hence, if you go to register a new user after donating some money, THEN some labels of the registry form will be displayed in **Polish** instead of **English**

You can also set **active** at **views.py** instead for every view.

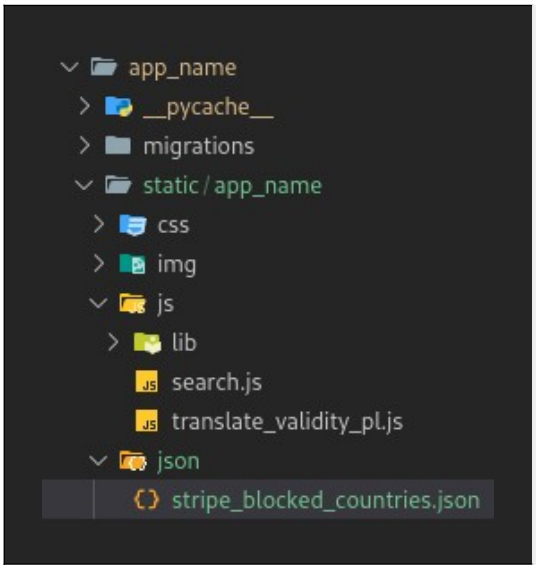
NOTE: activate() initializes the locale, so that gettext_lazy: _() can translate the country names.

Stripe has **blocked** some countries. Let's disclude them from the custom country field.

source: https://foundeck.com/blog/stripe-for-unsupported-countries/
main source: https://support.stripe.com/questions/sanctions-on-russia-and-belarus

Both of the sources have been accessed: 19/April/2025, and might be inaplicable in future

Disclude blocked countries



Install stripe_blocked_countries.json

https://github.com/gubrus50/django5-tutorial/blob/main/project_folder/app_name/static/app_name/json/stripe_blocked_countries.json

Create utility

📝 project_folder/**app_name/utils.py** 🐍 utils.py

```python
from django.conf import settings
from django.contrib.staticfiles import finders
import json
import os

---

# AI Generated - Copilot (19/Apr/2025)

def get_json_data(json_target):
    """Fetch JSON data dynamically based on environment."""
    file_path = None

    if settings.DEBUG: # Development mode (using staticfiles finders)
        file_path = finders.find(json_target)
    else: # Production mode (using STATIC_ROOT)
        file_path = os.path.join(settings.STATIC_ROOT, json_target)

    if file_path and os.path.exists(file_path):
        try:
            with open(file_path, 'r', encoding='utf-8') as f:
                return json.load(f)
        except json.JSONDecodeError as e:
            print(f"Error decoding JSON file '{json_target}': {e}")
            return None
    else:
        print(f"JSON file '{json_target}' not found.")
        return None
```

📝 project_folder/**app_name/forms.py** 🐍 forms.py

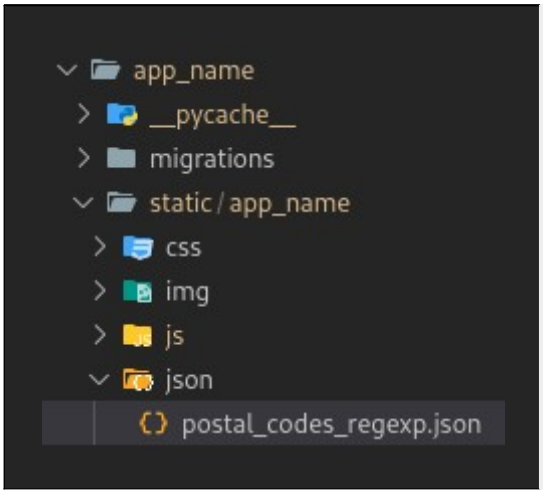
```python
from django_recaptcha.fields import ReCaptchaField
from django.utils.translation import activate, gettext_lazy as _
from django_countries import countries

from django import forms
from .models import ModelName
from .utils import get_json_data

# Get SET of abbrevs OF stripe blocked countries JSON - {“AB”, “CD”, “EF” ...}
BLOCKED_COUNTRIES = {entry["abbrev"] for entry in
get_json_data("app_name/json/stripe_blocked_countries.json")}
```

```python
class DonateForm(forms.Form):
...

    def __init__(self, *args, **kwargs):
        super().__init__(*args, **kwargs)

        # Generate country list in the correct language
        activate(self.locale)
        # Manually translate country names using Django's gettext
        self.fields['country'].choices = [
            (code, _(name)) # Wrap country name in gettext_lazy
            for code, name in countries if code not in BLOCKED_COUNTRIES
        ]

        # Select initial county (currently selected)
        self.fields['country'].initial = self.locale.upper()
```

Some **countries requrie postal code** to complete payments,

Let’s implement custom postal code field.

Custom Postalcode Field



Install postal_codes_regexp.json

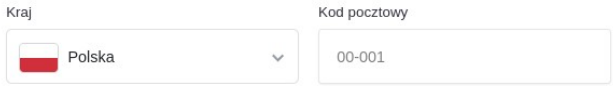
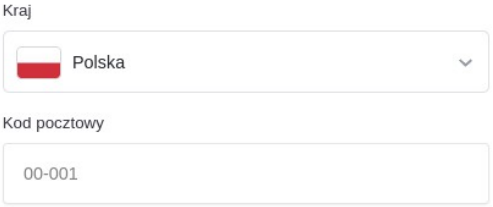
https://github.com/gubrus50/django5-tutorial/blob/main/project_folder/app_name/static/app_name/json/postal_codes_regexp.json

📝 project_folder/**app_name/forms.py** 🐍 forms.py

```
class DonateForm(forms.Form):
...
```

```
    # CHOICES = [('PL', 'Poland'), ('GB', 'Great Britain') ...]
    country = forms.ChoiceField(...)

    postal_code = forms.CharField(
      label='Kod pocztowy',
      max_length=15,
      widget=forms.TextInput(attrs={
        'placeholder': '12-345',
        'class': 'p-Input-input Input Input-input--empty p-PostalCodeInput-
input',
        'inputmode': 'text',
        'aria-required': 'true',
        'data-country-parent': '#div_id_country',
        'autocomplete': 'billing postal-code',
        'title': '',
          'id': 'Field-postalCodeInput',
      }),
      required=True
    )

...
```

NOTE: The dataset **data-country-parent** is required to update the postcode validation expression based on the selected country at **#div_id_country**

Desktop - space between	**Mobile** - stack
	

📝 project_folder/**app_name**/templates/app_name/**donate.html** </> donate.html

```
...

.side-by-side > div {
    flex-grow: 1;
    flex-shrink: 1;
    flex-basis: auto;
    width: 100%;
    transition: all 1.25s cubic-bezier(0.68, -0.55, 0.27, 1.55), margin 0.1s ease-out;
}

.smooth-collapse {
    width: 0px !important;
    opacity: 0;
}
.smooth-collapse[data-width="0"] {
    margin: 0px !important;
    position: absolute;
}

/* Desktop - space between */
@media (min-width: 767px) {
    .side-by-side {
        display: flex;
    }
    .side-by-side > div:last-child {
        margin-left: 20px; /* This replaces the spacing div */
    }
}

/* Mobile - stack */
@media (max-width: 766px) {
    .side-by-side > div:last-child {
        margin-top: 10px; /* Space between stacked containers */
        margin-left: 0;
    }
}

.dynamic-select img {
...
```

```
...
</style>
<script name="stripe.js" src="https://js.stripe.com/v3/"></script>
<script name="DynamicSelect.js" src="{% static 'app_name/js/lib/dynamic_select.js' %}"></script>
<script name="translate-validity-pl.js" src="{% static 'app_name/js/translate_validity_pl.js' %}"></script>
<script name="postal-code-validation" type="text/javascript">
```

```
let POSTAL_CODES_REGEXP;

fetch("{% static 'app_name/json/postal_codes_regexp.json' %}")
  .then(response => {
    if (!response.ok) throw new Error(`HTTP error! Status: ${response.status}`);
    return response.json();
  })
  .then(data => {
    POSTAL_CODES_REGEXP = data;
  })
  .catch(error => console.error("Error:", error));
```

```
const isCountriesPostalCodeValid = (countryCode, postalCode) => {

    let isValid = false;

    POSTAL_CODES_REGEXP.forEach(obj => {
        if (countryCode.toLowerCase() === obj.abbrev.toLowerCase()) {
            // Return if postal-code doesn't match regex
            if (!postalCode.match(new RegExp(obj.postal || ""))) return;
            // Is valid if postal-code matches the regexp-example-length
            if (obj.example) {
                if (obj.example.length == postalCode.length) isValid = true;
                else return;
            }
            // Is valid if postal-code is not empty
            isValid = (postalCode.length > 0);
        }
    });

    return isValid;
}
```

```
</script>
{% endblock %}
```

```
NOTE: Fetch REQUESTS and PARSES
      → postal_codes_regexp.json AS POSTAL_CODES_REGEXP IN global scope

It will be also used TO enhance the country field <dynamic-select>

isCountriesPostalCodeValid is used TO improve extension: field_error.html
```

Enhance field_error.html extension + translate validity

📝 project_folder/**app_name**/static/app_name/js/**translate_validity_pl.js** JS

```js
// AI Generated @ copilot.microsoft.com 26/Mar/2025 & edited by McRaZick

const validityTranslations = {
    valueMissing: "To pole jest wymagane.",
    typeMismatch: "Wprowadź poprawny typ danych (np. email lub URL).",
    patternMismatch: "Wartość nie pasuje do wzorca.",
    tooShort: "Wprowadź co najmniej {minLength} znaków.",
    tooLong: "Wartość przekracza maksymalną liczbę znaków ({maxLength}).",
    rangeUnderflow: "Wprowadź wartość większą lub równą {min}.",
    rangeOverflow: "Wprowadź wartość mniejszą lub równą {max}.",
    stepMismatch: "Wartość musi być zgodna z krokiem {step}.",
    customError: "To pole zawiera błąd niestandardowy.",
    invalidPostalCode: "Wprowadź poprawny kod pocztowy.",
    valid: ""
};

const translateValidity = (validity, input) => {
    for (let [key, message] of Object.entries(validityTranslations)) {
        if (validity[key]) {
            // Replace placeholders dynamically if applicable
            message = message
                .replace("{minLength}", input.minLength || "")
                .replace("{maxLength}", input.maxLength || "")
                .replace("{min}", input.min || "")
                .replace("{max}", input.max || "")
                .replace("{step}", input.step || "");
            return message;
        }
    }
    return "";
};
```

Let's **update** field_error.html

📝 .../templates/**app_name**/**extensions**/stripe/**field_error.html** </>

```
<div class="AnimateSinglePresence" aria-live="polite">
    <div class="AnimateSinglePresenceItem">
        <p id="Field-{{ id_type }}" class="p-FieldError Error" role="alert" aria-live="polite">
            {{ content }}
        </p>
    </div>
    <script type="text/javascript">
        // private scope wrapper is used to prevent polluting global scope
        (() => {
            const target = document.querySelector("{{ target }}"),
                  script = document.currentScript,
                  parent = script.parentElement,
                  field  = parent.querySelector("#Field-{{ id_type }}"),
                  input  = ("{{ id_type }}" === 'selectError')
                         ? target.querySelector('select')
                         : target.querySelector('input');
```

```
            input.addEventListener('input', () => {
                let validity = input.validity;

                if (!validity.valid) {
                    input.classList.add('Input--invalid');
                    field.classList.remove('Field--hide');
                    field.textContent = translateValidity(validity, input);
                    return;
                }
                else if (input.id === 'Field-postalCodeInput') {
                    let countryParent = document.querySelector(input.dataset.countryParent),
                         countryInput = countryParent.querySelector('input'),
                          countryCode = countryInput.value,
                           postalCode = input.value;

                    // Invalid PostCode
                    if (!isCountriesPostalCodeValid(countryCode, postalCode)) {
                        input.classList.add('Input--invalid');
                        field.classList.remove('Field--hide');
                        field.textContent = translateValidity({
                            'invalidPostalCode': true
                        }, input);
                        return;
                    }
                }
                // Valid
                input.classList.remove('Input--invalid');
                field.classList.add('Field--hide');
            });
...
```

Organize billing address fields country & postal_code

📝 project_folder/**app_name**/templates/app_name/**donate.html** </> donate.html

```
...
<form id="payment-form" data-secret="{{ client_secret }}">
    {% csrf_token %}
    {% include 'app_name/extensions/stripe/extended_mounting.html' %}
```

```
    {{ form.donation|as_crispy_field }}
    <div id="payment-element">
        <!-- Elements will create form elements here -->
    </div>
    {{ form.country|as_crispy_field }}
    <div id="billing-address" class="p-0 m-0">
        <div class="side-by-side">
            {{ form.country|as_crispy_field }}
            {{ form.postal_code|as_crispy_field }}
        </div>
        <script type="text/javascript">
          // Remove <br> nodes from billing-address fields' <label>.
          // And marginate fields vertically like those in Payment Element.
          (() => {
              let script = document.currentScript,
              fields = script.parentElement.querySelectorAll('[id^="div_id_"]'),
              label = null;

              [...fields].map(field => {
                  field.classList.replace('mb-3', 'my-3');
                  label = field.querySelector('label.form-label');
                  label.innerHTML = label.innerText.trim();
              });

              script.remove();
          })();
        </script>
    </div>
    {% include 'app_name/extensions/stripe/field_error.html' with
id_type="numberError" target="#div_id_donation" %}
    {% include 'app_name/extensions/stripe/field_error.html' with
id_type="selectError" target="#div_id_country" %}
    {% include 'app_name/extensions/stripe/field_error.html' with
id_type="postalCodeError" target="#div_id_postal_code" %}
     <section class="stripe-agreement mt-3">
...
```

```
// Mount Donation & Billing Address (Fields), once paymentElement is ready
paymentElement.on('ready', () => {
...
```

```
    let parentPC = document.querySelector('#div_id_postal_code'),
        inputPC = document.querySelector('#div_id_postal_code > input'),
        fieldPC = document.querySelector('#Field-postalCodeError'),
        limitPC = inputPC.getAttribute('maxlength');

    // Set initial maxlength for postal-code input, based on selected country
    POSTAL_CODES_REGEXP.forEach(obj => {
        if (obj.abbrev.toLowerCase() !== country.value.toLowerCase()) return;
        else if (limitPC)
            inputPC.setAttribute('maxlength', obj.example.length ?? limitPC);
    });
```

```
    // https://github.com/gubrus50/dynamic-select-images-js
    new DynamicSelect('#div_id_country > select', {
        class: 'form-control px-0',
        selectedStyle: 'border: 0',
        onChange: function updateAndValidatePostalCode(value, text, option) {
```

```
            POSTAL_CODES_REGEXP.forEach(obj => {
                // Return if country doesn't match
                if (obj.abbrev.toLowerCase() !== value.toLowerCase()) return;
                // Hide & disable #div_id_postal_code IF obj has no postal-code
                if (!obj.postal) {
                    inputPC.setAttribute('disabled', '');
                    inputPC.setAttribute('aria-required', false);
                    parentPC.classList.add('smooth-collapse');
                    return;
                }
                // Otherwise, show & enable #div_id_postal_code
                else if (inputPC.hasAttribute('disabled')) {
                    inputPC.removeAttribute('disabled');
                    inputPC.setAttribute('aria-required', true);
                    parentPC.classList.remove('smooth-collapse');
                }
                // Update placeholder and maxlength for postal-code <input>
                inputPC.setAttribute('placeholder', obj.example ?? '');
                if (limitPC) inputPC.setAttribute(
                    'maxlength', obj.example.length ?? limitPC
                );

                ... continutes on the next page
```

```
                // Clear postal-code <input>, and hide invalid field
                inputPC.value = '';
                inputPC.classList.remove('Input--invalid');
                fieldPC.classList.add('Field--hide');
            });
```

```
            // Hide invalid field of <dynamic-select> and danger highlight
            ... previously implemented code
        }
    });
```

```
    // Remove #mounting with .loader(s)
    ... previously implemented code
});

// Update data-width of #div_id_postal_code (used for transition animation)
setInterval(() => { parentPC.dataset.width = parentPC.clientWidth }, 10);
```

NOTE: Postal code field inherits transition animation FROM **.side-by-side**

NOTE: dataset **width** is used to support **.smooth-collapse** stylesheet class

---

NOTE: Postal code field should collapse (hide) when property: “postal”,
is NOT provided IN **postal_codes_regexp.json** → **POSTAL_CODES_REGEXP**

NOTE: As postal code field is collapsing, the country field should expand
gradually and cover the available width of **#billing-address** wrapper

---

NOTE: Error field OF postal code field IS now corresponding
TO the real-time change OF the country field’s value

Let’s replace Payment Element’s **billing address** with the custom one

Initialize custom billing address as main address line

📝 project_folder/**app_name**/templates/app_name/**donate.html** </> donate.html

```
// Set up Stripe.js and Elements to use in checkout form,
// passing the client secret obtained in a previous step
const elements = stripe.elements(options);

// Create Payment Element
const paymentElementOptions = {
    layout: {
        type: 'tabs', // accordion | tabs | auto
        defaultCollapsed: false,
    },
    fields: {
        billingDetails: {
            address: 'never',
        },
    }
};

const paymentElement = elements.create('payment', paymentElementOptions);

// Mount/Show the Payment Element
paymentElement.mount('#payment-element');
```

NOTE: **billing_details** must be manually provided AT **confirmPayment**
OF payment element with **billing_details** option SET to “never”

NOTE: **billing_details** AT payment_method_data requires properties:
line1, line2, city, state, postal_code, and country

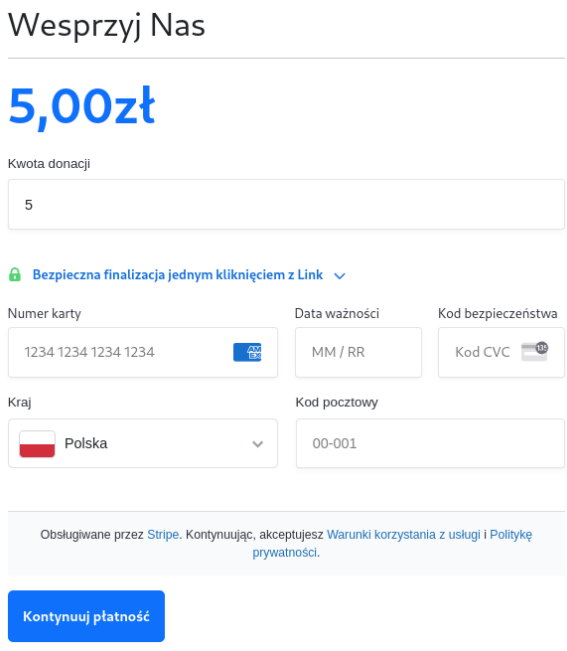
```
document.addEventListener('htmx:afterRequest', async (event) => {
...

    const {error} = await stripe.confirmPayment({
        //`Elements` instance that was used to create the Payment Element
        elements,
        confirmParams: {
            return_url: window.location.origin + "{% url 'payment_success' %}",
            /* IF You've disabled billing_details,
                THEN You must specify payment_method_data manually */
            payment_method_data: {
                billing_details: {
                    address: {
```

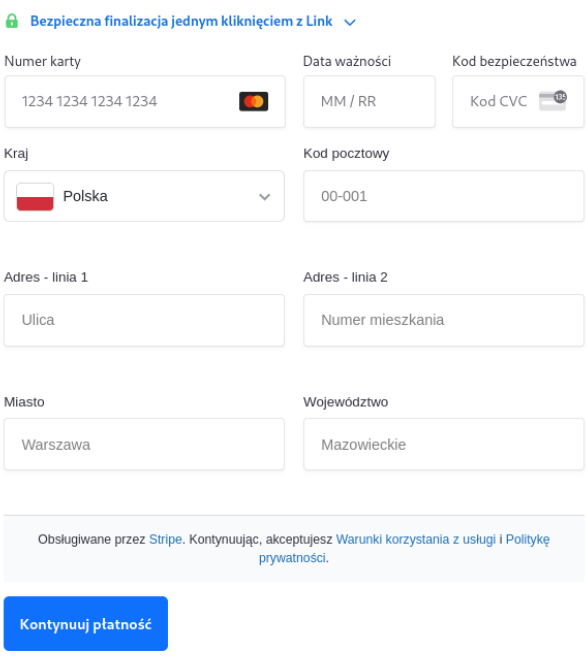
```
... confirmParams {

payment_method_data: {
 billing_details: {
  address: {
   // Get, required for Stripe API, billing data
   line1: document.querySelector('#div_id_line_1 > input:not(:disabled)')?.value || null,
   line2: document.querySelector('#div_id_line_2 > input:not(:disabled)')?.value || null,
   city : document.querySelector('#div_id_city   > input:not(:disabled)')?.value || null,
   state: document.querySelector('#div_id_state  > input:not(:disabled)')?.value || null,
   postal_code: document.querySelector('#div_id_postal_code > input:not(:disabled)')?.value || null,
   // Get the appropriate country code (e.g., 'GB' for the United Kingdom)
   country: document.querySelector('#div_id_country input[name="country"]:not(:disabled)')?.value
         || document.querySelector('#div_id_country > select:not(:disabled)')?.value
         || null,
  },
 },
},

...
```

NOTE: Country value of the target: “#div_id_country > select” is used instead WHEN the select element fails to convert into a <dynamic-select> element

Since this is a donation form, collecting address details such as line1, line2, city, and state is unnecessary unless required for specific purposes - such as, shipping a product purchased through the payment element.

You should be able to implement additional fields when needed by defining them first in the **DonateForm** and by attaching additional functionality using the custom-defined extensions





Error – 400 , 403 , 404 and 500 🚨

LearnDjango: https://learndjango.com/tutorials/customizing-django-404-and-500-error-pages 22/May/2025

Common HTTP status codes:

Status	Name
400	Bad Request
403	Forbidden
404	Page Not Found
500	Internal Server Error
505	HTTP Version Not Supported

DEBUG=True @ **settings.py** will display a full log of particular issue to help developers.

This option should be disabled in production as it can expose critical information to clients.

Setting DEBUG=False will display build-in templates in case of an error: 400,403,404,500

We can replace these build-in templates with our own by including, for example **404.html** template, in templates directory of the main application (**app_name**).

NOTE: Custom error tempaltes should not be complicated, so minimize the use of template tags. This is especially true for the **500.html** template, in fact, you should make it fully static since failed service of the server may not be able to render the template.

📝 project_folder/**app_name**/templates/**404.html** </> 404.html

```
{% load static %}
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>404 - Error</title>
    <link rel="stylesheet" href="{% static 'app_name/css/error.css' %}">
</head>
<body>
    <main>
        <label class="hidden" style="--delay: 6.4s">ERROR</label>
        <h1 class="hidden" style="--delay: 1s">
            <span style="--delay: 0.5s">4</span>
            <span style="--delay: 1s">0</span>
            <span style="--delay: 1.5s">4</span>
        </h1>
        <h2 class="hidden" style="--delay: 4s">Page Not Found</h2>
        <p  class="hidden" style="--delay: 6.2s">The page may have been
removed, renamed or is temporarily unavailable. Please try again later</p>
    </main>
</body>
</html>
```

📝 project_folder/**app_name**/static/app_name/css/**error.css** error.css

```css
* { box-sizing: border-box; padding: 0; margin: 0; cursor: default; }
body {
  display: flex;
  justify-content: center;
  align-items: center;
  height: calc(100vh - 100px);
  overflow: hidden;
}
main { max-width: 750px; font-family: arial; color: hsl(240, 6%, 20%); }
label {
  position: absolute;
  font-family: arial;
  font-weight: bold;
  font-size: 2em;
  color: #dad6d6;
}
h1 { font-size: 10em; white-space: nowrap; }
h2 { font-size: 2.5em; }
p  { font-size: 1.75em; }

@keyframes fadeIn {
  from { opacity: 0; transform: translateY(20px); }
  to   { opacity: 1; transform: translateY(0); }
}
@keyframes gradientAnimation {
  0%  { opacity: 0; background-position: 0% 50%; font-size: 11em; }
  25% { opacity: 1; }
  50% { background-position: 200% 50%; font-size: 10em; }
}

.hidden {
  --delay: .5s;
  opacity: 0;
  animation: fadeIn .5s ease-in-out var(--delay) forwards;
}
span {
  --delay: 0s;
  margin: 0;
  padding: 0;
  background: linear-gradient(45deg, #dad3d3, #444241, #c4b4b2);
  background-size: 400% 400%;
  animation: gradientAnimation 5s ease-in-out var(--delay) forwards;
  background-clip: text;
  -webkit-background-clip: text;
  -webkit-text-fill-color: transparent;
}
```

Serve **staticfiles** in Production with **WhiteNoise** 📦

You might have encountered a problem when serving the stylesheet from previous part of the documentation while being in production.

Normally, Django's built-in static file handling works fine in development, but when you switch to production via DEBUG=False, Django **does not serve static files**—it expects a dedicated static file server like Nginx or an external storage solution (e.g., AWS S3).

You should already have some experience with initializing Amazon S3 bucket. However, there is alternative solution to quickly simulate the production environment locally.

WhiteNoise steps in by allowing Django to serve static files **directly**, without needing a separate web server or storage provider. It compresses files, adds caching headers, and handles efficient delivery, making it ideal for small-to-medium projects or when you don't want to rely on a CDN (Content Delivery Network).

In **development**, Django serves static files directly from the static/ folders inside each app when DEBUG=True. The STATICFILES_DIRS setting allows additional locations for static files.

In **production**, Django **does not serve static files by itself** when DEBUG=False. Instead, the STATIC_ROOT directory is used, where all static files are collected.

How Django Handles Static Files

- Django **searches for static files across multiple locations** using `STATICFILES_FINDERS`, meaning it can pull static assets from individual apps or shared locations.
- If an app (app_name, users, chat) has a `static/` directory, Django treats it as a valid source for assets when you use `{% static 'path/to/resource' %}`.
- However, **in production**, all static files are collected into **one central directory** (`STATIC_ROOT`) via `collectstatic`, ensuring assets from different apps are merged into a single location.

🖥️ (venv) @ project_folder 🐍 manage.py

```
python manage.py collectstatic
```

AI Generated – Copilot @ copilot.microsoft.com

Install **WhiteNoise**

🖥️ (venv) @ project_folder 📚 pip library

```
pip install whitenoise
pip freeze > requirements.txt # update requirements.txt
```

Official WhiteNoise Documentation for Django:
https://whitenoise.readthedocs.io/en/latest/django.html

📚 **WhiteNoise** 🐍 settings.py

```
INSTALLED_APPS = [
    'daphne',
    'whitenoise.runserver_nostatic',
    ...
]
```

```
MIDDLEWARE = [
  ...
  'django.middleware.security.SecurityMiddleware',
  'whitenoise.middleware.WhiteNoiseMiddleware',
  ...
]
```

WhiteNoise app should be installed before 'django.contrib.staticfiles' TO avoid conflics.

WhiteNoise middleware should be installed after 'django.middleware.security.SecurityMiddleware'

Update backend of staticfiles

```
STORAGES = {
    "default": {
        "BACKEND": DEFAULT_FILE_STORAGE,
        "OPTIONS": {
            "access_key": AWS_ACCESS_KEY_ID,
            "secret_key": AWS_SECRET_ACCESS_KEY,
            "bucket_name": AWS_STORAGE_BUCKET_NAME,
        },
    },
    "staticfiles": {
        "BACKEND": "django.contrib.staticfiles.storage.StaticFilesStorage",
        "BACKEND": "whitenoise.storage.CompressedManifestStaticFilesStorage",
        "OPTIONS": {
            "location": STATIC_ROOT,
        },
    },
}
```

NOTE: Consider a CDN for high traffic and frequent requests for static files

Account Model 🫆👤🪪

This exercise requires a completion of **stripe payment system**
with the **donate** view, and **3 – 5** registered users.

The User model is extended through the Profile model, which was previously created in the User app. The Profile model is specifically designed to store public user information, including contact details, bio, custom nickname, avatar image, and other non-critical attributes.

To manage the overall account state, an Account model is required. This model should include essential properties such as account status (e.g., disabled or suspended), email verification status, multi-factor authentication settings, and some privileges (staff / admin).

Profile model includes **stripe_customer_id** and **stripe_last_intent_id**
These properties belong to **Account** model. Hence, a need for custom migration

In this part of the documentation we will:

- **Organize** models.py OF the **users** app BY moving AWS S3 definitions TO utils.py.
- **Create Account model** and register it in the **admin** panel.
- **Update** utility get_or_create_stripe_customer().
- **Update** some views in **app_name** application and **profileView()** in **users** app.
- **Migrate** new **Account** model.
- **Create custom migration** to migrate users' stripe data TO their **Account** model.
- **Remove** stripe data from **Profile** model and unregister that data in **Profile's admin panel**.

Organize models.py and create **Account** model

📝 project_folder/**users/utils.py** **(users app)** 🐍 utils.py

```python
from django.core.files.uploadedfile import UploadedFile
from django.conf import settings

import requests, stripe, boto3 # ← Added boto3
from botocore.exceptions import ClientError

stripe.api_key = settings.STRIPE_SECRET_KEY

---

s3 = boto3.client(
    's3',
    aws_access_key_id=settings.AWS_ACCESS_KEY_ID,
    aws_secret_access_key=settings.AWS_SECRET_ACCESS_KEY,
    region_name=settings.AWS_S3_REGION_NAME
)
... more on other page
```

```
def is_profile_pic(image_key):
    ...

def remove_profile_pic(image_key):
    ...

def recycle_profile_pic(image_key):
    ...


... def is_image_nsfw():
```

NOTE: **is_profile_pic** is not used anywhere, so it can be removed.
Above functions are found in models.py in **users** application.
Move them TO utils.py

📝 project_folder/**users/models.py** **(users app)** 🐍 models.py

```
from django.db import models
from django.contrib.auth.models import User
from django_resized import ResizedImageField
from django.conf import settings

from .utils import (
    remove_profile_pic,
    recycle_profile_pic,
    get_or_create_stripe_customer,
)
```

Moved – (ClientError , s3 , is_profile_pic() , remove_profile_pic() , recycle_profile_pic()) **TO** utils.py

---

```
class Profile(models.Model):
    user = models.OneToOneField(User, on_delete=models.CASCADE)
    stripe_customer_id = models.CharField(
        max_length=255, blank=True, null=True, unique=True, editable=False)
    stripe_last_intent_id = models.CharField(
        max_length=255, blank=True, null=True, unique=True, editable=False)

    phone_number = models.CharField(max_length=15)
    image = ResizedImageField(
        size=[300, 300],
        crop=['middle', 'center'],
        quality=75,
        force_format='JPEG',
        upload_to='profile_pics',
        default='default_profile.jpg'
    )
```

```
    def save(self, *args, **kwargs):
        try:
            this = Profile.objects.get(user=self.user)

            # Create Stripe customer for new Profile.
            # (Stripe is used for making payments)
            if not self.stripe_customer_id:
                self.stripe_customer_id = get_or_create_stripe_customer(self.user)

            # Only move the old image if there is an existing image
            # and it's different from the new image
            if this.image and this.image.name != self.image.name:
                #recycle_profile_pic(this.image.name)
                remove_profile_pic(this.image.name)
```

NOTE: Remember what was your option – (**recycle** | **remove**) profile picture. Use **remove_profile_pic** TO save space in S3 bucket at Amazon Web Services

```
        except Profile.DoesNotExist:
            # This is a new profile, so no need to move any image.
            pass


        super().save(*args, **kwargs)
```

```
class Account(models.Model):
    user = models.OneToOneField(User, on_delete=models.CASCADE)
    # State
    is_active = models.BooleanField(default=True)
    is_suspended = models.BooleanField(default=False)
    suspension_end = models.DateTimeField(blank=True, null=True)

    # Security
    has_verified_email = models.BooleanField(default=False)
    mfa_secret = models.CharField(max_length=32, blank=True, null=True)
    mfa_enabled = models.BooleanField(default=False)
    #backup_codes = ""

    # Payment
    stripe_customer_id = models.CharField(
        max_length=255, blank=True, null=True, unique=True, editable=False)
    stripe_last_intent_id = models.CharField(
        max_length=255, blank=True, null=True, unique=True, editable=False)

... continues on next page
```

NOTE: I haven't removed **stripe_customer_id** NOR **stripe_last_intent_id** FROM **Profile** model. We will remove them later as they are required for now

```
    def initialize(self, *args, **kwargs):

        # Create Stripe customer for new Account.
        # (Stripe is used for making payments)
        if not self.stripe_customer_id:
            self.stripe_customer_id = get_or_create_stripe_customer(self.user)


        super().save(*args, **kwargs)
```

Register **Account** model in **admin** panel and in **registry** view

📝 project_folder/**users/admin.py** **(users app)** 🐍 admin.py

```
from django.contrib import admin
from .models import Profile, Account # ← Added Account
```

```
class ProfileAdmin(admin.ModelAdmin):
    readonly_fields = (
        'stripe_customer_id',
        'stripe_last_intent_id'
    )
    list_display = [field.name for field in Profile._meta.fields]


@admin.register(Account)
class AccountAdmin(admin.ModelAdmin):
    readonly_fields = (
        'stripe_customer_id',
        'stripe_last_intent_id'
    )
    list_display = [field.name for field in Account._meta.fields]


# Register your models here.
admin.site.register(Profile, ProfileAdmin)
```

NOTE: @admin.register(**Account**) = admin.site.register(**Account**, AccountAdmin). Otherwise we'd have to repeat ourselves. Don't modify **ProfileAdmin** jut yet!

📝 project_folder/**users/views.py** **(users app)** 🐍 views.py

```
...
from .models import Profile, Account
...
```

```
def registerUserView(request):
    if request.method == 'POST':

        form_user = UserRegisterForm(request.POST)
        form_profile = ProfileForm(request.POST)

        if form_user.is_valid() and form_profile.is_valid():

            # Register the user, (and returns user instance)
            user = form_user.save()
            # Create Profile model for new user
            profile = form_profile.save(commit=False)
            profile.user = user
            profile.save()
            # Create Account model for new user
            account = Account.objects.create(user=user)
            account.initialize()

            # Authenticate the user
            raw_password = form_user.cleaned_data.get('password1')
            user = authenticate(username=user.username, password=raw_password)

            messages.success(request, f'Created account: {user.username}')
            ...
```

Take a break

Update **get_or_create_stripe_customer()** utility

We have organized models.py, and registered new model: Account.

Let's update get_or_create_stripe_customer() utility
TO retreive and register stripe data TO **Account** model, instead of a **Profile** model.

We will need this refurbished function in our custom migration.

📝 project_folder/**users/utils.py** **(users app)** 🐍 utils.py

```python
... is_image_nsfw(): is above


def get_or_create_stripe_customer(user):
    """Retrieves or creates a Stripe customer ID for the given user.
    Args:
        user: Django auth User instance
    Returns:
        str: The Stripe customer ID from the user's Account model
    Note:
        If no Stripe customer ID exists, this function will:
        1. Create a new Stripe customer account
        2. Save the ID to the user's Account model
        3. Return the newly created ID
    """

    stripe_customer_id = None

    if hasattr(user, 'account'):
        # Retrieve the user's Stripe customer ID from its account
        stripe_customer_id = getattr(user.account, 'stripe_customer_id', None)

    if stripe_customer_id is None:
        # Create a new Stripe customer
        customer = stripe.Customer.create(
            name=user.username,
            email=user.email,
            metadata={'user_id': str(user.id)}
        )
        stripe_customer_id = customer.id

        if hasattr(user, 'account'):
            # Update the user's account with the new Stripe customer ID
            user.account.stripe_customer_id = stripe_customer_id
            user.account.save()

    return stripe_customer_id
```

Update **views** in **app_name** app and **profileView** in **users** app

Replace all ...profile.stripe_... with ...account.stripe_...

📝 project_folder/**app_name/views.py** **(app_name app)** 🐍 **views**.py

```python
def donateView(request):
    ... intent

    request.user.account.stripe_last_intent_id = intent.id
    request.user.account.save()

    ... context
```

```python
def donateUpdatePaymentIntentView(request):
    ... donation

    # Note: amount is in groszy (PLN)
    intent = stripe.PaymentIntent.modify(
        id=request.user.account.stripe_last_intent_id,
        amount=int(donation * 100),
        metadata={'donation': str(donation)}
    )

    ... return
```

📝 project_folder/**users/views.py** **(users app)** 🐍 views.py

```python
def profileView(request, user_id):
    ...
```

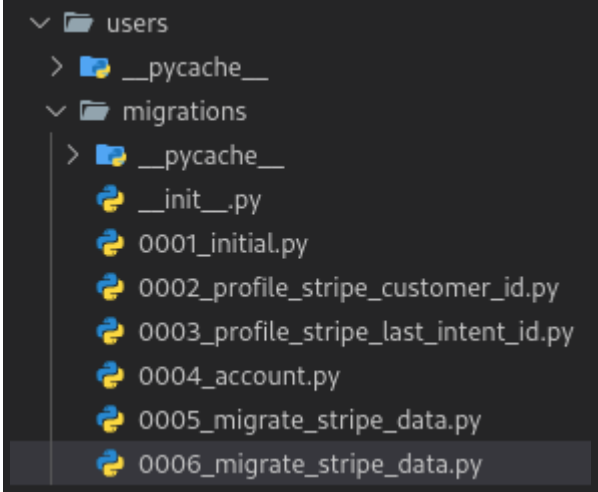
```python
    if check_password(confirm_password, user_instance.password):
        form_user.save()
        form_profile.save()
        stripe.Customer.modify(
            user_instance.account.stripe_customer_id,
            name=user_instance.username,
            email=user_instance.email
        )
        messages.success(request, 'Successfully updated profile')
    else:
        messages.error(request, 'Invalid password!')
        form_user.add_error('confirm_password', 'Invalid password')
```

Update the database with migrations

Migrate users' stripe data FROM **Profile** TO new **Account** model

💻 (venv) @ project_folder 🐍 manage.py

```
python manage.py makemigrations
python manage.py makemigrations –empty users –name migrate_stripe_data
```



NOTE: Ignore my migrations (in a provided example).

Our migrations may differ as I was doing other things for testing purposes. You should focus on the last two migrations in **your users migrations** folder instead.

The before last migration NNNN_account.py is used TO include the **Account** model, so do not remove it.

We will modify the NNNN_migrate_stripe_data.py

TO move existing users' **stripe data**
FROM their **Profile** model TO their **Account** model,

which will be assigned and populated via
custom definition – `migrate_stripe_data()` .

📝 project_folder/**users**/migrations/**NNNN_migrate_stripe_data.py** **(users app)** 🐍

```
# Generated by Django N.N.N on YYYY-MM-DD HH:MM

from django.db import migrations
from users.utils import get_or_create_stripe_customer
```

```
def migrate_stripe_data(apps, schema_editor):
    Profile = apps.get_model('users', 'Profile')
    Account = apps.get_model('users', 'Account')

    for profile in Profile.objects.all():
        # Get or create Account without triggering save()
        account, created = Account.objects.get_or_create(user=profile.user)

        # Migrate existing Stripe data if available
        if profile.stripe_customer_id:
            account.stripe_customer_id = profile.stripe_customer_id
            account.stripe_last_intent_id = profile.stripe_last_intent_id
```

```
        # Only create new Stripe customer if profile never had one
        elif not account.stripe_customer_id:
            account.stripe_customer_id = get_or_create_stripe_customer(profile.user)

        # Save with direct SQL update to bypass model save()
        Account.objects.filter(pk=account.pk).update(
            stripe_customer_id=account.stripe_customer_id,
            stripe_last_intent_id=account.stripe_last_intent_id
        )
```

```
class Migration(migrations.Migration):

    dependencies = [
        ('users', 'NNNN_account'),
    ]

    operations = [
        migrations.RunPython(migrate_stripe_data),
    ]
```

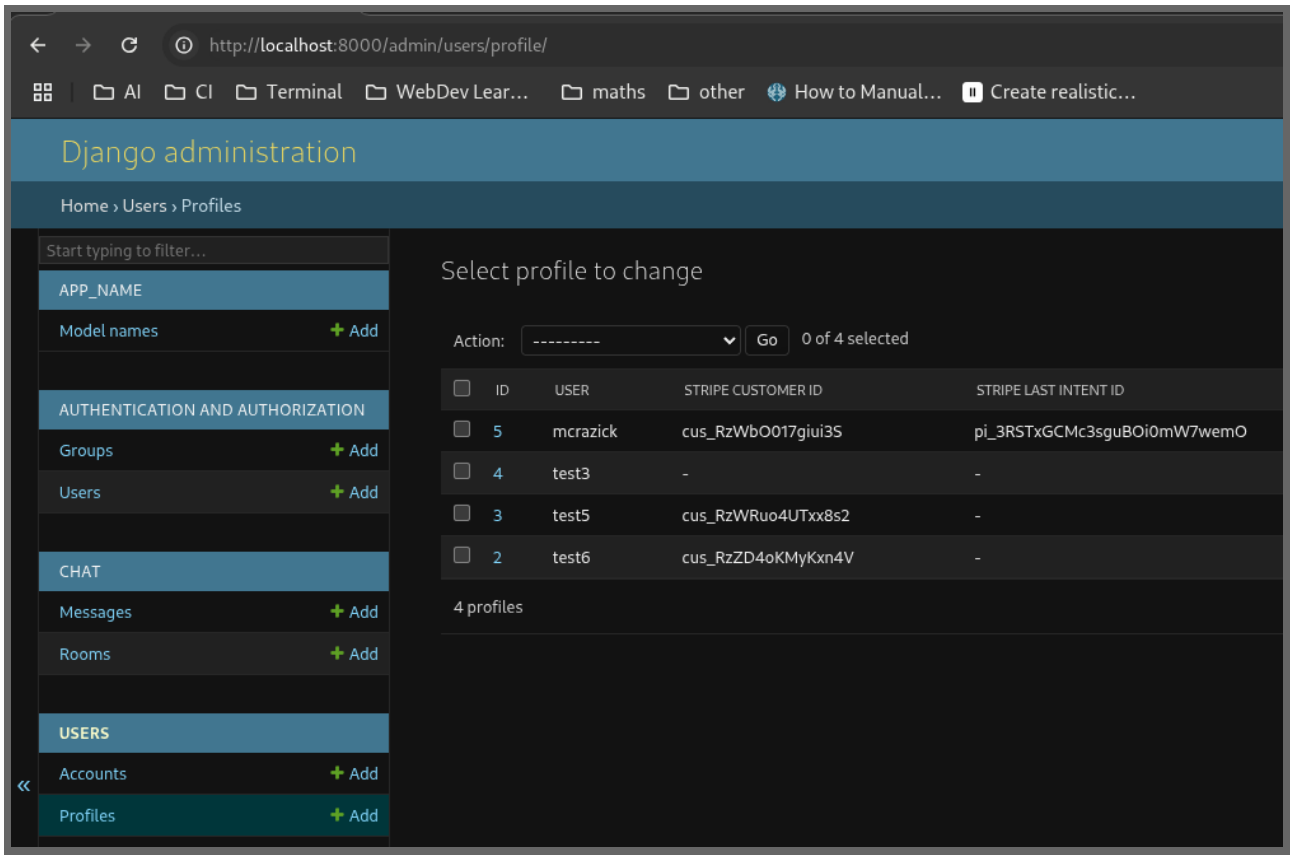
NOTE: **NNNN_account** should be your **before last** migration @ users/migrations

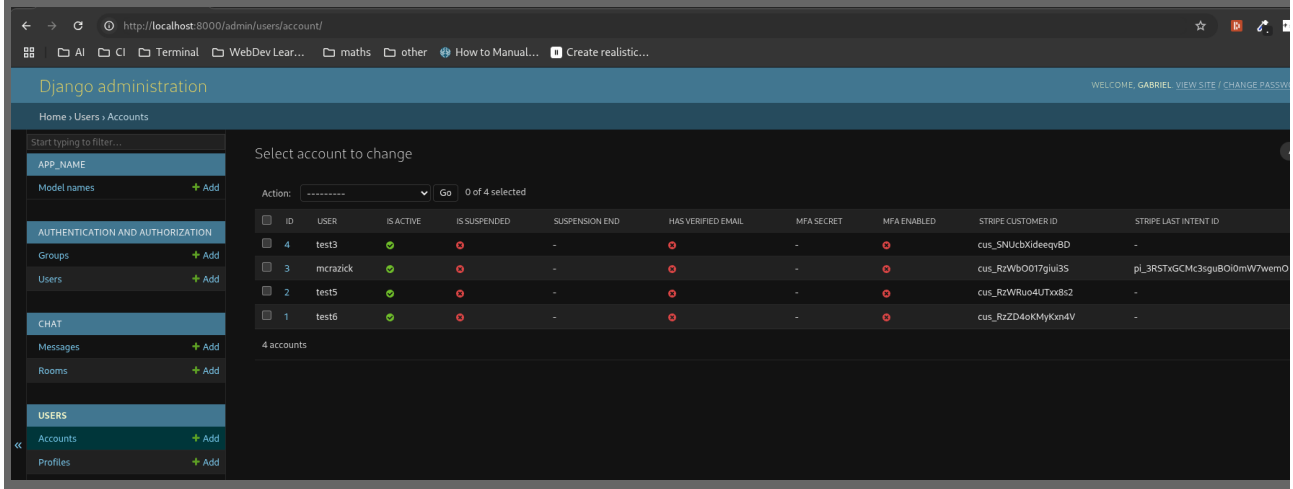
🖥️ (venv) @ project_folder 🐍 manage.py

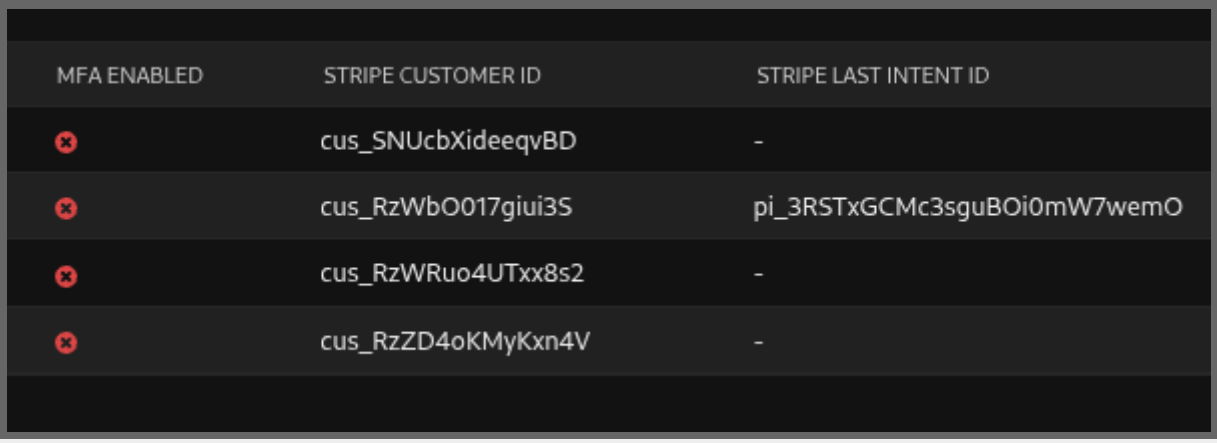
```
python manage.py migrate
python manage.py runserver localhost:8000
```

Head TO localhost:8000/admin (your admin panel) TO verify changes

Verify changes in **admin** panel







NOTE: **stripe_customer** has been successfully created FOR user: “test3”

Remove stripe data FROM **Profile** model and its **admin** panel

📝 project_folder/**users/admin.py** **(users app)** 🐍 admin.py

```
from django.contrib import admin
from .models import Profile, Account

---

@admin.register(Profile)
class ProfileAdmin(admin.ModelAdmin):
    readonly_fields = (
        'stripe_customer_id',
        'stripe_last_intent_id'
    )
    list_display = [field.name for field in Profile._meta.fields]


@admin.register(Account)
class AccountAdmin(admin.ModelAdmin):
    readonly_fields = (
        'stripe_customer_id',
        'stripe_last_intent_id'
    )
    list_display = [field.name for field in Account._meta.fields]


# Register your models here.
admin.site.register(Profile, ProfileAdmin)
```

📝 project_folder/**users/models.py** **(users app)** 🐍 models.py

```
class Profile(models.Model):
    user = models.OneToOneField(User, on_delete=models.CASCADE)
    stripe_customer_id = models.CharField(
        max_length=255, blank=True, null=True, unique=True, editable=False)
    stripe_last_intent_id = models.CharField(
        max_length=255, blank=True, null=True, unique=True, editable=False)
...
```

🖥️ (venv) @ project_folder 🐍 manage.py

```
python manage.py makemigrations users
python manage.py migrate
```

2FA (Two Factor Authentication) 👤📲🔏

This exercise requires a completion of **Account model**
and be confident with **Django + Python** and **JavaScript + HTMX**

This section of the documentation assumes a solid grasp of previously applied utilities and methodologies, as it emphasizes full-stack development. It highlights frequent asynchronous communication between the client and server, both directly and indirectly.

We will also utilize API from two platforms – **Zoho** Mail & **Twilio**. For serving OTPs

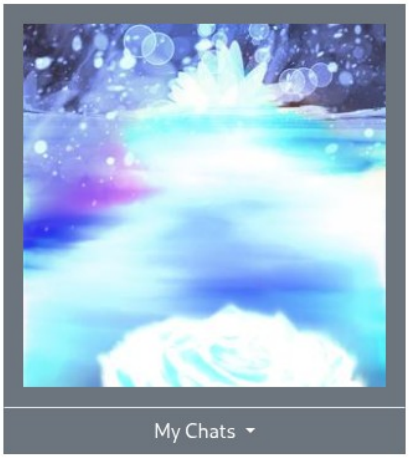
---

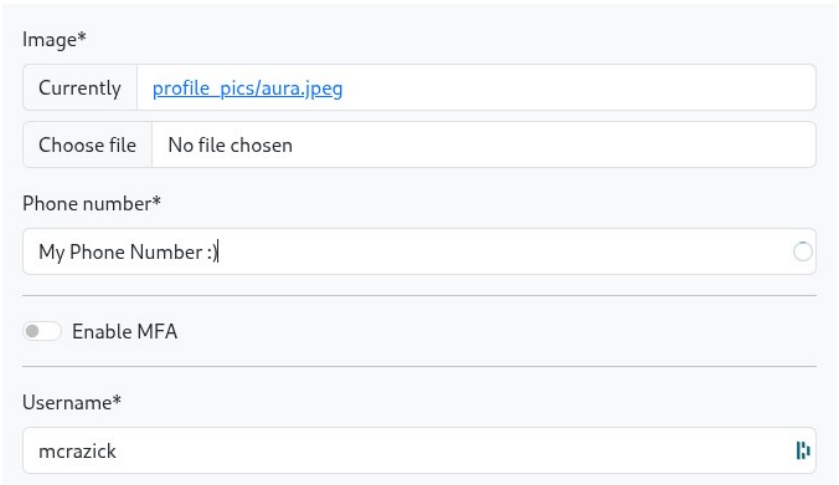
Important Abbreviations

- **MFA (Multi-Factor Authentication)**: Requires multiple forms of verification, such as a password plus a biometric scan.
- **2FA (Two-Factor Authentication)**: A subset of MFA, involving exactly two authentication steps—often combining something you know (password) with something you have (a phone or security key).

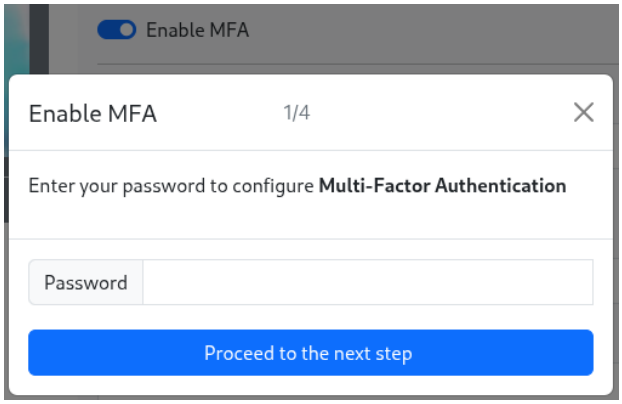
  3D Secure is an example used in payment authentication.
- **OTP (One-Time Password)**: A single-use code, typically sent via SMS or email, valid for a short period.

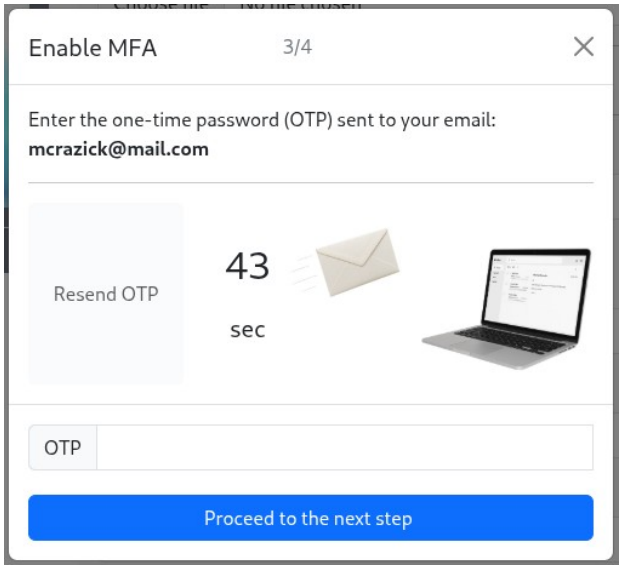
We will use OTP based of User's MFA secret. User will receive OTP via Email, SMS or Mobile Authenticator App of User's choice. (I recommend Microsoft's Authenticator App)

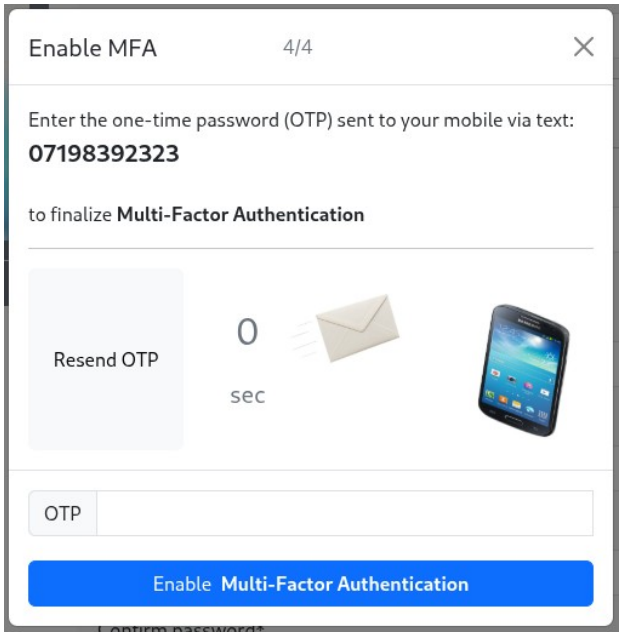


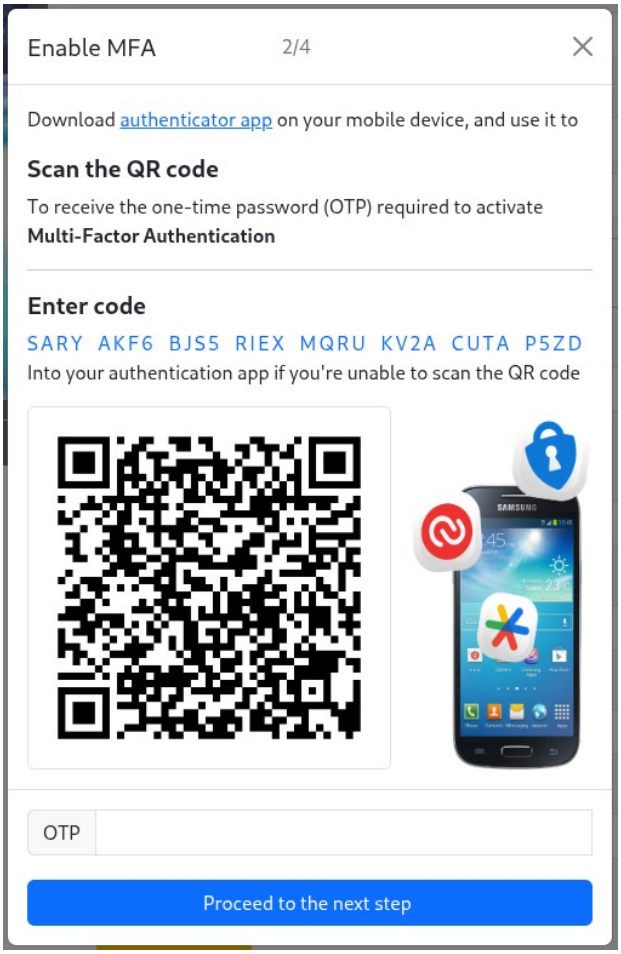


We're going to create this new toggable button in **Profile** template – **Enable MFA**









We will utilize **Bootstrap5** library TO create 4 template Modals:

1. password.html
2. otp_qrcode.html
3. otp_email.html
4. otp_sms.html

All inheriting from a **base.html** (Modal template) via **include.html**

We will utilize **HTMX** library to communicate with the backend TO serve a Modal at-a-time, (Based on the current **step** `<input>`)

Images are available in **Users** App - Static

NOTE: Familiarity with the **hx-swap-oob** attribute is essential, as it will be used in conjunction with Django's **{% include %}** and **{% extends %}** template tags

These modals will be **requested** on demand, **and** terminated on **submit + close** event

Install **PyOTP** + **QRCode** + **Twilio** and **PhoneNumberField**

🖥️ (venv) @ project_folder 📚 pip library

```
pip install pyotp qrcode twilio "django-phonenumber-field[phonenumberslite]"
pip freeze > requirements.txt # update requirements.txt
```

```
NOTE: - PyOTP is used to generate OTPs
      - QRCode is used to generate QR Image
      - Twilio API. Is used to request OTPs via SMS. Twilio Docs SMS setup
      - django-phonenumber-field converts phonenumber input TO E.164 Format
```

📚 **django-pronenumber-field** 🐍 settings.py

```
INSTALLED_APPS = [
    ...
    'storages',
    'phonenumber_field',
    ...
]
```

```
Install phonenumber_field app
before styling libraries:

- bootstrap,
- crispy,
- sass, etc…
```

📝 project_folder/**users/models.py** **(users app)** 🐍 models.py

```
...
from phonenumber_field.modelfields import PhoneNumberField
import pyotp


class Profile(models.Model):
    user = models.OneToOneField(User, on_delete=models.CASCADE)
    phone_number = models.CharField(max_length=15)
...


class Account(models.Model):
    user = models.OneToOneField(User, on_delete=models.CASCADE)

    # Contact
    phone_number = PhoneNumberField(unique=True, null=True)
...
```

```
Migrate changes. (I didn't bother migrating phone number's of my users)

IF you had 100 of Users with unique phone numbers at Profile model,
THEN you may want to consider constructing a custom migration.
```

```
class Account(models.Model):
...

    def initialize(self, *args, **kwargs):

        # Create Stripe customer for new Account.
        # (Stripe is used for making payments)
        if not self.stripe_customer_id:
            self.stripe_customer_id = get_or_create_stripe_customer(self.user)

        # Create MFA Secret for new Account.
        # (MFA secret is used for generating One-Time password)
        if not self.mfa_secret:
            self.mfa_secret = pyotp.random_base32()


        super().save(*args, **kwargs)

...
```

Update the Main <form> at **Profile** Template

📝 project_folder/**users/forms.py** **(users app)** 🐍 forms.py

```
from django import forms
from django.contrib.auth.models import User
from django.contrib.auth.forms import UserCreationForm
from .models import Profile, Account
```

```
class ProfileForm(forms.ModelForm):
    class Meta:
        model = Profile
        fields = ['image'] # Removed: 'phone_number', from the list

class AccountForm(forms.ModelForm):
    class Meta:
        model = Account
        fields = ['phone_number']
...
```

📝 project_folder/**users/views.py** **(users app)** 🐍 views.py

```
...
from .models import Profile
from .forms import UserRegisterForm, UserUpdateForm, ProfileForm, AccountForm
...
```

```
@login_required
def profileView(request, user_id):
    user_instance = get_object_or_404(User, pk=user_id)
```

```
    if request.method == 'POST' and request.user.id == user_instance.id:

        form_user = UserUpdateForm(
            request.POST,
            instance=user_instance
        )
        form_profile = ProfileForm(
            request.POST,
            request.FILES,
            instance=user_instance.profile
        )
        form_account = AccountForm(
            request.POST,
            instance=user_instance.account
        )
```

```
        if form_user.is_valid() and form_profile.is_valid() and form_account.is_valid():
            confirm_password = form_user.cleaned_data.get('confirm_password')
            if check_password(confirm_password, user_instance.password):
                form_user.save()
                form_profile.save()
                form_account.save()
            ...
```

```
        else:
            form_user = UserUpdateForm(instance=user_instance)
            form_profile = ProfileForm(instance=user_instance.profile)
            form_account = AccountForm(instance=user_instance.account)

    context = {
        'profile_user': user_instance,
        'forms': {
            'user': form_user,
            'profile': form_profile,
            'account': form_account
        }
    }
```

📝 project_folder/**users**/templates/users/**profile.html** </> profile.html

```
...
{% if user.id == profile_user.id %}

  <form action="{% url 'profile' profile_user.id %}"
        enctype="multipart/form-data"
        method="POST">

    {% csrf_token %}
    {{ forms.profile|crispy }}
    {{ forms.account|crispy }}
    {{ forms.user|crispy }}

    <div class="row justify-content-between">
      <div class="col-auto">
        <button class="btn btn-warning" type="submit">Update Profile</button>
      </div>
      <div class="col-auto">
        <a href="{% url 'password_reset' %}" class="btn btn-link">
          change password
        </a>
      </div>
    </div>

  </form>

{% else %}
...
```

TASK: User Registration and Phone Number Update

1. **Register a new user** and ensure successful creation.
2. **Verify MFA Setup** in the admin panel, confirming the user has a unique mfa_secret.
3. **Login as the newly created user** to ensure authentication works correctly.
4. **Update the user's phone number**, ensuring that any national number provided is automatically converted to **E.164 format**.
5. **Verify the update** by checking the stored number in the admin panel.

Enable MFA

(Continues on the next page)

Setup environment variables AND configure settings.py

📝 project_folder/**.env** .env

```
# Website/Company name
COMPANY_NAME='MyCompany'
```

```
# Twilio API Keys (We'll get the valid keys after creating some utilities)

TWILIO_ACCOUNT_SID='AUXXXXXXXXXXXXXXXXXXXXXXXXXXXXd091'
TWILIO_AUTH_TOKEN='yiXXXXXXXXXXXXXXXXXXXXXXXXXX6d12'
TWILIO_PHONE_NUMBER='+NNXXXXXXXX51'
```

📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
COMPANY_NAME = str(os.environ['COMPANY_NAME'])
```

NOTE: COMPANY_NAME variable is custom made. Hence, independend from libraries

```
# Django Phonenumber Field

# -- WARNING! -- Data loss may occur when changing the DB format!
# Hence, it is critical to read the below documentation before making any changes.
# https://django-phonenumber-field.readthedocs.io/en/latest/reference.html#phone-number-format-choices

PHONENUMBER_DB_FORMAT='E164'        # 'E164' by default when unspecified
PHONENUMBER_DEFAULT_FORMAT='E164' # 'E164' by default when unspecified
PHONENUMBER_DEFAULT_REGION='GB'     # 'None' by default when unspecified
```

```
# One-Time Password for Multi-Factor Authentication

OTP_ISSUER_NAME = COMPANY_NAME
OTP_DEFAULT_INTERVAL = 30 # 30 seconds
OTP_EMAIL_INTERVAL = 180 # 3 minutes
OTP_SMS_INTERVAL = 180 # 3 minutes
```

NOTE: OTP_… variables are custom made and therefore NOT dependent on libraries

```
# Twilio API keys (USE Live credentials API Keys instead of Test credentials)

TWILIO_ACCOUNT_SID = os.getenv('TWILIO_ACCOUNT_SID')
TWILIO_AUTH_TOKEN = os.getenv('TWILIO_AUTH_TOKEN')
TWILIO_PHONE_NUMBER = os.getenv('TWILIO_PHONE_NUMBER')
```

📝 project_folder/**users/utils.py** **(users app)** 🐍 utils.py

```python
from django.core.files.uploadedfile import UploadedFile
from django.core.mail import send_mail
from django.conf import settings
from twilio.rest import Client

import io, base64, requests, stripe, boto3, pyotp, qrcode
from botocore.exceptions import ClientError
...
```

```python
def get_or_create_mfa_secret_for_user(user_instance):
    """
    Generates a random base32 string and saves it as mfa_secret
    in the, attached to the auth user_instance, account model.

    Returns: 'mfa_secret' from user_instance.account model (on success),
             'False' otherwise.
    """

    if hasattr(user_instance, 'account'):
        if not user_instance.account.mfa_secret:
            user_instance.account.mfa_secret = pyotp.random_base32()
            user_instance.account.save()

    return user_instance.account.mfa_secret or False
```

```python
def get_users_mfa_secret_as_qrcode_base64(user_instance):
    """
    Generates a Base64-encoded QR code from an MFA secret.

    This function:
    - This function ensure the user has a stored MFA secret.
    - Converts the MFA secret into an OTP provisioning URI.
    - Generates a QR code from the OTP URI.
    - Stores the QR code in an in-memory buffer as a PNG.
    - Encodes the QR code image into a Base64 data URI format.

    Args:
        user_instance: A Django User instance.

    Returns:
        str: A Base64-encoded PNG data URI suitable for embedding in HTML.
    """

    mfa_secret = get_or_create_mfa_secret_for_user(user_instance)
```

...continues on the next page

```
    otp_uri = pyotp.totp.TOTP(mfa_secret).provisioning_uri(
        name=user_instance.email,
        issuer_name=settings.OTP_ISSUER_NAME
    )
```

```
    # Convert OTP URI to QR Code as PNG
    qr = qrcode.make(otp_uri)      # Convert OTP URI → QR Code
    buffer = io.BytesIO()          # Set in-memory buffer to temporarily store the QR Code
    qr.save(buffer, format='PNG') # Convert QR Code → PNG image & store it in the buffer
    buffer.seek(0)                 # Move buffer's reading position to the beginning
```

```
    # Return QR image AS data base64 URI
    qrcode_png_base64 = base64.b64encode(buffer.getvalue()).decode('utf-8')
    return f'{qrcode_png_base64}'
```

```
def generate_otp_for_user(user_instance, interval=settings.OTP_DEFAULT_INTERVAL):
    """
    Generates a time-based one-time password (OTP) using the user's MFA secret

    This function ensure the user has a stored MFA secret,
    generates an OTP using TOTP (based on interval)

    Args:
        user_instance: A Django User instance.
        interval: Natural number (in seconds).

    Returns:
        str: The generated OTP
    """
```

```
    mfa_secret = get_or_create_mfa_secret_for_user(user_instance)

    totp = pyotp.TOTP(mfa_secret, interval=interval)
    otp = totp.now()

    return otp
```

...continues on the next page

```
def email_otp_to_user(user_instance):
    """
    Generates a time-based one-time password (OTP)
    using the user's MFA secret and sends it via email.

    This function ensures the user has a stored MFA secret,
    generates an OTP using TOTP (based on OTP_EMAIL_INTERVAL),
    and delivers it to their registered email address.

    Args:
        user_instance: A Django User instance.
    Returns:
        str: The generated OTP (on success). bool: False (on missing otp).
    """
```

```
    interval = settings.OTP_EMAIL_INTERVAL

    otp = generate_otp_for_user(user_instance, interval=interval)
    if not otp:
        return False
```

```
    # Send OTP via email
    sender_email = settings.EMAIL_HOST_USER
    subject = 'Your OTP Code'
    message = f'Your OTP code is {otp}. It expires in {interval} seconds.
\n\nPlease do not share this code with anyone!'

    send_mail(subject, message, sender_email, [user_instance.email])
    return otp
```

```
def sms_otp_to_user(user_instance):
    """
    Generates a time-based one-time password (OTP)
    using the user's MFA secret and sends it via SMS.

    This function ensures the user has a stored MFA secret,
    generates an OTP using TOTP (based on OTP_SMS_INTERVAL),
    and delivers it to their registered in account model:
        - phone number (which should be in E.164 format)

    Args:
        user_instance: A Django User instance.
    Returns:
        str: The generated OTP (on success). bool: False (on missing otp).
    """
```

...continues on the next page

```
    interval=settings.OTP_SMS_INTERVAL

    otp = generate_otp_for_user(user_instance, interval=interval)
    if not otp:
        return False
```

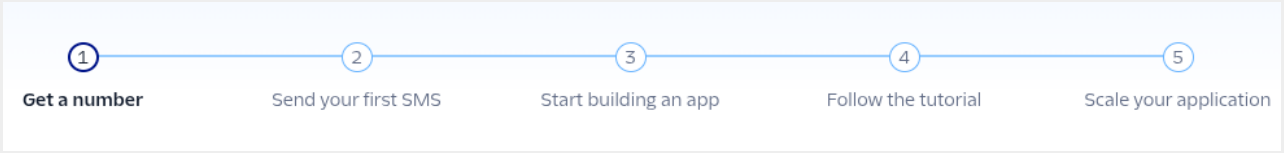
```
    account_sid = settings.TWILIO_ACCOUNT_SID
    auth_token = settings.TWILIO_AUTH_TOKEN
    client = Client(account_sid, auth_token)
```

```
    # Both 'from_' and 'to' phone numbers must be of format: E.164
    message = client.messages.create(
        body=f'Your OTP code is {otp}. It expires in {interval} seconds.
\n\nPlease do not share this code with anyone!',
        # Twilio Phone Number must support SMS
        from_=str(settings.TWILIO_PHONE_NUMBER),
        to=str(user_instance.account.phone_number)
    )
```

```
    return otp
```

Register **Twilio Phone Number**

Once you register a Twilio account at: https://www.twilio.com/try-twilio
Head to the Twilio console panel at: https://console.twilio.com
Follow the steps: 1 – 2

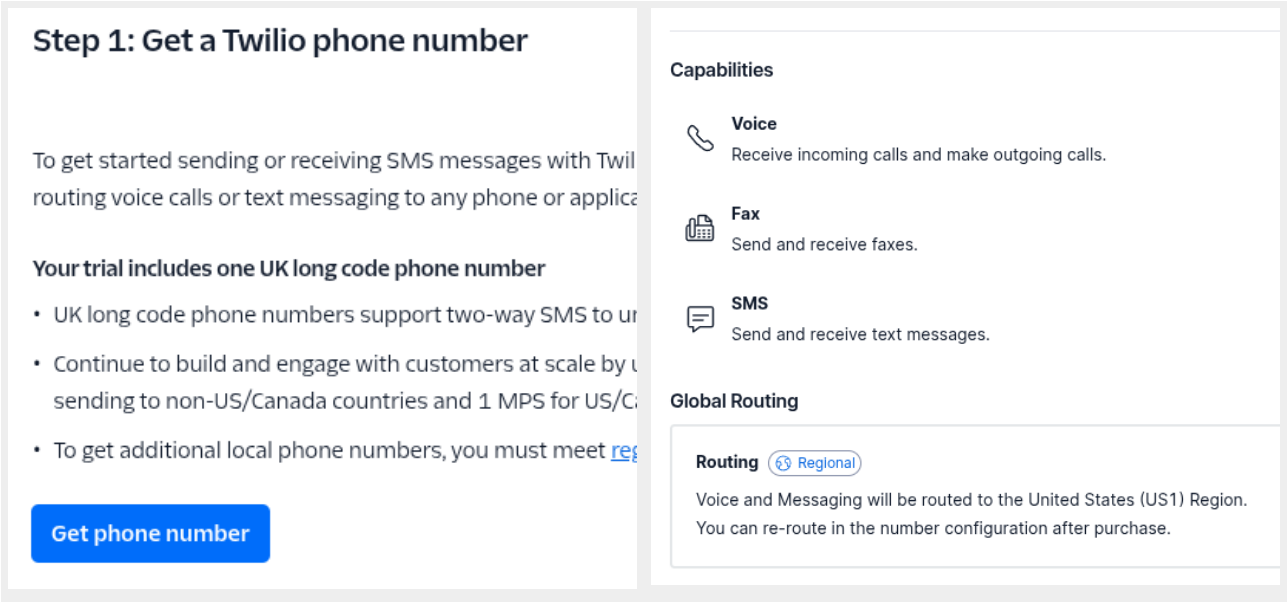


NOTE: Working script is already implemented in **Users** app utils.py - **sms_otp_to_user**()

By scrolling down, you should see **Go to API Keys** link at **Account Info**
https://console.twilio.com/us1/account/keys-credentials/api-keys

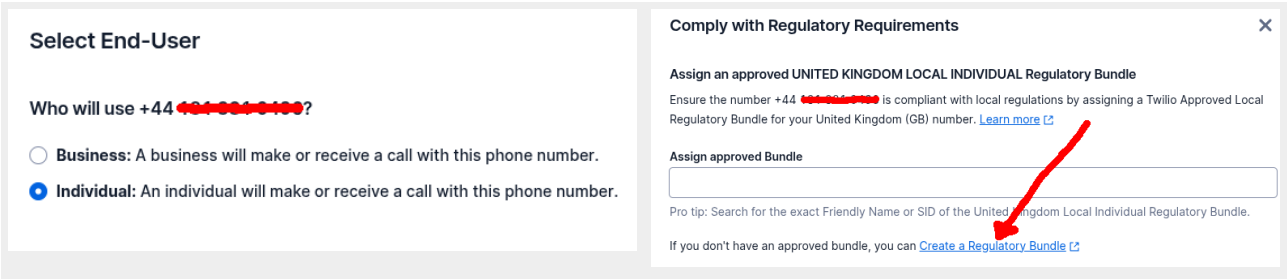
Head there after you register new Twilio Phone Number, and
Copy the **Live credentials** into your **environment variables**

NOTE: **Test credentials** cannot send **SMS** at least during testing, this was the case, though it may have changed. Nonetheless, consider this a heads-up about a potential issue



Make sure that your Phone Number of choice:

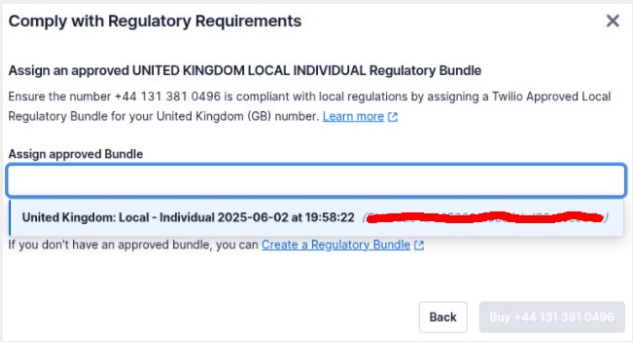
- Provides SMS functionality TO send text messages: Requested by the user OTP(s)
- Routing is set to United States (US1) as some routers do NOT support all features
- Is situated near your target – clients. IF you operate in UK – Choose an UK Number

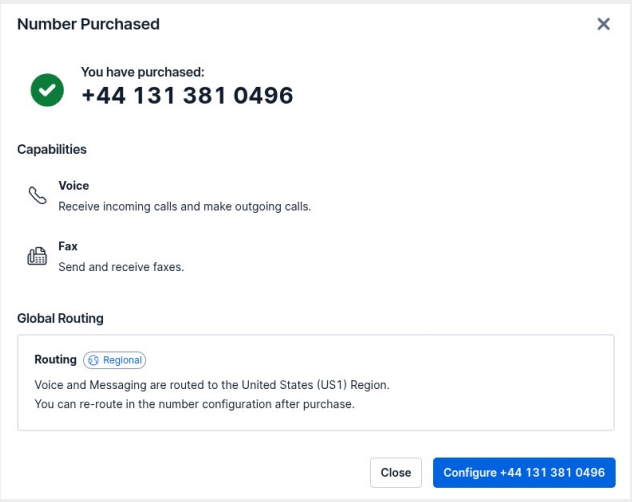


Make sure that your Phone Number of choice:

- Is setup correctly for your needs. I am NOT operating as a business. Since my Django application is a personal project for educational purposes only. Hence, **individual End-User**
- Complies with the **Regulatory Requirements**. You will need to provide documentation, such that proves - Your/Companies address. Best documentation is that issued by the government: Passport and Driving License. You may also provide other supporting documents, such as: Bank Statement or University Associate Card

It might take some time for Twilio to verify documents' integrity. (4 - 6 hours depending on the day and ongoing events like bank holidays). The bundle should arrive to your mail box

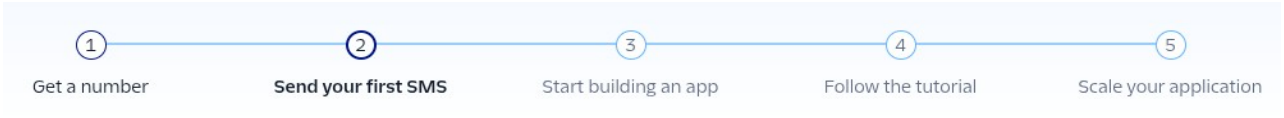


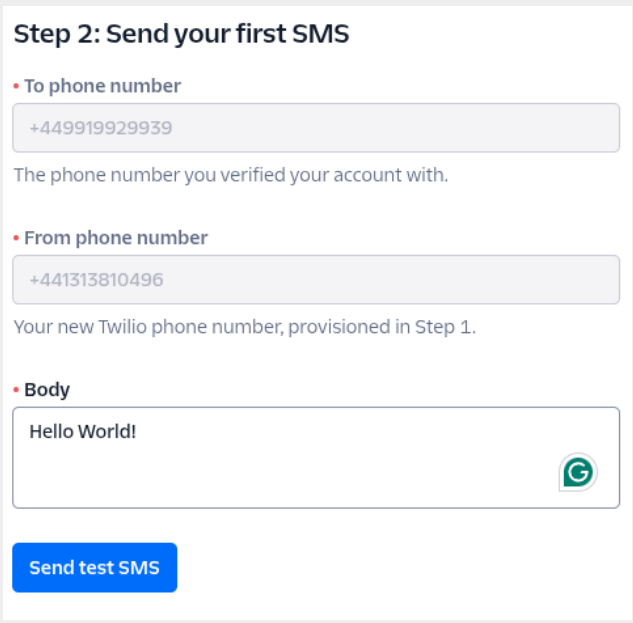


NOTE: "+441313810496"
(My old Twilio number, and it dosen't support SMS)

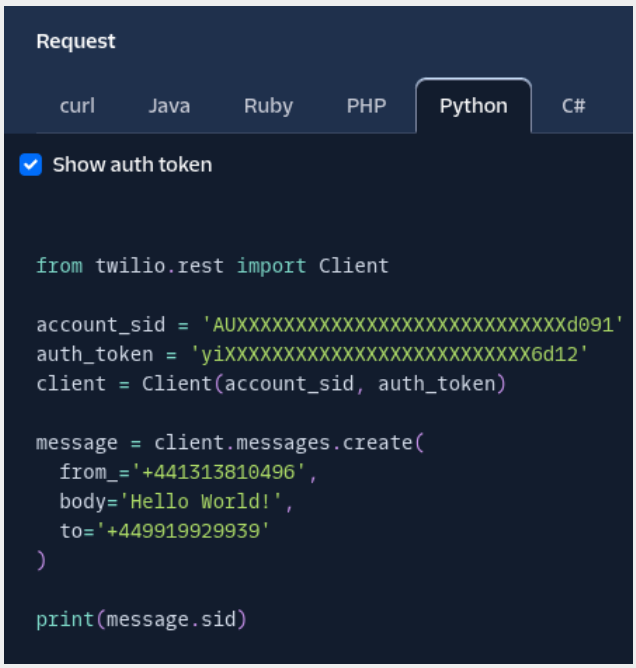
Is a phone number in a **E.164** format

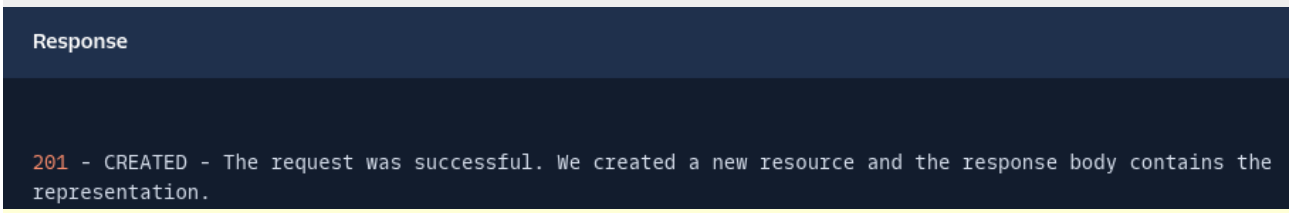
Send **SMS** via Twilio Phone Number





Assume **From Phone Number** - is from my mobile





NOTE: You may receive **ERROR** 21608 initially because:
Trial accounts cannot send messages to unverified numbers.

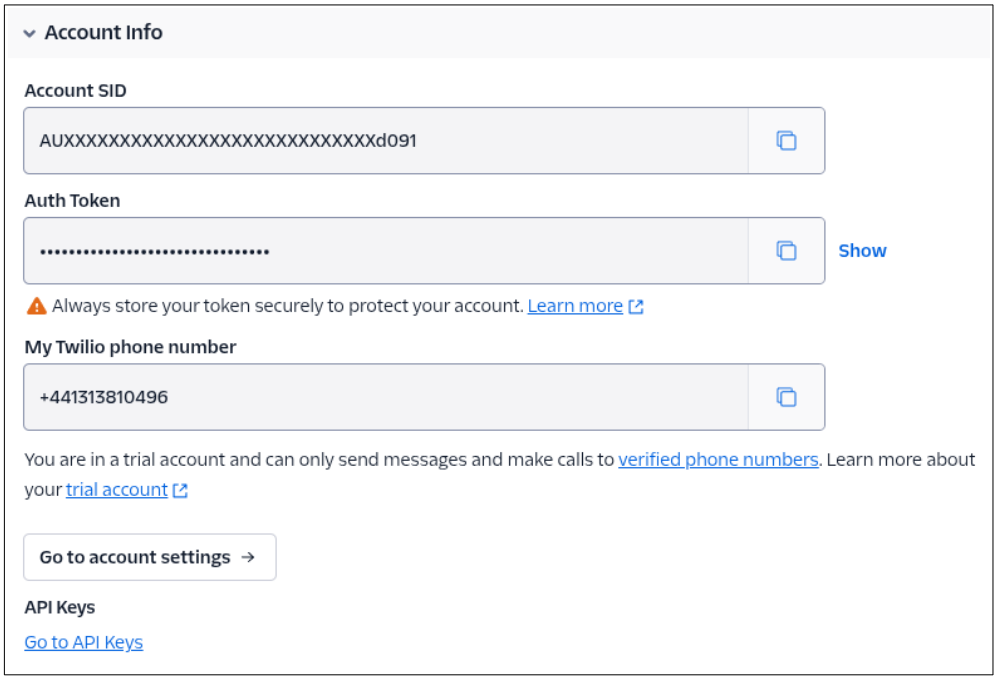
(You can also inspect **successful** and **failed** messages at - Twilio SMS logs)

Resolve ERROR 21608 for Trial Twilio Account

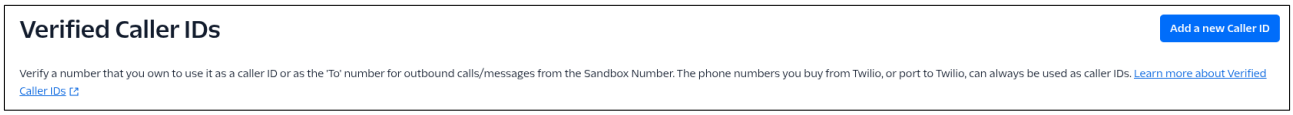
Trial Twilio accounts are restricted from sending messages to unverified phone numbers to prevent misuse by malicious actors. As a result, the current Twilio setup is not suitable for production use in our Django app.

To ensure smooth deployment, upgrading the account will be essential when the application goes live. In the meantime, our focus is on testing the Twilio SMS API. Let's resolve this limitation to enhance our development experience.

At **Send your first SMS**, Scroll down to section **Account Info**



Head to: https://console.twilio.com/us1/develop/phone-numbers/manage/verified
By pressing the **verified phone numbers** link

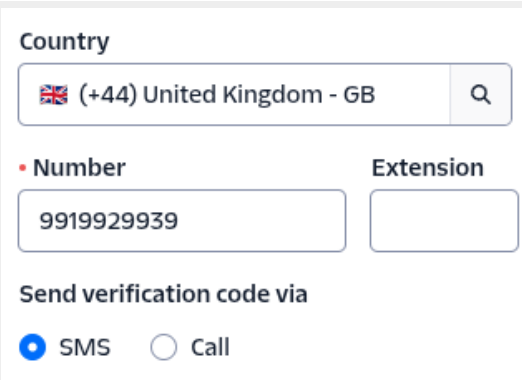


Hit the **button**: Add a new Caller ID

NOTE: I had an issue when I provided Phone Number in UK's National Format: "077XXXXXXXX"

Typically, the platform should handle input data formatting automatically. However, something went wrong in this case

Hence, to avoid the issue - manually remove the leading "0"



Give the Twilio server some time to update the registered phone number, and then Head back to the **Send your first SMS** and try sending a text message. Next set API Keys

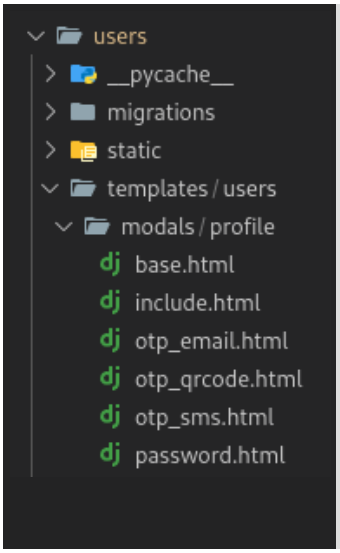
📝 project_folder/**users/views.py** **(users app)** 🐍 views.py

```python
from .utils import get_users_mfa_secret_as_qrcode_base64

@login_required
def profileView(request, user_id):
    user_instance = get_object_or_404(User, pk=user_id)

    # Generate QR Code image to verify OTP for user's MFA
    qrcode_data_uri = get_users_mfa_secret_as_qrcode_base64(request.user)

    ...

    context = {
        'profile_user': user_instance,
        'qrcode_data_uri': qrcode_data_uri,
        'forms': {
            'user': form_user,
            'profile': form_profile,
            'account': form_account
        }
    }
```

This implementation guarantees that every user's account instance is assigned an **mfa_secret**, just like we did when initializing a Stripe customer. Without this, existing users wouldn't be able to setup a Multi-Factor Authentication

We'll use the **qrcode_data_uri** in one of the modals.
Treat it as a password, it cannot be exposed to malitious actors.

Create modals



base.html will be used to extend repeating HTML elements for the modals:

otp_email.html | otp_qrcode.html | otp_sms.html | password.html

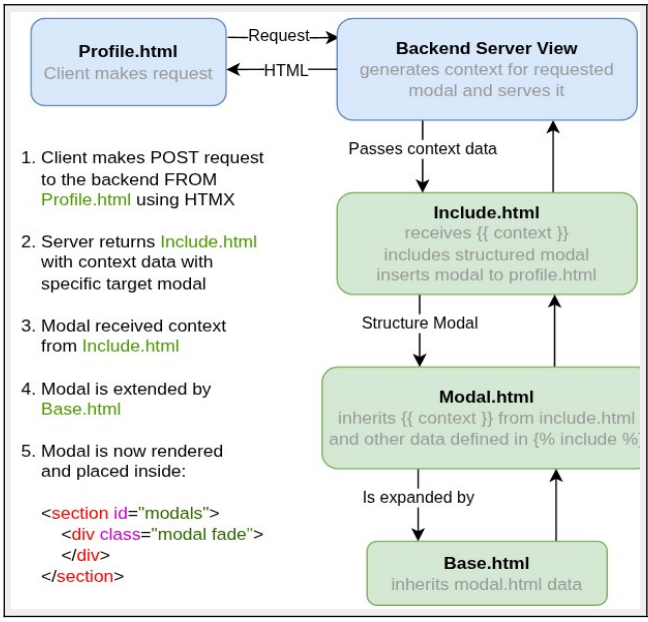
include.html combined with HTMX **hx-swap-oob** will be used as a render() template in the backend to serve specific modals

We will pass context data to serve specific modals via custom view: **enableMFAView**()

For now, create the tree structure in **Users** app as shown in the example.
And download some image assets from: [github-django5-tutorial-users-images]

authenticator_apps.png | mail_to_laptop.png | mail_to_phone.png

And save these assets in **users / static / users / img**



Modals should be removed FROM

<section id="modals"></section>

when **closed**

To protect sensitive information like:

mfa_secret being available
in the DOM tree.

Also, backend server should always replace the innerHTML of → <section id="modals">

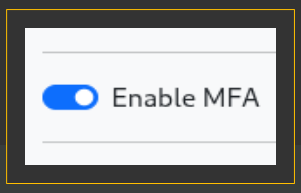
So that there is always one modal at a time

📝 project_folder/**users**/templates/users/**profile.html** </> profile.html

```
...
{% block content %}

<section id="modals"></section>

<div class="container">
...
```

```
  <form action="{% url 'profile' profile_user.id %}"
        enctype="multipart/form-data"
        method="POST">
```

```
    {% csrf_token %}
    {{ forms.profile|crispy }}
    {{ forms.account|crispy }}
    <hr>
    <div class="form-check form-switch mb-3">
      <input class="form-check-input" type="checkbox" id="mfa-flex-switch"
        {% if user.account.mfa_enabled %}checked{% endif %}
        hx-post="{% url 'enable_mfa' %}"
        hx-trigger="click throttle:1s"
        hx-swap="none">
      <label class="form-check-label" for="mfa-flex-switch" title="Multi Factor Authentication">Enable MFA</label>
    </div>
    <hr>
    {{ forms.user|crispy }}
```



📝 project_folder/**users**/templates/users/**modals**/profile/**base.html** </>

```
{% load custom_filters %}
<div class="modal fade" id="{{ step|replace:'_|-' }}-modal" tabindex="-1"
  data-bs-backdrop="static"
  aria-labelledby="{{ step|replace:'_|-' }}-label"
  aria-hidden="true">

  <div class="modal-dialog modal-dialog-centered">
    <div class="modal-content">

      <div class="modal-header">
        <h5 class="modal-title" id="{{ step|replace:'_|-' }}-label">{{ title }}</h5>
        <span class="mx-auto text-secondary">{{ page }}</span>
        <button type="button" class="btn-close" onclick="onAnyClosedModal()"
          data-bs-dismiss="modal" aria-label="Close"></button>
      </div>

      <div class="modal-body">{% block body %}{% endblock %}</div>

      <form id="{{ step|replace:'_|-' }}-form" class="modal-footer"
        hx-post="{{ post_url }}"
        hx-trigger="submit throttle:200ms"
        hx-swap="none">
        {% csrf_token %}{% block form %}{% endblock %}

        <div class="input-group mb-3">
          {% block input %}{% endblock %}
          <input type="hidden" name="step" value="{{ step }}">
        </div>
        <button type="submit" class="btn btn-primary modal-submit-button w-100"
          hx-post="{{ post_url }}"
          hx-trigger="click delay:1000ms"
          hx-swap="none">

          <span class="spinner-grow spinner-grow-sm visually-hidden"
            role="status" aria-hidden="true"></span>
          <span class="button-text">{{ submit }}
            <strong class="ms-1">{{ submit_boldend }}</strong>
          </span>

        </button>
      </form>
    </div>
  </div>
</div>
```

NOTE: base.html = **Bootstrap5** → Static Modal

`{% load custom_filters %}` Converts “my_string_name” TO “my-string-name”

`{{ variable }}` Orange variables are FROM **include.html**

onAnyClosedModal() → IS function FROM **base.html**

📝 project_folder/**users**/templates/users/**profile.html** </> profile.html

```
{% block base %}
<script name="main-script" type="text/javascript">

const input_enable_mfa = document.getElementById('mfa-flex-switch');
const onAnyClosedModal = () => input_enable_mfa.checked = false;

</script>
{% endblock %}
```

📝 project_folder/**app_name**/templatetags/**custom_filters.py** **(app_name app)** 🐍

```
from django import template

register = template.Library()

@register.filter
def replace(value, arg):
    """Replace characters in a string. Usage: {{ string|replace:'_|-' }}"""
    old, new = arg.split('|')
    return value.replace(old, new)
```

NOTE: You may have to restart the server to register the filter: replace()

📝 project_folder/**users**/templates/users/**modals**/profile/**include.html** </>

```
<section id="modals" hx-swap-oob="innerHTML">
  {% with model_path='users/modals/profile/'|add:step|add:".html" %}
    {% include model_path with
       title=title post_url=post_url step=step page=page submit=submit
       submit_boldend=submit_boldend
    %}
  {% endwith %}
</section>
```

`{{ variable }}` Red variables are FROM **users** app view: **enableMFAView()**

NOTE: This view does NOT exist. We'll create it later.

Password Modal

📝 project_folder/**users**/templates/users/**modals**/profile/**password.html** </>

```
{% extends 'users/modals/profile/base.html' %}
{% load custom_filters %}

{% block body %}
  <p id="{{ step|replace:'_|-' }}-instructions">Enter your password to configure
    <strong>Multi-Factor Authentication</strong>
  </p>
{% endblock %}

{% block input %}
  <span class="input-group-text">Password</span>
  <input name="password" type="password" class="form-control" aria-label="one-time-Password" aria-describedby="{{ step|replace:'_|-' }}-instructions" required>
{% endblock %}
```

QR Code Modal

📝 project_folder/**users**/templates/users/**modals**/profile/**otp_qrcode.html** </>

```
{% extends 'users/modals/profile/base.html' %}
{% load custom_filters %}
{% load static %}

{% block body %}
  {% if qrcode_data_uri %}
  <div id="{{ step|replace:'_|-'  }}-instructions">
    <p>Download <a href="#">authenticator app</a> on your mobile device, and use it to</p>
    <h5><strong>Scan the QR code</strong></h5>
    <p>To receive the one-time password (OTP) required to activate <strong>Multi-Factor Authentication</strong></p>
    <hr>
    <h5><strong>Enter code</strong></h5>
    <span id="mfa-secret" class="text-primary" style="letter-spacing: 0.15em; word-spacing: 0.3em;"></span>

    <script type="text/javascript">...continues on the next page</script>
```

```
<script type="text/javascript">
(() => {
    // Wrapped with self-invoking function for security reasons:
    // mfa_secret code must not be easily available to prevent fraud
    //
    // "DMSKAJIWESKJ"... -> "DMSK AJIW ESKJ"
    let splitText = text => text.match(/.{1,4}/g).join(' ');
    let mfaSecret = document.getElementById('mfa-secret');

    mfaSecret.innerText = splitText('{{ request.user.account.mfa_secret }}');
    mfaSecret = undefined;

    document.currentScript.remove();
})();
</script>
```

```
    <script type="text/javascript">...above script</script>
    <p>Into your authentication app if you're unable to scan the QR code</p>
  </div>
  {% endif %}
```

```
  <div class="d-flex justify-content-between">
    <img class="w-75 border rounded-2" style="max-width: 300px;"
      src="{{ qrcode_data_uri }}" alt="Failed to load - QR Code">
    <img class="w-auto" style="max-width: 150px;"
      src="{% static 'users/img/authenticator_apps.png' %}">
  </div>
{% endblock %}
```

```
{% block input %}
  <span class="input-group-text">OTP</span>
  <input name="otp_code" type="text" class="form-control" required
    aria-label="one-time-password"
    aria-describedby="{{ step|replace:'_|-' }}-instructions"
    hx-post="{{ post_url }}"
    hx-trigger="input changed delay:250ms"
    hx-swap="none">
{% endblock %}
```

Email Modal

📝 project_folder/**users**/templates/users/**modals**/profile/**otp_email.html** </>

```
{% extends 'users/modals/profile/base.html' %}
{% load custom_filters %}
{% load static %}

{% block body %}
  <p id="{{ step|replace:'_|-' }}-instructions">Enter the one-time password (OTP) sent to
your email: <br><strong>{{ request.user.email }}</strong></p>
  <hr>
  <div class="d-flex justify-content-between text-center">
    <button type="button" class="btn btn-light w-50 me-4">
      <span class="spinner-border text-secondary visually-hidden" role="status"
       aria-hidden="true"></span>
      <span class="button-text">Resend OTP</span>
    </button>
    <p class="count-text text-secondary px-auto m-auto fs-2 w-25">
      <span class="count-down">--</span>
      <br><span class="fs-5">sec</span>
    </p>
    <img style="max-height: 150px" src="{% static 'users/img/mail_to_laptop.png' %}"
      alt="mail_to_laptop.png">
    <script type="text/javascript">...below script</script>


<script type="text/javascript">
(() => {

    let script = document.currentScript,
        parent = script.parentElement,

        counter = parent.querySelector('.count-down'),
        countTxt = parent.querySelector('.count-text'),
        button = parent.querySelector('.btn'),

        buttonTxt = button.querySelector('.button-text'),
        spinner = button.querySelector('.spinner-border'),

        timeout = null,
        fallback = null,
        interval = null,
        isIntervalActive = false,
        count = 0;

                          ...continues on the next page
```

```
    function countDown() {
        counter.innerText = count;
        if (count > 0) count -= 1;
        else {
            clearInterval(interval);
            button.removeAttribute('disabled');
            countTxt.classList.add('text-secondary');
            isIntervalActive = false;
        }
    }

    button.addEventListener('click', () => {
        if (count > 0) return;
        // Request new OTP code AND send it to user's email
        // https://htmx.org/api/#ajax
        htmx.ajax('POST', '{% url "request_otp" "email" %}', {
            swap: 'none',
            headers: {
                'X-CSRFToken': '{{ csrf_token }}',
            }
        });
        timeout = setTimeout(() => {
            spinner.classList.remove('visually-hidden');
            buttonTxt.classList.add('visually-hidden');
        }, 500);


        // Set fallback execution after 15 seconds
        fallback = setTimeout(() => {
            console.warn('No response received in 15 seconds, executing fallback.');
            buttonTxt.classList.remove('visually-hidden');
            spinner.classList.add('visually-hidden');
        }, 15000);
    });
```

```
    document.addEventListener('htmx:afterRequest', async (event) => {
        if (event.detail.pathInfo.requestPath !== '{% url "request_otp" "email" %}') return;

        // Receive response from the backend

        let xhr = event.detail.xhr,
            responseText = await xhr.responseText,
            response = '';

        if (xhr.getResponseHeader('Content-Type')?.includes('application/json')) {
            response = JSON.parse(responseText);
        }
        else return;     ...continues on the next page
```

```
        // Cancel the timeout & fallback execution if response is received
        clearTimeout(timeout);
        clearTimeout(fallback);

        // Handle response

        if (response.success === 'OTP Sent')
        {
            if (isIntervalActive) return;
            count = 45;

            button.setAttribute('disabled', '');
            countTxt.classList.remove('text-secondary');

            isIntervalActive = true;
            if (interval) clearInterval(interval);
            interval = setInterval(countDown, 1000);

            buttonTxt.classList.remove('visually-hidden');
            spinner.classList.add('visually-hidden');
        }
        else if (response.error) {
            console.error(response.error);
        }

    });

    script.remove();

})();
</script>


    <script type="text/javascript">...above script</script>
  </div>
{% endblock %}
```

```
{% block input %}
  <span class="input-group-text">OTP</span>
  <input name="otp_code" type="text" class="form-control" required
    aria-label="one-time-password"
    aria-describedby="{{ step|replace:'_|-' }}-instructions"
    hx-post="{{ post_url }}"
    hx-trigger="input changed delay:250ms"
    hx-swap="none">
{% endblock %}
```

SMS Modal

📝 project_folder/**users**/templates/users/**modals**/profile/**otp_sms.html** </>

```
{% extends 'users/modals/profile/base.html' %}
{% load custom_filters %}
{% load static %}

{% block body %}
  <p id="{{ step|replace:'_|-' }}-instructions">
    Enter the one-time password (OTP) sent to your mobile via text:
    <br>
    <span class="phone-number d-block fs-5">
      <strong>{{ request.user.profile.phone_number }}</strong>
    </span>
    <br>to finalize <strong>Multi-Factor Authentication</strong>
  </p>
  <hr>
  <div class="d-flex justify-content-between text-center">
    <button type="button" class="btn btn-light w-50 me-4">
      <span class="spinner-border text-secondary visually-hidden" role="status"
       aria-hidden="true"></span>
      <span class="button-text">Resend OTP</span>
    </button>
    <p class="count-text text-secondary px-auto m-auto fs-2 w-25">
      <span class="count-down">--</span>
      <br><span class="fs-5">sec</span>
    </p>
    <img style="max-height: 150px" src="{% static 'users/img/mail_to_phone.png' %}"
      alt="mail_to_phone.png">
    <script type="text/javascript">...below script</script>


The <script> is similar to that of - Email Modal
Copy it and replace the following:

---

button.addEventListener('click', () => {
        if (count > 0) return;
        // Request new OTP code AND send it to user's email
        // https://htmx.org/api/#ajax
        htmx.ajax('POST', '{% url "request_otp" "email" %}', {
        htmx.ajax('POST', '{% url "request_otp" "sms" %}', {

---

document.addEventListener('htmx:afterRequest', async (event) => {
        if (event.detail.pathInfo.requestPath !== '{% url "request_otp" "email" %}') return;
        if (event.detail.pathInfo.requestPath !== '{% url "request_otp" "sms" %}') return;
```

```
    <script type="text/javascript">...</script>
  </div>
{% endblock %}
```

```
{% block input %}
  <span class="input-group-text">OTP</span>
  <input name="otp_code" type="text" class="form-control" required
    aria-label="one-time-password"
    aria-describedby="{{ step|replace:'_|-' }}-instructions"
    hx-post="{{ post_url }}"
    hx-trigger="input changed delay:250ms"
    hx-swap="none">
{% endblock %}
```

NOTE: You can test modals by including them in **profile.html** template using the `{% include %}` tag. However, you'd have to define/remove `{% url %}` tags FOR the **enable_mfa** and **request_otp** paths.

Refer TO **Bootstrap5** – JavaScript Modal Methods, TO manually toggle included modals.

```
var myModalEl = document.querySelector('#myModal');
var modal = bootstrap.Modal.getOrCreateInstance(myModalEl);
    modal.toggle();
```

NOTE: Modals in github repository: **django-tutorial** are way different. The way modals are implemented now in the documentation help understand the flow of data. The overall tree will be changed later.

SMS and Email Modals share similar script.
Only their <img> and `{% url %}` tags and different.

We will use `{% include %}` tag later so that we can use one script for both modals.

Take a break

Modals Functionality

Let's add some event listeners and functions TO:

- **Toggle** ⏳**loading** animation for the submit <button>,
- ➕ **Add** ⚠️ error highlight to the <input>,
- 👻 **Hide** all modals,
- 🗑️ **Dispose** modals from the DOM, and
- 🧽 **Clear** ⚠️ error highlight from the modal's <input>.

📝 project_folder/**users**/templates/users/**profile.html** </> profile.html

```
{% block base %}
<script name="functions-for-included-modal" type="text/javascript">

const modals = document.getElementById('modals');

function hideModals() {
    document.querySelectorAll('.modal').forEach(modal => {
        const Modal = bootstrap.Modal.getOrCreateInstance(modal);
              Modal.hide();
    });
}
function setInvalidInput(input) {
    input.classList.add('is-invalid');
    input.classList.add('text-danger');
}
function setNormalInput(input) {
    input.classList.remove('is-invalid');
    input.classList.remove('text-danger');
}
function setLoadingButtonForModal(button) {
    button.querySelector('.spinner-grow').classList.remove('visually-hidden');
    button.querySelector('.button-text').innerText = 'loading...';
}
function setNormalButtonForModal(button) {
    button.querySelector('.spinner-grow').classList.add('visually-hidden');
    button.querySelector('.button-text').innerHTML = button.dataset.name;
}

</script>
<script name="main-script" type="text/javascript">

const input_enable_mfa = document.getElementById('mfa-flex-switch');
const onAnyClosedModal = () => input_enable_mfa.checked = false;

</script>
{% endblock %}
```

📝 project_folder/**users**/templates/users/**modals**/profile/**include.html** </>

```
<section id="modals" hx-swap-oob="innerHTML">
  {% with model_path='users/modals/profile/'|add:step|add:".html" %}
    {% include model_path with
       title=title post_url=post_url  step=step  page=page  submit=submit
       submit_boldend=submit_boldend
    %}
  {% endwith %}
  <script type="text/javascript">...below script</script>
</section>
```

```
<script type="text/javascript">
    // Global access to currently loaded modal element
    var modal = new bootstrap.Modal(
        document.currentScript.parentElement.querySelector('.modal'));

    (() => {

        // https://getbootstrap.com/docs/5.0/components/modal/#methods
        // Destroy modal when it is fully closed
        modal._element.addEventListener('hidden.bs.modal', () => {
            modal._element.remove();
            modal.dispose(); // Removes Bootstrap modal_instance
        });

        // Remove inputs error-highlights ON input change AND modal exit
        let input = modal._element.querySelector('input:not([type="hidden"])');
            input.addEventListener('keydown', () =>
        {
            setNormalInput(input);
        });
        let btnClose = modal._element.querySelector('.btn-close');
            btnClose.addEventListener('click', () =>
        {
            setNormalInput(input);
        });

        // Set loading animation for button, when pressed
        let btnSubmit = document.querySelector('.modal-submit-button')
            btnSubmit.dataset.name = btnSubmit.innerHTML.trim();
            btnSubmit.addEventListener('click', () =>
        {
            setLoadingButtonForModal(btnSubmit);
        });
```

...continues on the next page

```
        /* Remove faded background element: .modal-backgrop & added styles
        /
        /  Note: Models remove .modal-backgrop & hidden overflow + padding
        /  By themselves on modal_instance.hide() call.
        /
        /  However, the Bootstrap Modal is replaced too quickly
        /  By HTMX for its eventListener to remove these additions.
        */
        document.querySelectorAll('.modal-backdrop')
        ?.forEach(backdrop => backdrop.remove());
        document.body.style.removeProperty('overflow');
        document.body.style.removeProperty('padding-right');

        modal.show();
        document.currentScript.remove();

    })();
</script>
```

Take a moment to revisit the modals—having a solid grasp of HTMX will be crucial as we move into implementing the views. This final stage of the tutorial may be challenging at first, but the key is to understand how `include.html` interacts with the extended **modal** and how data flows between them.

Important Considerations:

- The HTML elements with `hx-post` attribute triggers all HTMX eventListeners.

- To manage responses efficiently, determine which HTML element initiated the HTMX request.

- If a request is unnecessary, handle it promptly to avoid redundant processing and improve performance.

Enable MFA View

📝 project_folder/**users/views.py** **(users app)** 🐍 views.py

```
...
from django.http import HttpResponseBadRequest, JsonResponse
from django.urls import reverse

from .models import Profile, Account
from .forms import UserRegisterForm, UserUpdateForm, ProfileForm, AccountForm
from .utils import (
    get_users_mfa_secret_as_qrcode_base64,
    email_otp_to_user,
    sms_otp_to_user,
)

import stripe, pyotp
...
```

```python
@login_required
def enableMFAView(request):
    if request.method != 'POST':
        return HttpResponseBadRequest()
    if request.user.account.mfa_enabled:
        return JsonResponse({'error': 'MFA already enabled'}, status=400)
```

```python
    # Configuration
    # Note: changing STEPS order affects modals-display-sequence
    STEPS = ['password', 'otp_qrcode', 'otp_email', 'otp_sms']
    TITLE = 'Enable MFA'
    POST_URL = reverse('enable_mfa')
    CONTEXT_BASE = {
        'title': TITLE,
        'post_url': POST_URL,
    }
```

NOTE: **STEPS**, **TITLE** & **POST_URL** = varibles passed TO the **include.html** modal

```python
    # Show initial modal
    step = request.POST.get('step')
    # If the step is invalid or it's the last step and all previous steps were completed,
    # it's likely the session data is outdated, so we restart the form.
    if step not in STEPS or
    (not _all_steps_completed(request, STEPS)
     and request.session[f'verified_{STEPS[-1]}'] == True):

        _remove_all_steps(request, STEPS)
        # If valid step and IS NOT a first step
        if step in STEPS and step != STEPS[0]:
            messages.info(request, f'Restarted the session for Enable MFA')

        return _render_step_modal(request, STEPS[0], STEPS, CONTEXT_BASE)
```

NOTE: Every **modal.html** contains `<input name="step">`

```python
    # Validate current step
    if not _validate_step(request, step):
        return JsonResponse(
            {'error': _get_validation_error(step), 'step': step}, status=400)

    # Mark step as verified
    request.session[f'verified_{step}'] = True
```

```
    # Handle step-specific post-validation actions
    _handle_post_validation(request, step)
```

NOTE: _handle_post_validation() performs additional actions following the successful verification of a **step**. E.g. Sending an OTP via a specific method

```
    # Check if all steps are completed
    if _all_steps_completed(request, STEPS):
        request.user.account.mfa_enabled = True
        request.user.account.save()
        _remove_all_steps(request, STEPS)
        return JsonResponse(
            {'success': 'Enabled MFA', 'step': step}, status=200)

    # Handle final step verification failure
    if step == STEPS[-1]:
        return JsonResponse(
            {'error': 'Not all steps are verified', 'step': step}, status=400)
```

Enable MFA for logged-in user IF all steps (modal forms) are verified.
AND reset them TO "False" IN session storage.

It's crucial to reset these steps since each verified step unlocks access to the next. Some steps contain sensitive information. For instance,

otp_qrcode.html exposes **mfa_secret**, which could be exploited
by malicious actors to generate OTPs through an authentication app.

```
    # Proceed to next step
    next_step = STEPS[STEPS.index(step) + 1]
    return _render_step_modal(request, next_step, STEPS, CONTEXT_BASE)
```

Take a break

```
def _remove_all_steps(request, steps):
    # Remove all verified steps from the session
    for step_name in steps:
        session_key = f'verified_{step_name}'
        if session_key in steps:
            del request.session[session_key]
```

```
def _render_step_modal(request, step, all_steps, base_context):
    is_last_step = all_steps.index(step) == len(all_steps) - 1

    context = {
       **base_context,
       'step': step,
       'page': f'{all_steps.index(step) + 1}/{len(all_steps)}',
       'submit': 'Enable' if is_last_step else 'Proceed to the next step',
       'submit_boldend': 'Multi-Factor Authentication' if is_last_step else '',
    }
```

```
    if step == 'otp_qrcode':
        context['qrcode_data_uri'] = get_users_mfa_secret_as_qrcode_base64(request.user)
    return render(request, 'users/modals/profile/include.html', context)
```

Returns include.html modal + context data FOR the **{% include %}** variables

And qrcode_data_uri = (**mfa_secret** as QR image) IF **step** = "otp_qrcode"

```
def _validate_step(request, step):
    if step == 'password':
        password = request.POST.get('password')
        return request.user.check_password(password)
    else:
        otp = request.POST.get('otp_code')
        interval = {
            'otp_email': settings.OTP_EMAIL_INTERVAL,
            'otp_sms': settings.OTP_SMS_INTERVAL
        }.get(step, settings.OTP_DEFAULT_INTERVAL)

        totp = pyotp.TOTP(request.user.account.mfa_secret, interval=interval)
        return totp.verify(otp)
```

NOTE: Every **otp_modal.html** contains <input name="otp_code">

NOTE: IF **step** = "otp_email" THEN **interval** = settings.**OTP_EMAIL_INTERVAL**
IF **NO MATCH FOUND** for **step** THEN **interval** = settings.**OTP_DEFAULT_INTERVAL**

```
def _get_validation_error(step):
    if step == 'password':
        return 'Invalid password'
    elif 'otp_' in step:
        return 'Invalid OTP'
    else:
        return 'Invalid step'
```

```
def _handle_post_validation(request, step):
    if step == 'otp_qrcode':
        email_otp_to_user(request.user)
    elif step == 'otp_email':
        sms_otp_to_user(request.user)
```

```
def _all_steps_completed(request, steps):
    return all(request.session.get(f'verified_{step}', False) for step in steps)
```

Request OTP View

```
def requestOTPView(request, method):
    if request.method != 'POST':
        return HttpResponseBadRequest()

    # Allow requests only from this Django project
    allowed_origins = ['http://localhost', 'http://127.0.0.1']

    origin = request.headers.get('Origin') or request.headers.get('Referer')
    if not origin or not any(origin.startswith(o) for o in allowed_origins):
        return JsonResponse({'error': 'Unauthorized request'}, status=403)
```

```
    # Send OTP to user via specified method: (email | sms)
    send_otp_via = {
        'email': email_otp_to_user,
        'sms': sms_otp_to_user
    }

    if method in send_otp_via:
        send_otp_via[method](request.user)
        return JsonResponse({'success': 'OTP Sent', 'method': method}, status=200)
```

```
    # Return invalid method error
    return JsonResponse({'error': 'Invalid method', 'method': method}, status=400)
```

Security Notice: Allowed Origins Configuration

The `allowed_origins` setting **must** be strictly enforced to prevent unauthorized access, especially in production.

- **Development:** `localhost` may be acceptable.
- **Production:** The setting **must** reflect the custom domain to safeguard authentication security and prevent misuse.

Failure to properly configure this setting in production could allow external requests to abuse third-party services such as **Zoho and Twilio**, leading to unnecessary financial costs. Given that Twilio operates on a pay-per-request model, unauthorized access could result in excessive or fraudulent requests, creating serious financial and operational risks.

Critical Endpoint: Request OTP View

The `requestOTPView()` function handles OTP delivery via third-party services like **Zoho and Twilio**.

- **Only this Django application** should have permission to make requests.
- **This restriction is enforced via** `allowed_origins` to ensure security.
- **In production, the setting must reflect the custom domain**, NOT `localhost`.

Important Consideration: Third-Party Authentication

Some platforms allow users to sign in using external services such as **Facebook or Google**.

- If our system supports this functionality, we may need to reassess our approach to `allowed_origins` to accommodate these third-party integrations securely.

📝 project_folder/**users/urls.py** **(users app)** 🐍 urls.py

```
urlpatterns = [
    ...
    path('enable-mfa', views.enableMFAView, name='enable_mfa'),
    path('request-otp/<str:method>', views.requestOTPView, name='request_otp'),
]
```

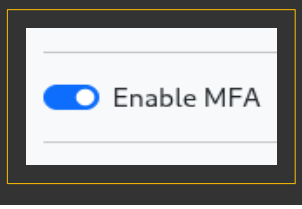
📝 project_folder/**users**/templates/users/**profile.html** </> profile.html

```
{% block base %}
<script name="functions-for-included-modal" type="text/javascript">...</script>
<script name="main-script" type="text/javascript">

const input_enable_mfa = document.getElementById('mfa-flex-switch');
const onAnyClosedModal = () => input_enable_mfa.checked = false;

document.addEventListener('htmx:afterRequest', async (event) => {

    let form = event.detail.target.closest('form');
    if (!form?.classList.contains('modal-footer')) return;

    // Receive response from the backend

    let xhr = event.detail.xhr,
        responseText = await xhr.responseText,
        response = '';

    if (xhr.getResponseHeader('Content-Type')?.includes('application/json')) {
        response = JSON.parse(responseText);
    }
    else return;

    // Handle response

    if (response.error) {
        console.error(response.error);
    }
    if (response.success) {
        hideModals();
    }
    else if (/Invalid OTP|Invalid password/g.test(response.error)) {
        let input = form.querySelector('input:not([type="hidden"])');
        setInvalidInput(input);
    }

    // Reset modal's submit button

    let button_submit = form.querySelector('.modal-submit-button');
    setNormalButtonForModal(button_submit);

});
</script>
{% endblock %}
```

Disable MFA

📝 project_folder/**users**/templates/users/**profile.html** </> profile.html

```
...
<input class="form-check-input" type="checkbox" id="mfa-flex-switch" name="switch"
    {% if user.account.mfa_enabled %}checked{% endif %}
    hx-post="{% url 'enable_mfa' %}"
    hx-trigger="click throttle:1s"
    hx-swap="none">
...
```



📝 project_folder/**users/views.py** **(users app)** 🐍 views.py

```
@login_required
def enableMFAView(request):
    if request.method != 'POST':
        return HttpResponseBadRequest()

    step = request.POST.get('step')
    switch = request.POST.get('switch')

    if request.user.account.mfa_enabled:
        return JsonResponse({'error': 'MFA already enabled'}, status=400)
...


    # Show initial modal
    step = request.POST.get('step')
    # --- Show initial modal TO start verifying steps TO Enable MFA ---

    # If the step is invalid or it's the last step and all previous steps were completed,
    # it's likely the session data is outdated, so we restart the form.
    if step not in STEPS or
        ...
```

```
... CONTEXT_BASE


# --- Prompt logged-in user TO Disable MFA ---

if request.user.account.mfa_enabled and not switch:

    if step == 'password':
        # Validate password
        if not _validate_step(request, step):
            return JsonResponse(
            {'error': _get_validation_error(step), 'step': step}, status=400)
        else:
            request.user.account.mfa_enabled = False
            request.user.account.save()
            return JsonResponse(
            {'success': 'Disabled MFA'}, status=200)

    _remove_all_steps(request, STEPS)
    return render(request, 'users/modals/profile/include.html', {
        'title': 'Disable MFA',
        'post_url': reverse('enable_mfa'),
        'step': 'password',
        'submit': 'Disable',
        'submit_boldend': 'Multi-Factor Authentication',
    })

# --- Show initial modal TO start verifying steps TO Enable MFA ---
```

NOTE: **password.html** modal includes instructions for **enabling** MFA. However, in this case, we are **disabling** the MFA. Let's update this modal specifically for **disabling** MFA

📝 project_folder/**users**/templates/users/**modals**/profile/**password.html** </>

```
{% extends 'users/modals/profile/base.html' %}
{% load custom_filters %}

{% block body %}
  <p id="{{ step|replace:'_|-' }}-instructions">Enter your password to {% if submit == 'Disable' %}deactivate{% else %}configure{% endif %}
    <strong>Multi-Factor Authentication</strong>
  </p>
{% endblock %}

{% block input %}
  <span class="input-group-text">Password</span>
  <input name="password" type="password" class="form-control" aria-label="one-time-Password" aria-describedby="{{ step|replace:'_|-' }}-instructions" required>
{% endblock %}
```

NOTE: **base.html** modal has an issue.

When the client closes the modal, we assume that the **step** was unverified.
Hence, the **switch** `<input id="mfa-flex-switch">` should be switched:

- **ON** when **MFA is enabled**
- **OFF** when **MFA is disabled**

  after the modal is closed / terminated.

However, function: **onAnyClosedModal()** is triggered from **profile.html** template.
Always turning the **switch** **ON**. Let's update this function, and spice up the submit button.

📝 project_folder/**users**/templates/users/**modals**/profile/**base.html** </>

```
...
<div class="modal-header">
  <h5 class="modal-title" id="{{ step|replace:'_|-' }}-label">{{ title }}</h5>
  <span class="mx-auto text-secondary">{{ page }}</span>
  <button type="button" class="btn-close" onclick="onAnyClosedModal('{{ submit }}')"
    data-bs-dismiss="modal" aria-label="Close"></button>
</div>
...
```

```
<button type="submit" class="btn
 btn-{% if submit == 'Disable' %}danger{% else %}primary{% endif %}
 modal-submit-button w-100"
  hx-post="{{ post_url }}"
  hx-trigger="click delay:1000ms"
  hx-swap="none">
...
</button>
...
```

📝 project_folder/**users**/templates/users/**profile.html** </> profile.html

```
{% block base %}
<script name="functions-for-included-modal" type="text/javascript">...</script>
<script name="main-script" type="text/javascript">

const input_enable_mfa = document.getElementById('mfa-flex-switch');
const onAnyClosedModal = () => input_enable_mfa.checked = false;
const onAnyClosedModal = submit => input_enable_mfa.checked = submit == 'Disable';
```

NOTE: Client cannot make spam requests via the **switch** `<input id="mfa-flex-switch">`

However, a client can spam the toggle animation. Desynchronizing the request and visual feedback of the switch itself. The switch can also bug-out, displaying invalid MFA state.

Let's fix this by throttling the toggle animation of the **switch** element.

📝 project_folder/**users**/templates/users/**profile.html** </> profile.html

```
{% block base %}
<script name="functions-for-included-modal" type="text/javascript">...</script>
<script name="main-script" type="text/javascript">

function throttleElement(element, type='click', delay=500) {
    element.dataset.throttle = false;
    element.addEventListener(type, event => {
        if (element.dataset.throttle == 'true') {
            event.preventDefault(); return;
        }
        element.dataset.throttle = true;
        setTimeout(() => element.dataset.throttle = false, delay);
    });
}

---

const input_enable_mfa = document.getElementById('mfa-flex-switch');
const onAnyClosedModal = submit => input_enable_mfa.checked = submit == 'Disable';

throttleElement(input_enable_mfa, 'click', parseInt(
    input_enable_mfa.getAttribute('hx-trigger')
    .match(/throttle:(\d+(s|ms))/)[1]
    .replaceAll('ms', '')
    .replaceAll('s', '000')
));
```

NOTE: This script retrieves the **delay** of **throttle** argument of the **switch** element `<input id="mfa-flex-switch">` specified in the `hx-trigger` attribute

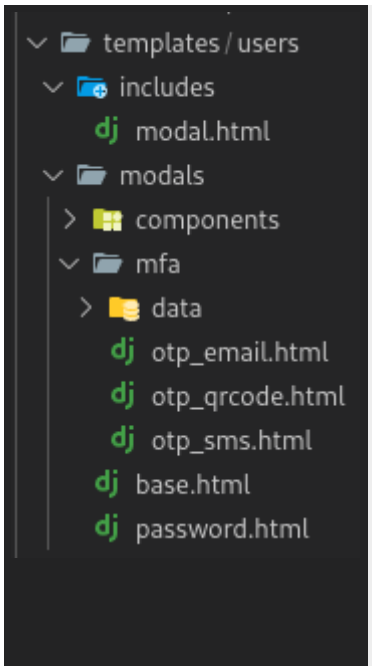
This approach improves developers' experience when updating the **throttle**

Take a break

(Test - Enable & Disable MFA)

Organize Modals

First, we have to refactor the modal template structure to improve scalability and maintainability. This change will simplify the process of adding new modals and refactoring existing ones for reusability.



NOTE: Includes.html →has been renamded TO → Modal.html

NOTE: /Components and /Data directories

- Components = simple elements that can be added to modals

- Data = <input type="hidden"> data used for POST requests

NOTE: Base.html and Password.html modals

- are NOT part of /MFA directory because these modals can be utilized & updated for other usecases

UPDATE: **render**() in **users**/views.py ,

UPDATE: `{% extend %}` and `{% include %}` in:

- **users**/templates/users/**modals** and
- **users**/templates/users/**Includes**

→ {% extends 'users/modals/profile/**base**.html' %}
TO
→ {% extends 'users/modals/**base**.html' %}

→ return render(request, 'users/modals/profile/**include**.html', {…}
TO
→ return render(request, 'users/includes/**modal**.html', {…}

FROM `{% with model_path='users/modals/profile/'|add:step|add:".html" %}`
TO `{% with model_path='users/modals/'|add:path|add:step|add:".html" %}`

The **path** variable will be passed as **context** in render()

📝 project_folder/**users**/templates/users/**modals**/mfa/**otp_email.html** </>

```
{% extends 'users/modals/profile/base.html' %}
{% extends 'users/modals/base.html' %}
{% load custom_filters %}
{% load static %}
...
```

📝 project_folder/**users**/templates/users/**modals**/mfa/**otp_qrcode.html** </>

```
{% extends 'users/modals/profile/base.html' %}
{% extends 'users/modals/base.html' %}
{% load custom_filters %}
{% load static %}
...
```

📝 project_folder/**users**/templates/users/**modals**/mfa/**otp_sms.html** </>

```
{% extends 'users/modals/profile/base.html' %}
{% extends 'users/modals/base.html' %}
{% load custom_filters %}
{% load static %}
...
```

📝 project_folder/**users**/templates/users/**modals**/**password.html** </>

```
{% extends 'users/modals/profile/base.html' %}
{% extends 'users/modals/base.html' %}
{% load custom_filters %}
...
```

📝 project_folder/**users**/templates/users/**includes**/**modal.html** </>

```
<section id="modals" hx-swap-oob="innerHTML">
  {% with model_path='users/modals/profile/'|add:step|add:".html" %}
  {% with model_path='users/modals/'|add:path|add:step|add:".html" %}
    {% include model_path with
       title=title post_url=post_url  step=step  page=page  submit=submit
       submit_boldend=submit_boldend
    %}
  {% endwith %}
...
```

📝 project_folder/**users/views.py** **(users app)** 🐍 views.py

```python
def _render_step_modal(request, step, all_steps, base_context):
    is_last_step = all_steps.index(step) == len(all_steps) - 1

    context = {
        **base_context,
        'path': 'mfa/' if step != 'password' else '',
        'step': step,
        'page': f'{all_steps.index(step) + 1}/{len(all_steps)}',
        'submit': 'Enable' if is_last_step else 'Proceed to the next step',
        'submit_boldend': 'Multi-Factor Authentication' if is_last_step else '',
    }
```

```python
    if step == 'otp_qrcode':
        context['qrcode_data_uri'] = get_users_mfa_secret_as_qrcode_base64(request.user)

    return render(request, 'users/modals/profile/include.html', context)
    return render(request, 'users/includes/modal.html', context)
```

```python
... def enableMFAView(request):

# --- Prompt logged-in user TO Disable MFA ---
```

```python
    _remove_all_steps(request, STEPS)
    return render(request, 'users/modals/profile/include.html', {
    return render(request, 'users/includes/modal.html', {
        'path': '',
        'title': 'Disable MFA',
        'post_url': reverse('enable_mfa'),
        'step': 'password',
        'submit': 'Disable',
        'submit_boldend': 'Multi-Factor Authentication',
    })
```

UPDATE: The main <script> of **otp_email** and **otp_sms** modals.

It is similar, only difference is with the <img> and `{% url %}` tags

For that reason. It's better to just include the <script> from a single source.

That source is a new **component** → **resend_otp.html**

📝 project_folder/**users**/templates/users/**modals**/components/**resend_otp.html** </>

```
{% load static %}
<div class="d-flex justify-content-between text-center">
  <button type="button" class="btn btn-light w-50 me-4">
    <span class="spinner-border text-secondary visually-hidden" role="status"
     aria-hidden="true"></span>
    <span class="button-text">Resend OTP</span>
  </button>
  <p class="count-text text-secondary px-auto m-auto fs-2 w-25">
    <span class="count-down">--</span>
    <br><span class="fs-5">sec</span>
  </p>
  <img style="max-height: 150px" src="{% static image_path %}"
    alt="{{ image_name }}">
  <script type="text/javascript">...below script</script>


The <script> is similar to that of - Email and SMS Modal
Copy it and replace the following:

-----------------------------------------------------------

button.addEventListener('click', () => {
        if (count > 0) return;
        // Request new OTP code AND send it to user's email
        // https://htmx.org/api/#ajax
        htmx.ajax('POST', '{% url "request_otp" "email" %}', {
        htmx.ajax('POST', '{{ post_url }}', {
-----------------------------------------------------------

document.addEventListener('htmx:afterRequest', async (event) => {
        if (event.detail.pathInfo.requestPath !== '{% url "request_otp" "email" %}') return;
        if (event.detail.pathInfo.requestPath !== '{{ post_url }}') return;


  <script type="text/javascript">...above script</script>
</div>
```

NOTE: Orange variables – **post_url**, **image_name** and **image_path** are FROM the `{% include %}` tag that we will add in the next page

📝 project_folder/**users**/templates/users/**modals**/mfa/**otp_email.html** </>

```
{% extends 'users/modals/profile/base.html' %}
{% extends 'users/modals/base.html' %}
{% load custom_filters %}
{% load static %}

{% block body %}
...
```

```
<div class="d-flex justify-content-between text-center">
    <button type="button" class="btn btn-light w-50 me-4">
      <span class="spinner-border text-secondary visually-hidden" role="status"
       aria-hidden="true"></span>
      <span class="button-text">Resend OTP</span>
    </button>
    <p class="count-text text-secondary px-auto m-auto fs-2 w-25">
      <span class="count-down">--</span>
      <br><span class="fs-5">sec</span>
    </p>
    <img style="max-height: 150px" src="{% static 'users/img/mail_to_laptop.png' %}"
      alt="mail_to_laptop.png">
    <script type="text/javascript">...</script>
```

Replace `<div class="d-flex justify-content-between text-center">...</ div>` with below tags:

```
{% url 'request_otp' 'email' as url_request_otp %}
{% include 'users/modals/components/resend_otp.html' with
   post_url=url_request_otp
   image_name='mail_to_laptop.png' image_path='users/img/mail_to_laptop.png'
%}
```

Do the same for **SMS** modal

📝 project_folder/**users**/templates/users/**modals**/mfa/**otp_sms.html** </>

```
{% url 'request_otp' 'sms' as url_request_otp %}
{% include 'users/modals/components/resend_otp.html' with
   post_url=url_request_otp
   image_name='mail_to_phone.png' image_path='users/img/mail_to_phone.png'
%}
```

Move **ALLOWED_ORIGINS** to settings.py instead

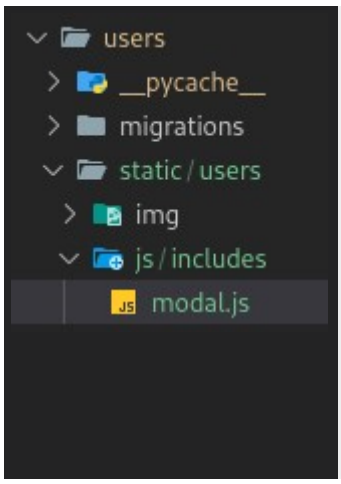
📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
ALLOWED_HOSTS = []

# pip install django-cors-headers
# If you would like to restrict the foreign requests.
# You'd need to include a new middleware: corsheaders.middleware.CorsMiddleware
# Specify your allowed origin below: "localhost", "https://my-domain.com"
if DEBUG:
    CORS_ALLOWED_ORIGINS = [
        'http://localhost',
        'http://127.0.0.1',
    ]
else:
    CORS_ALLOWED_ORIGINS = []
```

NOTE: I am not installing django-cors-headers , it is an optional feature

📝 project_folder/**users/views.py** **(users app)** 🐍 views.py

```
def requestOTPView(request, method):
    if request.method != 'POST':
        return HttpResponseBadRequest()

    # Allow requests only from this Django project
    allowed_origins = ['http://localhost', 'http://127.0.0.1']

    origin = request.headers.get('Origin') or request.headers.get('Referer')
    if not origin or not any(
        origin.startswith(o) for o in allowed_origins
        origin.startswith(o) for o in settings.CORS_ALLOWED_ORIGINS
    ):
        return JsonResponse({'error': 'Unauthorized request'}, status=403)
```



MOVE

```
<script name="functions-for-included-modal" >
```

AND eventListener - `htmx:afterRequest` **FROM**

```
<script name="main-script" type="text/javascript">
```

TO - users/**static**/users/**js**/**includes**/modals.js

📝 project_folder/**users**/templates/users/**profile.html** </> profile.html

```
<script name="functions-for-included-modal" type="text/javascript">
<script name="modal" src="{% static 'users/js/includes/modal.js' %}">

const modals = document.getElementById('modals');

function hideModals() {
    document.querySelectorAll('.modal').forEach(modal => {
        const Modal = bootstrap.Modal.getOrCreateInstance(modal);
              Modal.hide();
    });
}
function setInvalidInput(input) {
    input.classList.add('is-invalid');
    input.classList.add('text-danger');
}
function setNormalInput(input) {
    input.classList.remove('is-invalid');
    input.classList.remove('text-danger');
}
function setLoadingButtonForModal(button) {
    button.querySelector('.spinner-grow').classList.remove('visually-hidden');
    button.querySelector('.button-text').innerText = 'loading...';
}
function setNormalButtonForModal(button) {
    button.querySelector('.spinner-grow').classList.add('visually-hidden');
    button.querySelector('.button-text').innerHTML = button.dataset.name;
}

</script>
```

📝 project_folder/**users**/templates/users/**profile.html** </> profile.html

```
{% block base %}
<script name="modal" src="{% static 'users/js/includes/modal.js' %}"></script>
<script name="main-script" type="text/javascript">
...
```

```
document.addEventListener('htmx:afterRequest', async (event) => {

    let form = event.detail.target.closest('form');
    if (!form?.classList.contains('modal-footer')) return;
```

```
    // Receive response from the backend

    let xhr = event.detail.xhr,
        responseText = await xhr.responseText,
        response = '';

    if (xhr.getResponseHeader('Content-Type')?.includes('application/json')) {
        response = JSON.parse(responseText);
    }
    else return;
```

```
    // Handle response

    if (response.error) {
        console.error(response.error);
    }
    if (response.success) {
        hideModals();
    }
    else if (/Invalid OTP|Invalid password/g.test(response.error)) {
        let input = form.querySelector('input:not([type="hidden"])');
        setInvalidInput(input);
    }
```

```
    // Reset modal's submit button

    let button_submit = form.querySelector('.modal-submit-button');
    setNormalButtonForModal(button_submit);

});
```

📝 project_folder/**users**/static/users/js/includes/**modal.js** **(users app)** JS

```
const modals = document.getElementById('modals');
```

```
function hideModals() {
    document.querySelectorAll('.modal').forEach(modal => {
        const Modal = bootstrap.Modal.getOrCreateInstance(modal);
              Modal.hide();
    });
}
function setInvalidInput(input) {
    input.classList.add('is-invalid');
    input.classList.add('text-danger');
}
function setNormalInput(input) {
    input.classList.remove('is-invalid');
    input.classList.remove('text-danger');
}
function setLoadingButtonForModal(button) {
    button.querySelector('.spinner-grow').classList.remove('visually-hidden');
    button.querySelector('.button-text').innerText = 'loading...';
}
function setNormalButtonForModal(button) {
    button.querySelector('.spinner-grow').classList.add('visually-hidden');
    button.querySelector('.button-text').innerHTML = button.dataset.name;
}
```

```
document.addEventListener('htmx:afterRequest', async (event) => { … });
```

📝 project_folder/**users**/templates/users/**profile.html** </> profile.html

```
{% block base %}
<script name="modal" src="{% static 'users/js/includes/modal.js' %}"></script>
<script name="main-script" type="text/javascript">

function throttleElement(element, type='click', delay=500) {
    element.dataset.throttle = false;
    element.addEventListener(type, event => {
        if (element.dataset.throttle == 'true') {
            event.preventDefault(); return;
        }
        element.dataset.throttle = true;
        setTimeout(() => element.dataset.throttle = false, delay);
    });
}

const input_enable_mfa = document.getElementById('mfa-flex-switch');
const onAnyClosedModal = submit => input_enable_mfa.checked = submit == 'Disable';

throttleElement(input_enable_mfa, 'click', parseInt(
    input_enable_mfa.getAttribute('hx-trigger')
    .match(/throttle:(\d+(s|ms))/)[1]
    .replaceAll('ms', '')
    .replaceAll('s', '000')
));

</script>
{% endblock %}
```

This is how the base should look like for **profile.html template**

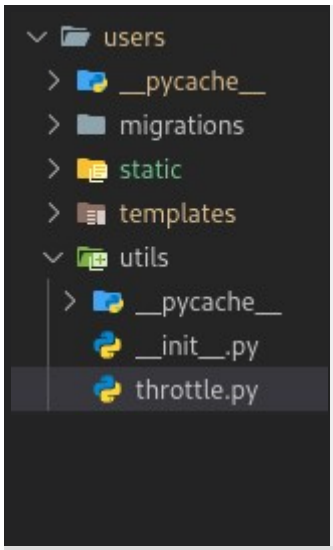
Take a break

(Revise this new architecture)

Authenticate users with MFA

First, let's create new utility **ThrottleOTPRequestExpiryDate**

This utility prevents spam OTP requests, safeguarding integrations with services like Zoho Mail and Twilio phone number. Since users with MFA enabled must verify their OTP before authentication, a **@request_required** decorator cannot be used reliably.



1. Create new directory: users/**utils**
2. Create files: **__init__.py** and **throttle.py**
3. **MOVE utils.py** utilities **TO __init__.py**
4. **REMOVE utils.py**

```
from users/utils import ( utility_name )
from .utils import ( utility_name )
from .utils.throttle import ThrottleOTPRequestExpiryDate
```

There is no need to change our code as it works the same.

The size of **ThrottleOTPRequestExpiryDate** justifies its separation from other utilities.
Also, this utility relies on one **cookie** and **session** data: **throttle_otp_request_expiry_date**

We use both **sessions** and **cookies** for handling client-side data.
Both can be cleared by the client at any time.

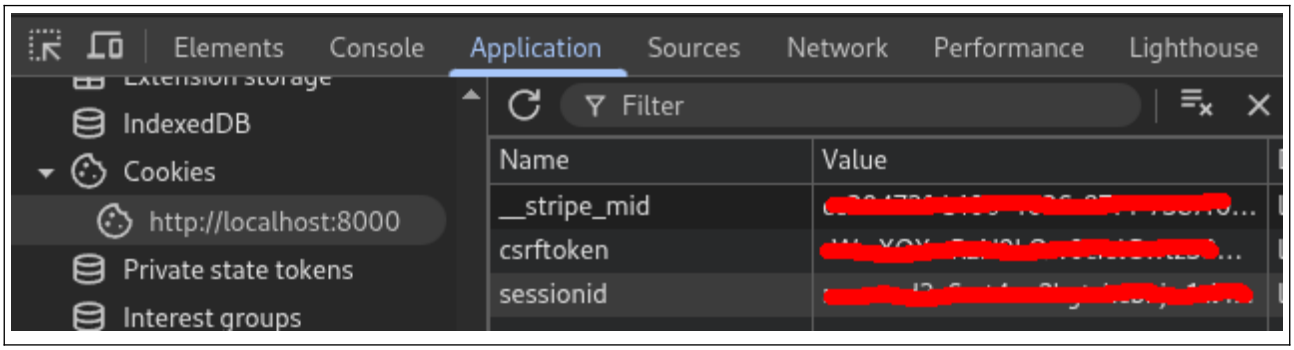
- **Cookies** are stored on the client's browser. Depending on their configuration, some can be accessed via JavaScript (e.g., non-`HttpOnly` cookies), while others are restricted for security reasons (`HttpOnly`, `Secure`, `SameSite` flags).
- Cookies can persist indefinitely if given a long expiration date, or until the client clears their browsing data. However, certain cookies may be exposed via cross-domain mechanisms like iframes, making them unsuitable for storing sensitive information.

- **Sessions**, by contrast, store data on the server side. Only the session key (usually held in a cookie) is stored on the client. As of Django version >= 5, that cookie in use is: **sessionid**
- In Django, session data is periodically cleared by the session engine. By default, unused session data is deleted after two weeks, though this duration can be customized via settings.

It's generally safer for storing sensitive information in a session
because it is never directly accessible by the client or scripts.

NOTE: We've used session data before when verifing steps at **Enable MFA** view.

Developer Tools → Application → Cookies



Use the **Refresh** button because changes of cookie data may not reflected in an instance.

📝 project_folder/my_website/**settings.py** 🐍 settings.py

```
# One-Time Password for Multi-Factor Authentication

OTP_ISSUER_NAME = COMPANY_NAME
OTP_TRED_NAME = 'throttle_otp_request_expiry_date'
OTP_REQUEST_THROTTLE_INTERVAL = 45
OTP_DEFAULT_INTERVAL = 30 # seconds
OTP_EMAIL_INTERVAL = 180 # 3 minutes
OTP_SMS_INTERVAL = 180 # 3 minutes
```

📝 project_folder/**users**/utils/**throttle.py** **(users app)** 🐍 throttle.py

```
from datetime import timedelta
from django.conf import settings
from django.utils import timezone
from django.utils.dateparse import parse_datetime

# OTP = One-Time Password
# TRED = Throttle Request Expiry-Date
#
OTP_TRED_NAME = getattr(settings, 'OTP_TRED_NAME', 'otp_tred')
#
#
... continues on next page
```

NOTE: getattr() sets **OTP_TRED_NAME** → 'otp_tred' if **OTP_TRED_NAME** doesn't exist

```
... OTP_TRED_NAME
#
#
-------------------------------------------------------------------------------

# - Create new expiry date
# expiry = ThrottleOTPRequestExpiryDate.new_date()
#
# ------------------------------------------------------------------------------
#
# Note: 'seconds' are optional, default value is specified at settings.py
#
# - Set in SESSION
# ThrottleOTPRequestExpiryDate.set_session(request, seconds=None)
#
# ------------------------------------------------------------------------------
#
# Note: INHERITS expiry date FROM request session ELSE creates new_date()
#
# - Set in COOKIE
# ThrottleOTPRequestExpiryDate.set_cookie(request, response, seconds=None)
#
# ------------------------------------------------------------------------------
#
# - Get from SESSION
# expiry_date = ThrottleOTPRequestExpiryDate.get(request, source='session')
#
# - Get from COOKIE
# expiry_date = ThrottleOTPRequestExpiryDate.get(request, source='cookie')
#
# ------------------------------------------------------------------------------
#
# - Is session date expired ?
# boolean = ThrottleOTPRequestExpiryDate.has_expired(request)
#
# ------------------------------------------------------------------------------
#
# - Remove from SESSION
# ThrottleOTPRequestExpiryDate.remove_session(request)
#
# - Remove from COOKIE
# ThrottleOTPRequestExpiryDate.remove_cookie(response)
#
#
class ThrottleOTPRequestExpiryDate:
    """
    A utility class for managing OTP throttle expiry dates in Django.
    Provides methods to create, set, get, and remove OTP throttle expiry dates
    in both session and cookie storage.
    """
... continues on next page
```

```
@staticmethod
def new_date(seconds=None):
    """
    Generates a new OTP throttle expiry timestamp.

    Args:
        seconds (int, optional):
            The throttle interval in seconds. If not provided, defaults to
            settings.OTP_REQUEST_THROTTLE_INTERVAL.

    Returns:
        str: ISO 8601 formatted timestamp (YYYY-MM-DDTHH:MM:SS.ssssssZ)
    """
```

```
    if seconds is None:
        seconds = settings.OTP_REQUEST_THROTTLE_INTERVAL
    return (timezone.now() + timedelta(seconds=seconds)).isoformat()
```

```
@staticmethod
def set_session(request, seconds=None):
    """
    Sets the OTP throttle expiry date in the session.

    Args:
        request: The HTTP request object containing session
        seconds (int, optional): The throttle interval in seconds

    Returns:
        HttpRequest: The modified request object with session expiry set
    """
```

```
    if seconds is None:
        seconds = settings.OTP_REQUEST_THROTTLE_INTERVAL
    request.session[OTP_TRED_NAME] = ThrottleOTPRequestExpiryDate.new_date(seconds)
```

```
@staticmethod
def set_cookie(request, response, seconds=None):
    """
    Sets the OTP throttle expiry date in a response cookie.
    Prioritizes existing session value if present, otherwise creates new expiry.

    Args:
        request: The HTTP request object (checks session first)
        response: The HTTP response object for setting the cookie
        seconds (int, optional): The throttle interval in seconds
    """
```

```
... def set_cookie():

    if seconds is None:
        seconds = settings.OTP_REQUEST_THROTTLE_INTERVAL

    # Priority: Use existing session value if available
    expiry_date = request.session.get(OTP_TRED_NAME)
    if not expiry_date:
        expiry_date = ThrottleOTPRequestExpiryDate.new_date(seconds)

    response.set_cookie(
        key=OTP_TRED_NAME,
        value=expiry_date,
        max_age=seconds,
        httponly=False, # Hence, allows JavaScript access
        secure=False # Hence, allows HTTP & non-HTTPS transmission
    )
```

```
@staticmethod
def get(request, source=None):
    """
    Retrieves the OTP throttle expiry date from the specified source.

    Args:
        request: The HTTP request object
        source (str): 'session' or 'cookie' specifying where to look

    Returns:
        datetime.datetime: The parsed expiry datetime, or None if not found

    Raises:
        ValueError: If an invalid source is specified
    """
```

```
    expiry_date = None

    if source == 'session':
        expiry_date = request.session.get(OTP_TRED_NAME)
    elif source == 'cookie':
        expiry_date = request.COOKIES.get(OTP_TRED_NAME)
    else:
        raise ValueError(f"Invalid source '{source}'. Expected 'session' or 'cookie'")

    return parse_datetime(expiry_date) if expiry_date else None
```

... continues on next page

```
@staticmethod
def has_expired(request):
    """
    Checks if the OTP throttle period has expired by:
        - retrieving the expiry date from the session and
        - comparing it to the current time.
    If missing or outdated, it's considered expired.

    Args:
        request: HttpRequest object to check session/cookie

    Returns:
        bool: True if throttle is still active (not expired), False otherwise
    """
---
    expiry_date = ThrottleOTPRequestExpiryDate.get(request, source='session')

    if not expiry_date or timezone.now() > expiry_date:
        return True
    else:
        return False
---
@staticmethod
def remove_session(request):
    """
    Removes the OTP throttle expiry date from the session.
    Args:
        request: The HTTP request object
    """
---
    if OTP_TRED_NAME in request.session:
        del request.session[OTP_TRED_NAME]
---
@staticmethod
def remove_cookie(response):
    """
    Removes the OTP throttle expiry date cookie from the response.
    Args:
        response: The HTTP response object
    """
---
    response.delete_cookie(OTP_TRED_NAME)
```

Concerns of `throttle_otp_request_expiry_date` session and cookie

Both **session** and **cookie → throttle_otp_request_expiry_date**
can be cleared by the client at any time! How so?

Deleting the session cookie: If the client deletes the cookie (like `sessionid` in Django), the server can no longer associate the user with a valid session. This doesn't delete the session on the server, but it makes it inaccessible from that client.

So why bother using the session anyways to prevent the OTP requests spam?

Because you're not relying on the session alone. It's about layering controls:

1. **Server-side throttling (reliable)**: When a valid session exists, this is your primary line of defense. Even if the client tries to spam via JavaScript, the server still honors the throttle date in the session.
2. **Client-side throttle (advisory)**: JavaScript + HTMX gives a responsive UX hint. It improves performance and reduces unnecessary backend hits—but it's never meant to be authoritative.

But here's where it gets trickier—what if a client deletes the cookie and just spams OTP requests from fresh contexts?

A few defenses you could consider:

- **IP-based throttling**: Pair session-based throttles with rate limits per IP. It's not perfect (especially with shared or rotating IPs), but it adds friction for bad actors.
- **Browser fingerprinting**: Not bulletproof and a bit controversial privacy-wise, but a lightweight fingerprint combined with a fallback session throttle can cover more edge cases.
- **Anonymous session fallback**: Even when the `sessionid` is lost, you can still generate a new session and apply a cooldown token—like a shadow ban on OTP requests for the same device.
- **Signed or encrypted client cookie** with a server-side secret, which you validate on each request to prevent tampering or spoofing.

Consider use of **reCAPTCHA**

(AI generated: Copilot, 20/Jun/2025)

Django request and response handling

Python passes **request** and **response** by reference (not by copy).

```
def sub(request):
    request.session['var'] = 'Hello World!'

def main(request):
    request.session.get('var') # → None
    sub(request)
    request.session.get('var') # → 'Hello World!'
```

Hence, mofidying **request.session** in a different function affects the original request.

```
def sub(response):
    response.set_cookie('drinked_cola', 'true', max_age=1000)

def main(request):
    response = JsonResponse({'success': 'Yippee!'}, status=200)
    sub(response)
    return response # → success message & cookie data: 'drinked_cola': 'true'
```

Django's `SessionMiddleware` saves session changes after the entire view finishes, regardless of whether you pass request through sub-funcitons.

```
def sub(request):
    response.session['var'] = 'Hello World!' # Session modified

def main(request):
    sub(request) # Session changes applied immediately
    print(request.session.get('var')) # → 'Hello World!'
    return HttpResponse('Done') # Django auto-saves session here
```

In Class-Based Views, request is assigned TO self.request.
Hence, self.request and request are aliases for the same object.

```
class Main(self, request, *args, **kwargs):
    self.request.session['var'] = 'Hello Wordl!'
    request.session.get('var') # → 'Hello Wordl!'
```

Take a break

(Study utility – ThrottleOTPRequestExpiryDate)

getCookie() and **masking** utilities

📝 project_folder/**app_name**/static/app_name/js/**cookies.js** **(app_name app)** JS

```
function getCookie(name) {
    const cookies = document.cookie.split('; ');
    for (const cookie of cookies) {
        const [cookieName, cookieValue] = cookie.split('=');
        if (cookieName === name) {
            return decodeURIComponent(cookieValue);
        }
    }
    return null; // Cookie not found
}
```

It will be used TO target cookie: **throttle_otp_request_expiry_date**

📝 project_folder/**app_name**/templates/app_name/**base.html** **(app_name app)** </>

```
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>{% block title %}{% endblock %}</title>
  {% bootstrap_css %}
  <script name="htmx.js"
    src="{% static 'app_name/js/lib/htmx.min.js' %}" defer></script>
  <script name="htmx-websockets.js"
    src="{% static 'app_name/js/lib/htmx_websockets.js' %}" defer></script>
  <script name="hyperscript.js"
    src="{% static 'app_name/js/lib/hyperscript.min.js' %}" defer></script>
  <script name="cookies.js"
    src="{% static 'app_name/js/cookies.js' %}"></script>
  {% block head %}{% endblock %}
</head>
```

📝 project_folder/**users**/utils/**__init__.py** **(users app)** 🐍 __init__.py

```python
import io, re, base64, requests, stripe, boto3, pyotp, qrcode
```

```python
def mask_email(email, visible_chars=1):
    # Function to mask part of an email address for privacy.
    # 'visible_chars' determines:
    #     How many characters of the email's 'name' remain visible.

    name, domain = email.split('@')
    # Splits the email into two parts:
    # 'name' (before @) and 'domain' (after @).

    masked_part = '*' * (len(name) - visible_chars)
    # Generates a string of '*' characters,
    # masking all but the first 'visible_chars' characters of the name.

    return f"{name[:visible_chars]}{masked_part}@{domain}"
    # Constructs the masked email by keeping the first 'visible_chars',
    # replacing the rest with '*', and appending the unchanged domain.
```

```python
def mask_phone_number(phone_number: str) -> str:
    """
    Masks the middle digits of an E.164 formatted phone number.
    Preserves the country code and the last two digits.
    Args:
        phone_number (str):
            The phone number in E.164 format (e.g., +447712345678).
    Returns:
        str: Masked phone number (e.g., +44********78).
    """
```

```python
    match = re.match(r"(\+\d{1,2})(\d+)(\d{2})$", phone_number)
    if not match:
        raise ValueError("Invalid E.164 phone number format")

    country_code, middle_part, last_visible = match.groups()
    masked_middle = '*' * len(middle_part)

    return f"{country_code}{masked_middle}{last_visible}"
```

We will mask contact details: **Email** and **Phone Number** during OTP prompts
TO protect client privacy during MFA logins → m*******@mail.com +44********78

Update _validate_step() and create requestMFAModalView()

📝 project_folder/**users/views.py** **(users app)** 🐍 views.py

```
...
from .models import Profile, Account
from .forms import UserRegisterForm, UserUpdateForm, ProfileForm, AccountForm
from .utils.throttle import ThrottleOTPRequestExpiryDate as OTPThrottle
from .utils import (
    get_users_mfa_secret_as_qrcode_base64,
    email_otp_to_user,
    sms_otp_to_user,
    mask_email,
    mask_phone_number,
)
```

NOTE: _validate_step() requires a **user_instance**.
We relied on authenticated user FROM request.user

However, now unauthorised client may request an OTP via MFA modals to sign-in
Therefore, we have to target the right and existing user before authentication

```
def _validate_step(request, step, user=None):
    user = user if user is not None else request.user
    if not user:
        raise ValueError('User not identified')

    if step == 'password':
        password = request.POST.get('password')
        return request.user.check_password(password)
        return user.check_password(password)
    else:
        otp = request.POST.get('otp_code')
        interval = {
            'otp_email': settings.OTP_EMAIL_INTERVAL,
            'otp_sms': settings.OTP_SMS_INTERVAL
        }.get(step, settings.OTP_DEFAULT_INTERVAL)

        totp = pyotp.TOTP(request.user.account.mfa_secret, interval=interval)
        totp = pyotp.TOTP(user.account.mfa_secret, interval=interval)
        return totp.verify(otp)
```

```python
def requestMFAModalView(request, modal):
    if request.method != 'POST':
        return HttpResponseBadRequest()
```

```python
    MODALS = ['otp_qrcode', 'otp_email', 'otp_sms']
    origin = request.headers.get('Origin') or request.headers.get('Referer')
    user_id = request.user.id if request.user.is_authenticated else
request.session.get('user_id')
```

```python
    # Allow requests only from CORS_ALLOWED_ORIGINS
    if not origin or not any(
        origin.startswith(o) for o in settings.CORS_ALLOWED_ORIGINS
    ):
        return JsonResponse({'error': 'Unauthorized request'}, status=403)
    # Validate requested modal
    if modal not in MODALS:
        return JsonResponse({'error': 'Invalid modal'}, status=400)
    # Get User ID
    if not user_id:
        return JsonResponse({'error': 'User not identified'}, status=400)
```

```python
    # None → <input value="None"> → "None" (Type: String)
    next_url = request.POST.get('next')
    next_url = None if next_url in ['None', 'null', 'False'] else next_url
```

```python
    tred_expired = OTPThrottle.has_expired(request)
    user_instance = get_object_or_404(User, id=user_id)

    # Throttle OTP request (via session)
    # ELSE Send OTP to user (via specified modal)
    if tred_expired:
        if modal == 'otp_email':
            email_otp_to_user(user_instance)
        elif modal == 'otp_sms':
            sms_otp_to_user(user_instance)

    # Set throttle OTP request (session)
    if tred_expired and modal != 'otp_qrcode':
        OTPThrottle.set_session(request)
```

NOTE: IF session: "throttle_otp_request_expiry_date" expires OR IS None
THEN this view can send OTPs TO target user_instance's Email OR SMS

```
    # Create the modal
    _remove_all_steps(request, MODALS)
    response = render(request, 'users/includes/modal.html', {
```

```
        'path': 'mfa/',
        'title': 'Multi-Factor Authentication',
        'post_url': reverse('login'),
        'step': modal,
        'submit': 'Login',
        'submit_boldend': 'Securly via MFA',
```

```
        # HX-POST data (in circulation)
        'next': next_url,
        'user_id': request.POST.get('user_id'),
        'email': request.POST.get('masked_email'),
        'phone_number': request.POST.get('masked_phone_number'),
```

```
        # Include OTP_REQUEST_THROTTLE_INTERVAL
        # used in resend_otp.html <component>
        **({
            'OTP_REQUEST_THROTTLE_INTERVAL': settings.OTP_REQUEST_THROTTLE_I...
        } if modal != 'otp_qrcode' else {})
```

```
    })
```

```
    # Set throttle OTP request (cookie)
    if modal != 'otp_qrcode':
        # Keep cookie updated in case of manual removal
        # TO prevent 'counter' issues
        OTPThrottle.set_cookie(request, response)
```

```
    return response
```

NOTE: Cookie - "throttle_otp_request_expiry_date" inherits expiry date
FROM Session - "throttle_otp_request_expiry_date" IF session IS NOT None
   Cookie IS - Always up-to-date FOR every request IN CASE client removes it

NOTE: HX-POST (in circulation) We will create: mfa/**data**/**in_circulation.html**
NOTE: POST data **user_id** & **next** We will create: mfa/**data**/**session_copy.html**

Head to the next page for explanation

We are about to create **CustomLoginView**() - it returns → initial context data:
next, **user_id**, **email**, **phone_number**

When client tries to login, an MFA modal will appear IF
entered in the <form> User, has Enabled MFA

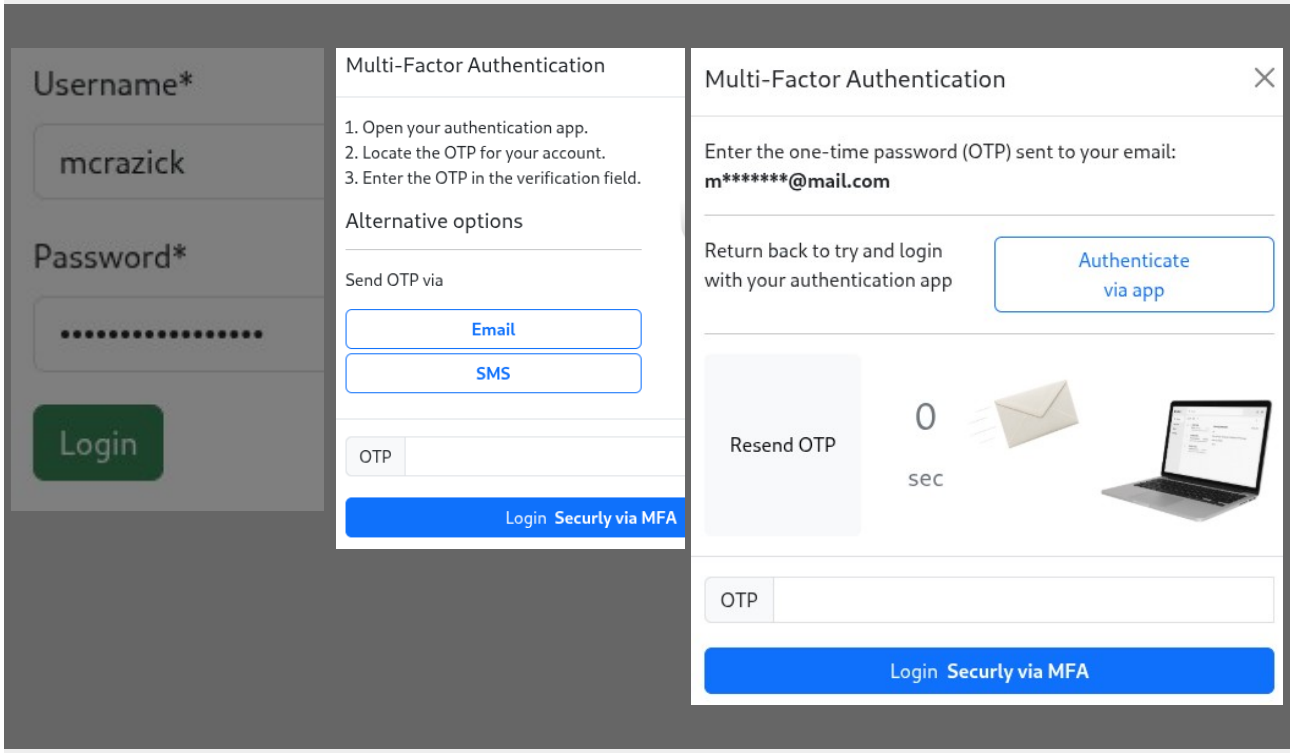
NOTE: The initially requested modal has to be: otp_qrcode.html

---

In otp_qrcode.html modal:

Client will be able to choose different OTP prompt method – via: Email OR SMS

We'll add <button> FOR - **Email**: otp_email.html and **SMS**: otp_sms.html
modal requests via - **requestMFAModalView**()



The <button> tags will use HTMX to request modal FROM **requestMFAModalView**()

The **response** will throw new **HttpResponse** object.
Loosing: initial context data , provided by the: **CustomLoginView**() request

---

Hence, we'll {% include %} in_circulation.html <component>
It will include initial context data as <input> data.

That way, when client keeps making requests FOR either:
otp_qrcode.html OR otp_email.html OR otp_sms.html modals.

Then, we will still have access TO initial variables: initial context data

---

session_copy.html <component> will include <input> data FOR **user_id** & **next** =
copies of session data: **user_id** and **next**, used TO verify final submit request

next is essential TO make successful htmx-login-redirections possible

CustomLoginView()

📝 project_folder/**users/views.py** **(users app)** 🐍 views.py

```python
from django.contrib.auth.views import LoginView
from django.contrib import messages
from django.conf import settings
from django.http import HttpResponse, HttpResponseBadRequest, JsonResponse
```

```python
class CustomLoginView(LoginView):
    template_name = 'users/form.html'
    STEPS = ['password', 'otp_qrcode', 'otp_email', 'otp_sms']
```

```python
    def success_redirect(self):
        # HTMX requests ruin the default redirection. Hence,
        # success_redirect() method is used to fix this issue.
        success_url = self.get_success_url()

        if self.request.headers.get('HX-Request') == 'true':
            # HTMX-aware response
            response = HttpResponse()
            response['HX-Redirect'] = success_url
            return response
        else:
            # Normal browser redirect
            return redirect(success_url)
```

```python
    def dispatch(self, request, *args, **kwargs):
        if self.redirect_authenticated_user and self.request.user.is_authenticated:
            return super().dispatch(request, *args, **kwargs)

        step = request.POST.get('step')
        # Call multi_factor_auth() custom method
        # IF POST request was made by the "Multi-Factor Authentication" modal
        if step in self.STEPS and step != 'password':
            return self.multi_factor_auth(request, *args, **kwargs)

        return super().dispatch(request, *args, **kwargs)
```

dispatch return super() → Calls: form_valid IF <form> credentials are valid
IF user has **Enabled MFA** → Calls: multi_factor_auth & returns otp_qrcode.html
ELSE log-in target user → Calls: success_redirect

Every **Modal** includes <input name="step">. Hence: **dispatch** → multi_factor_auth on **step** != 'password'

```
def multi_factor_auth(self, request, *args, **kwargs):

    # Validate - session data: 'verified_password', 'user_id' and 'next'

    if request.session.get('verified_password') != True:
        return JsonResponse({'error': 'Unverified password'}, status=400)

---

    user_id = request.session.get('user_id')
    user_id = str(user_id) if user_id is not None else None
    user_id_post = request.POST.get('user_id')

    if not user_id or user_id != user_id_post:
        return JsonResponse({'error': 'Empty or mismatched user_id', 'user_id': user_id},
status=400)

---

    next_url = request.session.get('next')
    # None → <input value="None"> → "None" (Type: String)
    next_url_post = request.POST.get('next')
    next_url_post = None if next_url_post in ['None', 'null', 'False'] else next_url_post

    if next_url != next_url_post:
        return JsonResponse({'error': 'Mismatched next_url', 'next_url': next_url}, status=400)

---

    # Validate - "Multi-Factor Authentication" data

    user = get_object_or_404(User, id=user_id)
    if hasattr(user, 'account') and user.account.mfa_enabled != True:
        return JsonResponse({'error': 'Disabled MFA'}, status=400)

    step = request.POST.get('step')
    if not _validate_step(request, step, user):
        return JsonResponse({'error': _get_validation_error(step), 'step': step}, status=400)

---

    # Reset used session & cookie data AND authenticate the user

    del self.request.session['next']
    del self.request.session['user_id']
    _remove_all_steps(request, self.STEPS)
    OTPThrottle.remove_session(self.request)

    login(self.request, user)
    response = self.success_redirect()
    OTPThrottle.remove_cookie(response)
    return response
```

```python
def form_valid(self, form):

    # Return "Multi-Factor Authentication" modal IF user has enabled MFA
    # Otherwise, authenticate the user
    user = form.get_user()
    request = self.request
```

```python
    if hasattr(user, 'account') and user.account.mfa_enabled:
        # Note: POST data (in circulation) includes some session data
        # These are used later to check if POST data matches the session
        _remove_all_steps(request, self.STEPS)
        request.session[f'user_id'] = user.id
        request.session[f'verified_password'] = True
        request.session[f'next'] = request.GET.get('next')

        return render(request, 'users/includes/modal.html', {
```

```python
            'path': 'mfa/',
            'title': 'Multi-Factor Authentication',
            'post_url': reverse('login'),
            'step': 'otp_qrcode',
            'submit': 'Login',
            'submit_boldend': 'Securly via MFA',
```

```python
            # Initial data for, in circulation, HX-POST requests
            'user_id': user.id,
            'next': request.GET.get('next'),
            'email': mask_email(user.email),
            'phone_number': mask_phone_number(str(user.account.phone_number)),
```

```python
        })
```

```python
    else:
        login(self.request, user)
        return self.success_redirect()
```

NOTE: `localhost:port/example/path?next=/next/path` ← **added** by **@login_required**

request.GET.get('next') = '/next/path'

NOTE: Query parameter: **next**, may not be included. In that case,
there is no redirection TO other **url path** after a successful login

Hence success_redirect → returns **redirect**(success_url) → LOGIN_REDIRECT_URL
where success_url IS handled by get_success_url method OF auth **LoginView**

OTPThrottle **enableMFAView**()

📝 project_folder/**users/views.py** **(users app)** 🐍 views.py

```python
@login_required
def enableMFAView(request):
...
```

```python
    # Check if all steps are completed
    if _all_steps_completed(request, STEPS):
        # Enable MFA
        request.user.account.mfa_enabled = True
        request.user.account.save()
        # Clear used session data
        _remove_all_steps(request, STEPS)
        OTPThrottle.remove_session(request)
        # Generate response AND clear used cookie data
        response = JsonResponse({'success': 'Enabled MFA', 'step': step}, status=200)
        OTPThrottle.remove_cookie(response)
        return response
```

```python
def _render_step_modal(request, step, all_steps, base_context):
    is_last_step = all_steps.index(step) == len(all_steps) - 1

    context = {
        **base_context,
        'path': 'mfa/' if step != 'password' else '',
        'step': step,
        'page': f'{all_steps.index(step) + 1}/{len(all_steps)}',
        'submit': 'Enable' if is_last_step else 'Proceed to the next step',
        'submit_boldend': 'Multi-Factor Authentication' if is_last_step else '',
    }
    if step == 'otp_qrcode':
        context['qrcode_data_uri'] = get_users_mfa_secret_as_qrcode_base64(request.user)

    elif step != 'password':
        # Include OTP_REQUEST_THROTTLE_INTERVAL used in resend_otp.html <component>
        context['OTP_REQUEST_THROTTLE_INTERVAL'] = settings.OTP_REQUEST_THROTTL...

    response = render(request, 'users/includes/modal.html', context)
    # Set throttle OTP request (cookie)
    # Keep cookie updated in case of manual removal to prevent 'counter' issues
    OTPThrottle.set_cookie(request, response)

    return response
```

```
def _handle_post_validation(request, step):
```

```
    STEPS = ['otp_qrcode', 'otp_email']

    # TRED = Throttle Request Expiry-Date
    tred_expired = OTPThrottle.has_expired(request)
    expiry_date = OTPThrottle.get(request, source='session')

    # Throttle OTP request (via session)
    if not tred_expired and step in STEPS:
        response = JsonResponse({
        'error': 'Throttle by expiry_date', 'expiry_date': expiry_date}, status=400)
        # Keep cookie updated in case of manual removal to prevent 'counter' issues
        OTPThrottle.set_cookie(request, response)
        return response

    # Set throttle OTP request (session)
    if tred_expired and step in STEPS:
        OTPThrottle.set_session(request)
```

```
    # Send OTP to user via specified step
    if step == 'otp_qrcode':
        email_otp_to_user(request.user)
    elif step == 'otp_email':
        sms_otp_to_user(request.user)
```

Take a break

(Study – CustomLoginView)

Update Login template to display Multi-Factor Authentication

> **NOTE**: This stage requires a User with Enabled MFA

📝 project_folder/**users**/templates/users/**form.html** **(users app)** </> form.html

```
{% extends 'app_name/base.html' %}
{% load static %}
{% load crispy_forms_tags %}
{% block title %}
  {% if registry %}Register{% else %}Login{% endif %} Page
{% endblock %}
{% block content %}

---

{% if not registry %}<section id="modals"></section>{% endif %}

{% if user.is_authenticated and not registry %}
  <div class="p-3 mb-5 bg-light rounded">
    <p>You are already logged-in as: <strong>{{ user }}</strong>
    <br>would you like to sign-in to another account?</p>
  </div>
{% endif %}

---

<form method="POST" enctype="multipart/form-data"
   hx-post="{% url 'login' %}{% if request.GET.next %}?next={{ request.GET.next|
urlencode }}{% endif %}"
   hx-trigger="click throttle:1s"
   hx-swap="none">

---

    {% csrf_token %}
    {% if request.GET.next %}
      <input type="hidden" name="next" value="{{ request.GET.next }}">
    {% endif %}
    {{ register_view_forms.profile|crispy }}
    {{ register_view_forms.user|crispy }}
    {{ form|crispy }}
    <button type="submit" class="btn btn-success">
      <span>{% if registry %}Register{% else %}Login{% endif %}</span>
    </button>

---

</form>
```

```
...
    <section class="float-end">
        {% if not registry %}
        <p>Don't have an account?  <a href="{% url 'register' %}">register now</a></p>
        {% else %}
        <p>Already have an account?  <a href="{% url 'login' %}">login now</a></p>
        {% endif %}
    </section>
...
```

NOTE: This is a minor change unrelated to the addition of MFA modals

Remove this old <section>

```
{% if user.is_authenticated and not registry %}
<p class="float-end">Would you like a new account?
  <a href="{% url 'register' %}">register now</a>
</p>
{% elif not registry %}
<p class="float-end">Don't have an account?
  <a href="{% url 'register' %}">register now</a>
</p>
{% else %}
<p class="float-end">Already have an account?
  <a href="{% url 'login' %}">login now</a>
</p>
{% endif %}
```

```
{% endblock %}

{% block base %}
<script name="modals" src="{% static 'users/js/profile/modals.js' %}"></script>
<script name="modals" src="{% static 'users/js/includes/modals.js' %}"></script>
{% endblock %}
```

NOTE: It is important TO **disclude next**: <input name="next"> FROM the <form> IF it's not required.

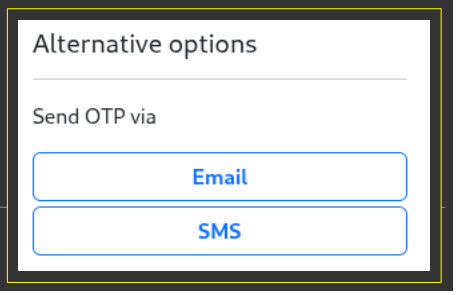
Otherwise, the **CustomLoginView** will target it (even if it wasn't specified in as a query parameter in URL) and it will try to use it and redirect us TO its specified path in a situation where we don't expect redirections

We cannot test the **CustomLoginView**() just yet because there are missing components for the Multi-Factor Authentication modals.

- /Components – mfa_options.html, mfa_return.html
- MFA/Data – in_circulation.html, session_copy.html

📝 project_folder/**users**/templates/users/modals/**components**/**mfa_options.html** </>

```
<form id="mfa-alternative-options"
  action="{% url 'request_mfa' 'none' %}"
  enctype="multipart/form-data"
  method="POST">
  {% include 'users/modals/mfa/data/in_circulation.html' %}

  <h5>Alternative options</h5>
  <hr>
  <p>Send OTP via</p>
  <button class="btn btn-outline-primary w-100 mb-1" type="button"
    hx-post="{% url 'request_mfa' 'otp_email' %}"
    hx-trigger="click throttle:1s"
    hx-swap="none">
    <strong>Email</strong>
  </button>
  <button class="btn btn-outline-primary w-100" type="button"
    hx-post="{% url 'request_mfa' 'otp_sms' %}"
    hx-trigger="click throttle:1s"
    hx-swap="none">
    <strong>SMS</strong>
  </button>

</form>
```



📝 project_folder/**users**/templates/users/**modals**/mfa/**otp_qrcode.html** </>

```
  {% if qrcode_data_uri %}...{% endif %}

  <div class="d-flex justify-content-between">
    {% if submit == 'Login' %}
      <div id="{{ step|replace:'_|-' }}-instructions">
        <ol class="ps-3">
          <li>Open your authentication app.</li>
          <li>Locate the OTP for your account.</li>
          <li>Enter the OTP in the verification field.</li>
        </ol>
        {% include 'users/modals/components/mfa_options.html' %}
      </div>
    {% else %}
      <img class="w-75 border rounded-2" style="max-width: 300px;"
      src="{{ qrcode_data_uri }}" alt="Failed to load - QR Code">
    {% endif %}
      <img class="w-auto" style="max-width: 150px;"
      src="{% static 'users/img/authenticator_apps.png' %}">
  </div>
{% endblock %}
```

📝 project_folder/**users**/templates/users/modals/**mfa**/data/**in_circulation.html** </>

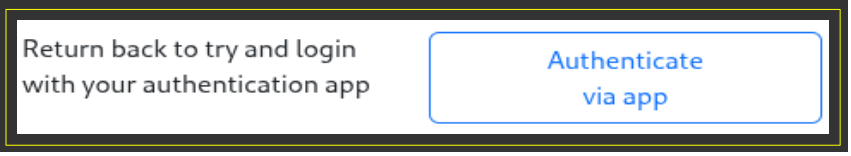
```
{% comment %}
Since HX-POST does not preserve data across requests,
essential details like "masked_(email)" and "masked_(phone_number)"
sent from the backend are lost when a client requests an Email or SMS modal
(for alternative One-Time Password (OTP) submission).

To mitigate this issue:

  - Relevant data is embedded within below specified input tags before sending the request.
  - When requestMFAModalView handles the request, it retrieves these values from the inputs.
  - The backend then returns the same data, ensuring it is available for template rendering of
requested modals.
{% endcomment %}

<!-- POST data (in circulation) -->
{% csrf_token %}
<input type="hidden" name="next" value="{{ next }}">
<input type="hidden" name="user_id" value="{{ user_id }}">
<input type="hidden" name="masked_email" value="{{ email }}">
<input type="hidden" name="masked_phone_number" value="{{ phone_number }}">
```

📝 project_folder/**users**/templates/users/modals/**mfa**/data/**session_copy.html** </>

```
{% comment %}
session_copy.html serves as a safeguard for verifying session integrity by posting back
session-related variables. The input tags act as a security measure to ensure the posted
values match those stored in the backend session.

If there is a mismatch between these values, it indicates a potential issue:

  - Either the session variable was altered or cleared.
  - Or the posted session copy variable was modified before submission.

In such cases, user verification fails due to unauthorized modifications, requiring
the "Multi-Factor Authentication" (MFA) modal to reset before proceeding.
{% endcomment %}

{% if next %}
  {# 'next' cannot be present when 'None' otherwise there will be issues with redirection #}
  <input type="hidden" name="next" value="{{ next }}">
{% endif %}
{% if user_id %}
  {# 'user_id' is not required when Enabling MFA #}
  <input type="hidden" name="user_id" value="{{ user_id }}">
{% endif %}
```

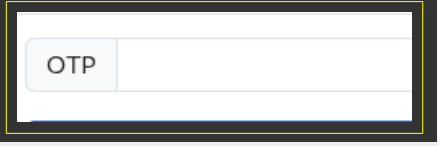
📝 project_folder/**users**/templates/users/modals/components/**mfa_return.html** </>

```
<form id="mfa-alternative-options" class="d-flex justify-content-between align-items-center"
   action="{% url 'request_mfa' 'none' %}"
   enctype="multipart/form-data"
   method="POST">
   {% include 'users/modals/mfa/data/in_circulation.html' %}

   <p class="w-50 me-2">Return back to try and login with your authentication app</p>
   <button class="btn btn-outline-primary w-50" type="button"
      hx-post="{% url 'request_mfa' 'otp_qrcode' %}"
      hx-trigger="click throttle:1s"
      hx-swap="none">
      Authenticate<br>via app
   </button>
</form>
```



📝 project_folder/**users**/templates/users/modals/components/**main_input.html** </>

```
{% load custom_filters %}

<span class="input-group-text">{{ label }}</span>
<input required
---
name="{{ name }}"
type="{% if name == 'password' %}password{% else %}text{% endif %}"
class="form-control"

---

aria-label="{{ aria_label }}"
aria-describedby="{{ step|replace:'_|-' }}-instructions"

---

hx-post="{{ post_url }}"
hx-trigger="
{% if name == 'password' %}submit throttle
{% else %}input changed delay
{% endif %}:250ms"
hx-swap="none">
```



NOTE: It's better to make a main input component so that future changes apply to all modals

The main button != component because it is a fundamental part of base.html modal.
Current modularity supports flexibility in case you plan on expanding modals architecture.

📝 project_folder/**users**/templates/users/**modals**/mfa/**otp_email.html** </>

```
{% extends 'users/modals/base.html' %}
{% load custom_filters %}
{% load static %}
{% block body %}
```

Careful with {{ request.user.email }}
The current design enables logged-in user to see their unmasked email when Enabling MFA.

It's safer to set email in controlled manner via context

```
  <p id="{{ step|replace:'_|-' }}-instructions">
    Enter the one-time password (OTP) sent to your email: <br>
    <strong>{% if email %}{{ email }}{% else %}{{ request.user.email }}{% endif %}
    </strong>
  </p>

  {% if submit == 'Login' %}
    <hr>
    {% include 'users/modals/components/mfa_return.html' %}
  {% endif %}

  <hr>
  {% url 'request_otp' 'email' as url_request_otp %}
  {% include 'users/modals/components/resend_otp.html' with
    post_url=url_request_otp
    image_name='mail_to_laptop.png' image_path='users/img/mail_to_laptop.png'
  %}
{% endblock %}

{% if submit == 'Login' %}
  {% block form %}
    {% include 'users/modals/mfa/data/session_copy.html' %}
  {% endblock %}
{% endif %}

{% block input %}
  {% include 'users/modals/components/main_input.html' with
    name='otp_code' label='OTP' aria_label='one-time-password'
  %}
{% endblock %}
```

📝 project_folder/**users**/templates/users/**modals**/mfa/**otp_sms.html** </>

```
{% extends 'users/modals/base.html
{% load custom_filters %}
{% load static %}
{% block body %}
```

Careful with {{ request.user.account.phone_number }}
The current design enables logged-in user to
see their unmasked phone number when Enabling MFA.

It's safer to set phone number in controlled manner via context

```
  <p id="{{ step|replace:'_|-' }}-instructions">
    Enter the one-time password (OTP) sent to your mobile via text:
    <br>
    <span class="phone-number d-block fs-5">
      <strong>{% if submit == 'Login' %}{{ phone_number }}{% else %}
{{ request.user.account.phone_number }}{% endif %}</strong>
    </span>
    {% if submit != 'Login' %}
      <br>to finalize <strong>Multi-Factor Authentication</strong>
    {% endif %}
  </p>

  {% if submit == 'Login' %}
    <hr>
    {% include 'users/modals/components/mfa_return.html' %}
  {% endif %}

  <hr>
  {% url 'request_otp' 'sms' as url_request_otp %}
  {% include 'users/modals/components/resend_otp.html' with
    post_url=url_request_otp
    image_name='mail_to_phone.png' image_path='users/img/mail_to_phone.png'
  %}
{% endblock %}

{% if submit == 'Login' %}
  {% block form %}
    {% include 'users/modals/mfa/data/session_copy.html' %}
  {% endblock %}
{% endif %}

{% block input %}
  {% include 'users/modals/components/main_input.html' with
    name='otp_code' label='OTP' aria_label='one-time-password'
  %}
{% endblock %}
```

📝 project_folder/**users**/templates/users/**modals**/mfa/**otp_qrcode.html** </>

```
{% extends 'users/modals/base.html' %}
{% load custom_filters %}
{% load static %}
{% block body %}
```

Confirm the structure of your **otp_qrcode.html** modal and then, at the end, include the:

session_copy.html and **main_input.html** components

```
  {% if qrcode_data_uri %}
    <div id="{{ step|replace:'_|-' }}-instructions">
      <p>Download <a href="#">authenticator app</a>
        on your mobile device, and use it to
      </p>
      <h5><strong>Scan the QR code</strong></h5>
      <p>To receive the one-time password (OTP) required to activate
        <strong>Multi-Factor Authentication</strong>
      </p>
      <hr>
      <h5><strong>Enter code</strong></h5>
      <span id="mfa-secret" class="text-primary"
        style="letter-spacing: 0.15em; word-spacing: 0.3em;">
      </span>
      <script type="text/javascript">...</script>
      <p>Into your authentication app if you're unable to scan the QR code</p>
    </div>
  {% endif %}

  <div class="d-flex justify-content-between">
    {% if submit == 'Login' %}
      <div id="{{ step|replace:'_|-' }}-instructions">
        <ol class="ps-3">
          <li>Open your authentication app.</li>
          <li>Locate the OTP for your account.</li>
          <li>Enter the OTP in the verification field.</li>
        </ol>
        {% include 'users/modals/components/mfa_options.html' %}
      </div>
    {% else %}
      <img class="w-75 border rounded-2" style="max-width: 300px;"
      src="{{ qrcode_data_uri }}" alt="Failed to load - QR Code">
    {% endif %}
      <img class="w-auto" style="max-width: 150px;"
      src="{% static 'users/img/authenticator_apps.png' %}">
  </div>

{% endblock %}
```

... continues on the next page

```
{% if submit == 'Login' %}
  {% block form %}
    {% include 'users/modals/mfa/data/session_copy.html' %}
  {% endblock %}
{% endif %}
```

```
{% block input %}
  {% include 'users/modals/components/main_input.html' with
    name='otp_code' label='OTP' aria_label='one-time-password'
  %}
{% endblock %}
```

📝 `project_folder/users/templates/users/modals/password.html` `</>`

```
{% extends 'users/modals/profile/base.html' %}
{% load custom_filters %}
```

```
{% block body %}
  <p id="{{ step|replace:'_|-' }}-instructions">Enter your password to
    {% if submit == 'Disable' %}deactivate{% else %}configure{% endif %}
    <strong>Multi-Factor Authentication</strong>
  </p>
{% endblock %}
```

```
{% block input %}
  {% include 'users/modals/components/main_input.html' with
    name='password' label='Password' aria_label='users-password'
  %}
{% endblock %}
```

Almost done, you should be able to test the MFA however, it's better to do so with additional next steps:

- Live expiry date feedback, and
- Error display FOR invalid data OF in_circulation AND session_copy data

Take a break

Get live expiry date time in resend_otp.html **modal**

📝 project_folder/**users**/templates/users/**modals**/components/**resend_otp.html** </>

```
{% load static %}
<div class="d-flex justify-content-between text-center">
  <button type="button" class="btn btn-light w-50 me-4">
    <span class="spinner-border text-secondary visually-hidden" role="status"
     aria-hidden="true"></span>
    <span class="button-text">Resend OTP</span>
  </button>
  <p class="count-text text-secondary px-auto m-auto fs-2 w-25">
    <span class="count-down">--</span>
    <br><span class="fs-5">sec</span>
  </p>
  <img style="max-height: 150px" src="{% static image_path %}"
    alt="{{ image_name }}">
  <script type="text/javascript">...below script</script>
<div/>
```

```
(() => {

    let script = document.currentScript,
        parent = script.parentElement,

        counter = parent.querySelector('.count-down'),
        countTxt = parent.querySelector('.count-text'),
        button = parent.querySelector('.btn'),

        buttonTxt = button.querySelector('.button-text'),
        spinner = button.querySelector('.spinner-border'),

        timeout = null,
        fallback = null,
        interval = null,
        isIntervalActive = false,
        count = 0;

    function countDown() {
        counter.innerText = count;
        if (count > 0) count -= 1;
        else {
            clearInterval(interval);
            button.removeAttribute('disabled');
            countTxt.classList.add('text-secondary');
            isIntervalActive = false;
        }
    }
```

```
function TREDSecondsLeft() {
    /* TRED = Throttle Request Expiry-Date
    /
    / Get the expiry date cookie. Notes:
    / - cookie's date format should be that of: ISO 8601
    / - up-to-date cookie should be provided with each response
    / - cookie should be initially provided with this <component>
    */
    const cookie = getCookie('throttle_otp_request_expiry_date');

    // Parse the date if cookie exists
    const expiryDate = cookie ? new Date(cookie) : null;

    // Validate the date and calculate remaining seconds
    if (expiryDate && !isNaN(expiryDate.getTime())) {
        const now = new Date();
        const secondsLeft = Math.floor((expiryDate - now) / 1000) + 1;
        return secondsLeft > 0 ? secondsLeft : 0; // Return 0 if expired
    }

    // Return null if no valid expiry date found
    return null;
}
```

```
button.addEventListener('click', () => {
    if (count > 0) return;
    /* Request new OTP code AND send it TO:
    / - user's contact method = email|sms (specified in the post_url)
    /
    / https://htmx.org/api/#ajax
    */
    htmx.ajax('POST', '{{ post_url }}', {
        swap: 'none',
        headers: {
            'X-CSRFToken': '{{ csrf_token }}',
        }
    });
    timeout = setTimeout(() => {
        spinner.classList.remove('visually-hidden');
        buttonTxt.classList.add('visually-hidden');
    }, 500);

    // Set fallback execution after 15 seconds
    fallback = setTimeout(() => {
        console.warn('No response received in 15 seconds, executing fallback.');
        buttonTxt.classList.remove('visually-hidden');
        spinner.classList.add('visually-hidden');
    }, 15000);
});
```

```
    function setThrottle() {
        if (isIntervalActive) return;
        count = 45;
        count = TREDSecondsLeft() ?? {{ OTP_REQUEST_THROTTLE_INTERVAL }};

        button.setAttribute('disabled', '');
        countTxt.classList.remove('text-secondary');

        isIntervalActive = true;
        if (interval) clearInterval(interval);
        countDown(); // Immediately show the count
        interval = setInterval(countDown, 1000);

        buttonTxt.classList.remove('visually-hidden');
        spinner.classList.add('visually-hidden');
    }
    // Throttle initially
    setThrottle();
```

```
    document.addEventListener('htmx:afterRequest', async (event) => {
        if (event.detail.pathInfo.requestPath !== '{{ post_url }}') return;

        // Receive response from the backend

        let xhr = event.detail.xhr,
            responseText = await xhr.responseText,
            response = '';

        if (xhr.getResponseHeader('Content-Type')?.includes('application/json')) {
            response = JSON.parse(responseText);
        }
        else return;

        // Cancel the timeout & fallback execution if response is received

        clearTimeout(timeout);
        clearTimeout(fallback);

        // Handle response

        if (response.success === 'OTP Sent') setThrottle();
        else if (response.error) console.error(response.error);

    });
```

```
    script.remove();
```

```
})();
```

```
        if (isIntervalActive) return;
        count = 45;

        button.setAttribute('disabled', '');
        countTxt.classList.remove('text-secondary');

        isIntervalActive = true;
        if (interval) clearInterval(interval);
        interval = setInterval(countDown, 1000);

        buttonTxt.classList.remove('visually-hidden');
        spinner.classList.add('visually-hidden');
```

NOTE: This script used to be part of `if (response.success === 'OTP Sent') {}` and was moved TO a new function: **setThrottle()**

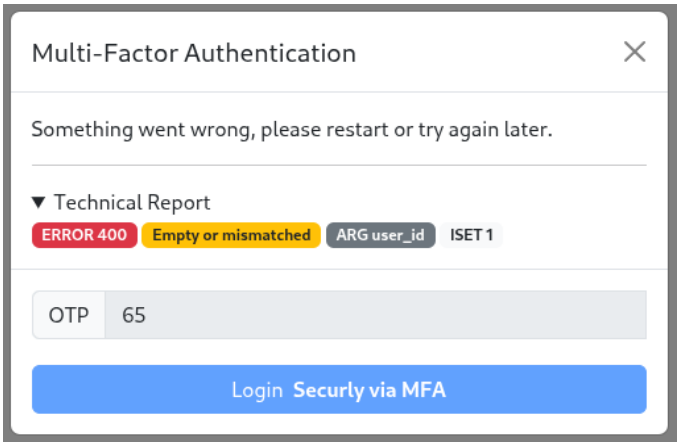
SUMMARY: **TREDSecondsLeft()** receives, set by the backend: **OTPThrottle**, cookie: 'throttle_otp_request_expiry_date', which stores expiry date object.

This object is used to get the remaining time, hence: seconds left.
Count = **OTP_REQUEST_THROTTLE_INTERVAL** in case the cookie is missing.

And OTP_REQUEST_THROTTLE_INTERVAL is passed as context data.
Its actual value is defined at settings.py

Let's now include the technical report (Error display)

"Empty or mismatched" refers to a **JsonResponse** returned FROM the backend.



ARG: Indicates the **argument** provided (`in_circulation` or `session_copy`), in the below example, the invalid argument is: `user_id`.

ISET: Denotes the initially set value for `user_id`. For example, if `user_id` was originally set to 1, but the backend received a different value (or none at all) via POST, it results in a mismatch or missing argument error.

MFA Technical report (Error display)

📝 project_folder/**users**/static/users/js/includes/**modal.js** **(users app)** JS

```
const modals = document.getElementById('modals');
```

```
function hideModals() {
    document.querySelectorAll('.modal').forEach(modal => {
        const Modal = bootstrap.Modal.getOrCreateInstance(modal);
              Modal.hide();
    });
}
function setInvalidInput(input) {
    input.classList.add('is-invalid');
    input.classList.add('text-danger');
}
function setNormalInput(input) {
    input.classList.remove('is-invalid');
    input.classList.remove('text-danger');
}
function setLoadingButtonForModal(button) {
    button.querySelector('.spinner-grow').classList.remove('visually-hidden');
    button.querySelector('.button-text').innerText = 'loading...';
}
function setNormalButtonForModal(button) {
    button.querySelector('.spinner-grow').classList.add('visually-hidden');
    button.querySelector('.button-text').innerHTML = button.dataset.name;
}
```

```
document.addEventListener('htmx:afterRequest', async (event) => {
```

```
    let form = event.detail.target.closest('form');
    if (!form?.classList.contains('modal-footer')) return;

    // Receive response from the backend

    let xhr = event.detail.xhr,
        responseText = await xhr.responseText,
        response = '';

    if (xhr.getResponseHeader('Content-Type')?.includes('application/json')) {
        response = JSON.parse(responseText);
    }
    else return;
```

```
// Handle response

let modal_body = form.parentElement.querySelector('.modal-body'),
    button_submit = form.querySelector('.modal-submit-button'),
    input_otp = form.querySelector('input[name="otp_code"]');

---

if (response.error) {
    // Report ERROR to the console & technical report <details>
    if (/Empty or mismatched|Mismatched/g.test(response.error)) {
        let msg = response.error, err = arg = '';

        arg = msg.replace(/Empty or mismatched|Mismatched/g, '').trim();
        err = msg.replace(arg, '').trim();
        msg += ': ' + response[arg];

        modal_body.innerHTML = `
            <p>Something went wrong, please restart or try again later.</p>
            <hr>
            <details open>
                <summary>Technical Report</summary>
                <span class="badge bg-danger">ERROR ${xhr.status}</span>
                <span class="badge bg-warning text-dark">${err}</span>
                <span class="badge bg-secondary">ARG ${arg}</span>
                <span class="badge bg-light text-dark">
                    ISET ${response[arg]}
                </span>
            </details>
        `;

        // Report ERROR & Disable - OTP <input> & Submit <button>
        button_submit.setAttribute('disabled', '');
        input_otp.setAttribute('disabled', '');
        console.error(msg);
    }
    else {
        console.error(response.error);
    }
}

---

if (response.success) {
    hideModals();
}
else if (/Invalid OTP|Invalid password/g.test(response.error)) {
    let input = form.querySelector('input:not([type="hidden"])');
    setInvalidInput(input);
}
```

```
    // Reset modal's submit button
    button_submit = form.querySelector('.modal-submit-button');
    setNormalButtonForModal(button_submit);

});
```

TEST the MFA
you can always refer back to the django5-project at github: click me

I can’t be bothered to demonstrate this, but you should be already capable of creating unique backup codes and additional MFA modal as an alternative MFA sign-in option.

Just make sure that your codes are never reused
Hence, keep them saved in a databse for their related user instance

Schedule deletion of User ❌👤

(in progress...)

✅ Key Implementation Notes

🔐 Backup Codes Management

- Ensure **backup codes are single-use and unique** per generation.
- Disallow reuse explicitly in both backend validation and view logic.
- The view responsible for generating or displaying backup codes **must be access-protected** — session-aware and rate-limited if unauthenticated clients may reach it.
- Consider registering a new modal to display backup codes elegantly within the profile or settings area.

🌍 Translation Caveats

- `translation.activate()` affects pluralization and other form behaviors.
- Some English-based views still lack `.po` translations — ensure consistency between `activate` calls and language-specific views to avoid unexpected language switches.

📦 Static Files and Migrations

- **Always run** `collectstatic` after updating static directories in any app, especially when using **Whitenoise** during development/testing.
- For migrations involving sensitive models (e.g., `Account`), perform necessary data preparation before applying schema changes. Inline logic during migration runs may be fragile or irreversible.

🧭 Navigation & Template Links

- Ensure **essential views** like login, logout, profile, donate, buy-plan, public chat, and option to create new model, are linked in the base template or navigation bar.
- You can progressively enhance UX by adding contextual links as the app evolves.

📁 Environment File Management

- Ensure `.env` and similar config files are **excluded** via `.gitignore`.
- Provide a `example.env` template including all expected variables (e.g., `STRIPE_SECRET_KEY=`, `DEBUG=`, `ALLOWED_HOSTS=`) to guide contributors and reduce setup friction.

🛡️ MFA & Session Security

- Views like `requestOTPView` and other MFA flows must be fortified against abuse. Key practices:
    - Enforce session and cookie validation pre-checks.
    - Guard against stateless access via middleware or decorators.
    - Introduce throttling to prevent request spamming, especially where OTP generation is involved.

📡 External API Resilience

- Services like **Stripe**, **Zoho**, and **Twilio** can fail mid-execution. Avoid assumptions that API calls succeed instantly.
- When adding/removing connected accounts (e.g., Stripe), use **webhooks** to confirm and sync status reliably.
- Incorporate retry strategies and graceful degradation where appropriate.

🧪 Testing and Deployment Best Practices

- After making changes, **always test** thoroughly — ideally across login, signup, navigation, and API endpoints.
- When preparing for production:
    - Set `DEBUG = False` during testing to catch deployment-specific issues.
    - Confirm that static assets, environment vars, and error logging behave as expected in live mode.

🧼 Environment Activation & Dependency Tracking

- Before starting the server, make sure you're in a **virtual environment** (e.g. `source venv/bin/activate`).
- **Always update** `requirements.txt` when installing or uninstalling Python packages: `pip freeze > requirements.txt`

This app may be rough around the edges, but it’s a goldmine for strengthening defensive coding abilities, architectual and design skills, and also the resilience thanks to debugging along the way.

Focus primarly on basics, do not worry about everything else,
it will come as a second nature with practice and strong dyscipline.

When you’re ready, create at least 5 projects. Not some silly apps, but like:

- a cooking website,
- task management utility for employees,
- social media application, and at last;
- a retail website that handles invoices.

You got this !