102- FASTAPI E2E

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Create a Simple API

We are going to create a new api for posting an item , creating users and deleting them and authentication. we also allow user to like an post

Lets Get Started

Creating Virtual Environment

```
python3 -m venv venv

Activate the Env
source  venv/bin/activate

INstall fastapi
pip install fastapi[all]

#it will all the required packages
```

```
source /home/esak/esak_2022/learnapi_beginners/venv/bin/activate
esak@esakpc:~/esak_2022/learnapi_beginners$ source /home/esak/esak_2022/learnapi_beginners/venv/bin/activate
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$ ls
LICENSE  main.py  README.md  venv
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$ source  venv/bin/activate
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$
```

Creating a Postgress user

```
sudo -u postgres psql
postgres=# create database mydb;
postgres=# create user myuser with encrypted password 'mypass';
postgres=# grant all privileges on database mydb to myuser;
```

Creating user, database and adding access on PostgreSQL

NOTE : Right off the bat - this is valid as on March 2017, running on Ubuntu 16.04.2, with PostgreSQL 9.6 TL;DR; version sudo -u postgres psqlpostgres=# create database mydb;postgres=# create user myuser with encrypted password 'mypass';postgres=# grant all privileges on database mydb to myuser; One nice thing about

https://medium.com/coding-blocks/creating-user-database-and-adding-access-on-postgresql-8bfcd2f4a91e

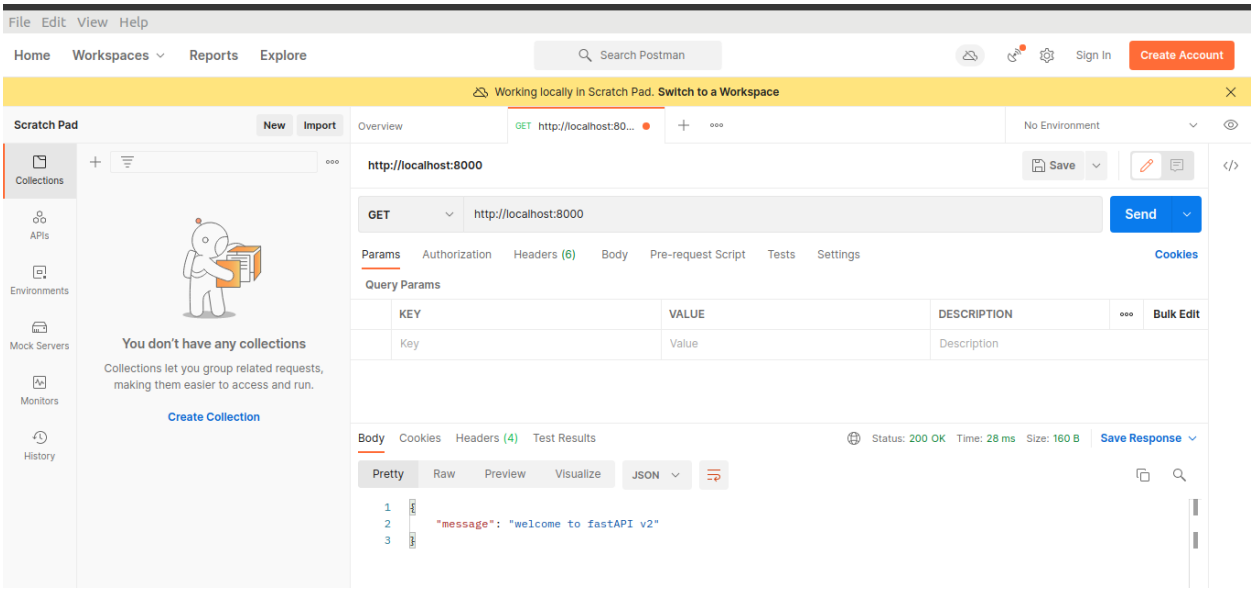
Create a Simple FASTAPI Code

```
from fastapi import FastAPI

app = FastAPI()  # create fastapi Instance

# create a Route
@app.get("/")
async def root():
    return {"message": "welcome to fastAPI"}

# here we are returning a Dictionary and fastapi will automatically convert it into an JSON
# You can also return Pydantic models (you'll see more about that later).
# There are many other objects and models that will be automatically converted to JSON (including ORMs, etc).
# when user hit the above / path , above code will be executed
# ORDER always matter
# if we have same path operation First one will be used
```

Lets Run the Code

```
uvicorn main:app --reload

# main is the FileName
# app is the fastapi Object , if we declare the fasApi object in a different name we have to use that as well
```

We can view the Output using a tool called postman



Lets Create a Post

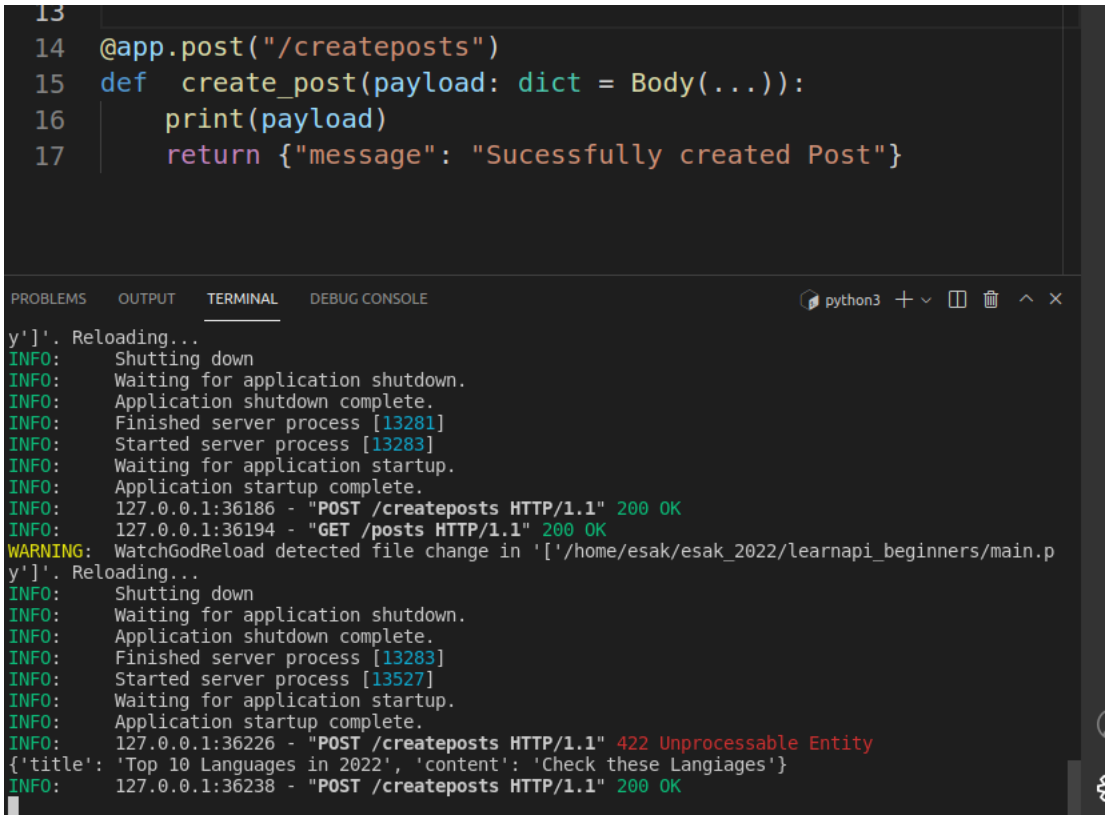
we are going to send some data to the web server using the HTTP method called POST

Extracting Data from the body of a request

```
from fastapi import FastAPI
from fastapi.param_functions import Body

@app.post("/createposts")
def  create_post(payload: dict = Body(...)):
    print(payload)
    return {"message": "Sucessfully created Post"}
```

```
Here
payload: dict = Body(...)  Body will get all the Json value we passed through the Postman Tool and it will be converted back to Dictionary
and assigned to variable named payload
so when we print payload we can see {'title': 'Top 10 Languages in 2022', 'content': 'Check these Langiages'}
```

we can see the output of the Body



Client can send any kind of data he wants we need to validate these data . we ultimately want the client to send data in a schema that we expect

All the data validation is performed under the hood by Pydantic, so you get all the benefits from it. And you know you are in good hands.

we can create an enum for our path parameters as well

```
from enum import Enum

from fastapi import FastAPI


class ModelName(str, Enum):
    alexnet = "alexnet"
    resnet = "resnet"
    lenet = "lenet"


app = FastAPI()


@app.get("/models/{model_name}")
async def get_model(model_name: ModelName):
    if model_name == ModelName.alexnet:
        return {"model_name": model_name, "message": "Deep Learning FTW!"}
```

```
    if model_name.value == "lenet":
        return {"model_name": model_name, "message": "LeCNN all the images"}

    return {"model_name": model_name, "message": "Have some residuals"}
```

When you declare other function parameters that are not part of the path parameters, they are automatically interpreted as "query" parameters.

```
@app.get("/items/")
async def read_item(skip: int = 0, limit: int = 10):
    return fake_items_db[skip : skip + limit]

in the URL it will be like
http://127.0.0.1:8000/items/?skip=0&limit=10


## The query is the set of key-value pairs that go after the ? in a URL, separated by & characters.
```

Lets Take another Example

```
@app.get("/items/{item_id}")
async def read_item(item_id: str, q: Optional[str] = None):
    if q:
        return {"item_id": item_id, "q": q}
    return {"item_id": item_id}

# Here item_id is a path parameter
# q is query parameter
```

we can perform additional validation in the Query Parameter

```
We are going to enforce that even though q is optional, whenever it is provided, its length doesn't exceed 50 characters.

from fastapi import FastAPI, Query
@app.get("/items/")
async def read_items(q: Optional[str] = Query(None, max_length=50)):
    results = {"items": [{"item_id": "Foo"}, {"item_id": "Bar"}]}
    if q:
        results.update({"q": q})
    return results

# q: Optional[str] = None === q: Optional[str] = Query(None)
# Addition to the default value we ahave added a parameter to the query to check the max length < 50 or not


# if we want to declare the default value to others
async def read_items(q: str = Query("fixedquery", min_length=3)):


So, when you need to declare a value as required while using Query, you can use ... as the first argument:
async def read_items(q: str = Query(..., min_length=3)):

# if we use deprecated=True, in the Query , it will be reflected in the Docs
```

Like using Query Parameter we can also use the Path Parameter

```
@app.get("/items/{item_id}")
async def read_items(
    *,
    item_id: int = Path(..., title="The ID of the item to get", gt=0, le=1000),
    q: str,
):

# here we are declaring the Path Parameter , which is required and its greater than 0 and less than 1000
# we declare the query parameter
```

```
# Python will complain if you put a value with a "default" before a value that doesn't have a "default".
# To Overcome this Limitation we are using '*' which makes everything as kwargs after *
```

```
And you can also declare numeric validations:

gt: greater than
ge: greater than or equal
lt: less than
le: less than or equal
```

A **request** body is data sent by the client to your API. A **response** body is the data your API sends to the client.

To declare a **request** body, you use Pydantic models with all their power and benefits.

we can created Doc string while Creating the Function Itself

```
@app.post("/items/", response_model=Item, summary="Create an item")
async def create_item(item: Item):
    """
    Create an item with all the information:

    - **name**: each item must have a name
    - **description**: a long description
    - **price**: required
    - **tax**: if the item doesn't have tax, you can omit this
    - **tags**: a set of unique tag strings for this item
    """
    return item
```

To make a Path as deprecated

```
@app.get("/elements/", tags=["items"], deprecated=True)
async def read_elements():
    return [{"item_id": "Foo"}]
```

Schema validation with pydantic

We want the user to send only title : str , and content : str , anything else should be rejected

Lets Create a Pydantic Class , it is from the BaseModel Class

```
from pydantic import BaseModel


# Creating a Pydantic Class for Data Validation
class Post(BaseModel):
    title: str
    content: str
```

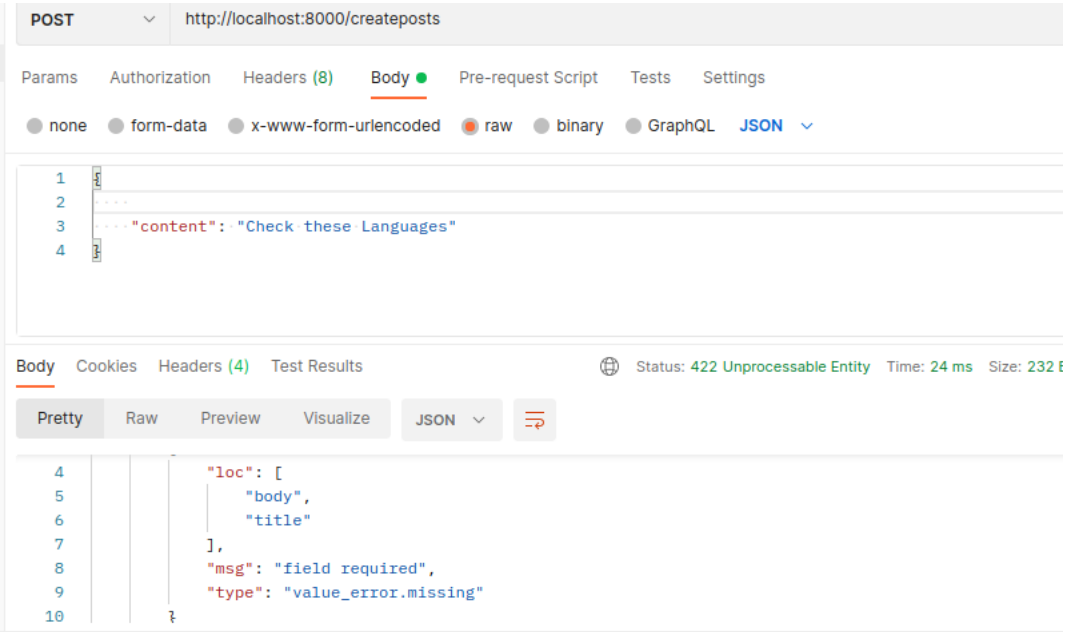
Lets Update the Route Code

```
@app.post("/createposts")
def  create_post(new_post:Post):   # we are providing a parameter called new_post which is of type Post Pydantic Class
    print(new_post)
    print(type(new_post))
    return {"data": new_post}  # we are returning the data in the Dict Format ,

when we check type of the data , it will be Post Class

title='Top 10 Languages in 2022' content='Check these Languages'
<class 'main.Post'>
```

To Extract Values from new_post we have access the attributes using the dot operator

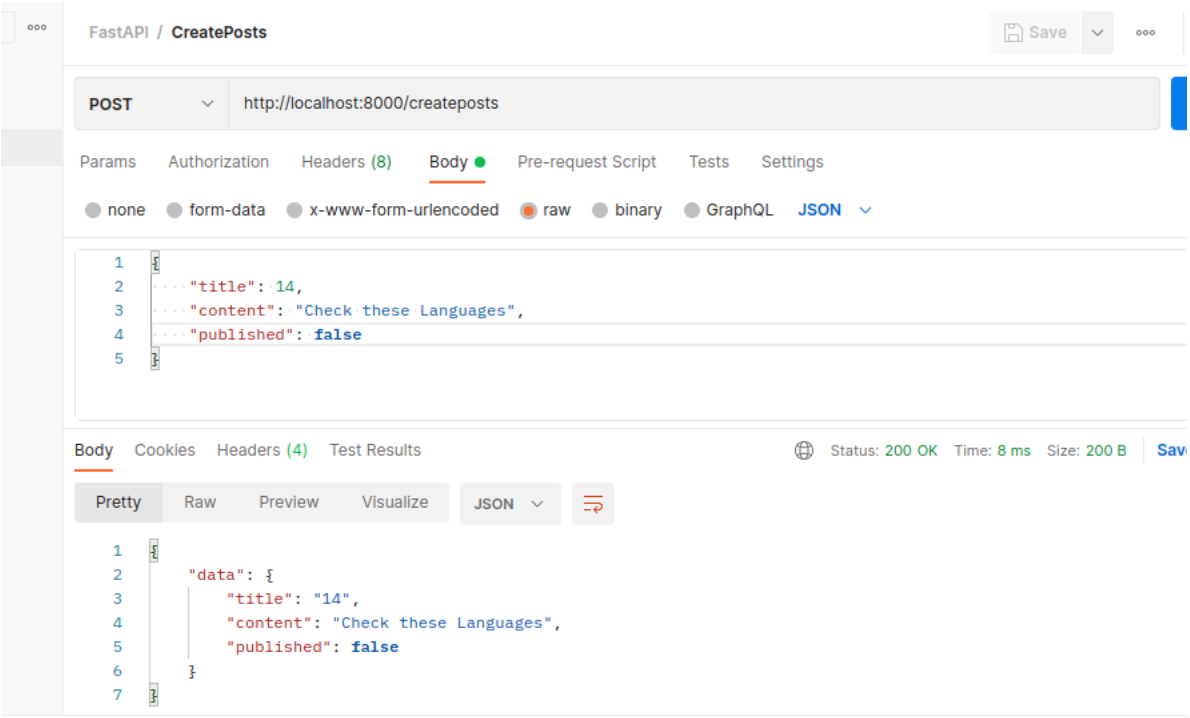
```
print(new_post.title)
```

Lets Check if we dont send the value using the postman , it will through the Error Message as below . it performs the validation automatically and throws the error



Lets Update our pydantic Class to include a optional Field , if the user choose the value , value will be used and if not default value will be used

```
# Creating a Pydantic Class for Data Validation
class Post(BaseModel):
    title: str
    content: str
    published: bool = True

# if user provided a value for published it will be used else default option wll be used
```



If the user didnt provided any data for a field we are going to make it as None

```
# Creating a Pydantic Class for Data Validation
class Post(BaseModel):
    title: str
    content: str
    published: bool = True
    rating: Optional[int] = None
```

Each Pydantic Model has a Method Called Dict

```
print(new_post.dict())
```

we can use the Field() in our pydantic model as well

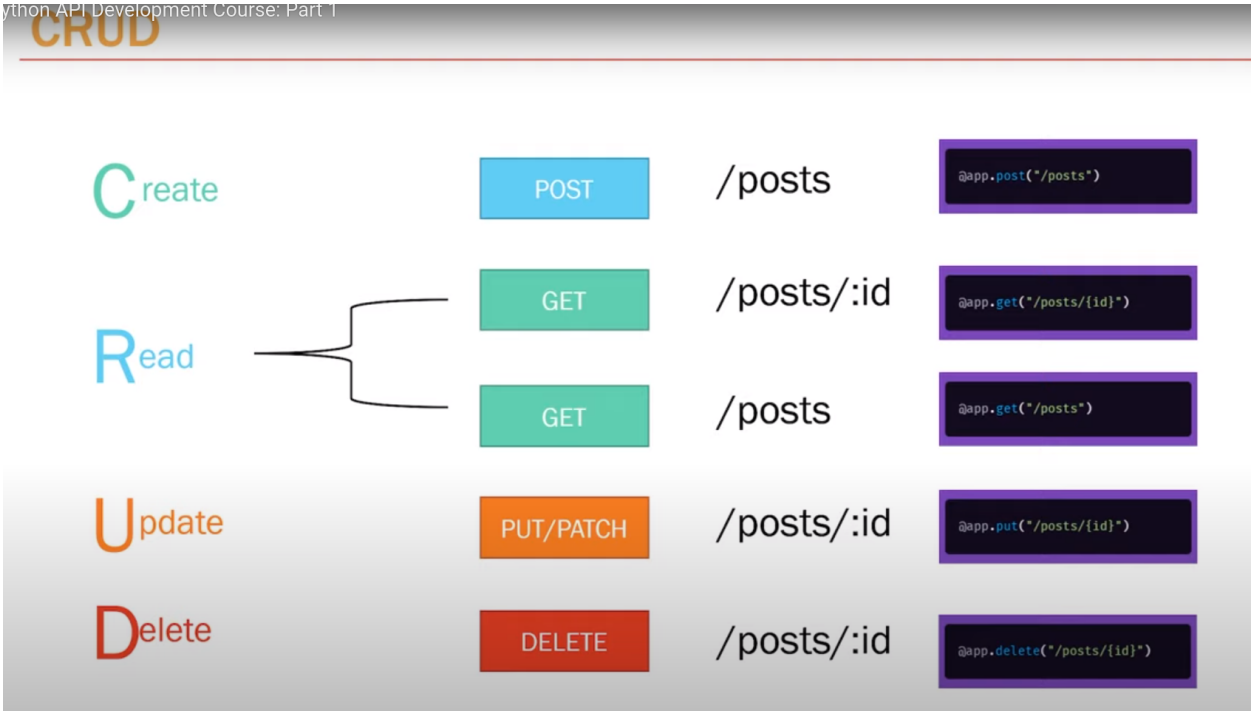
```
class Item(BaseModel):
    name: str
    description: Optional[str] = Field(
        None, title="The description of the item", max_length=300
    )
    price: float = Field(..., gt=0, description="The price must be greater than zero")
    tax: Optional[float] = None

# Here description is a Field and we define additional metadata and length condition
```

we can declare the response model from the endpoint

```
# we are returning list of Item Objects
@app.get("/items/", response_model=List[Item])
async def read_items():
    return items


# we can have union of two Object Models
@app.get("/items/{item_id}", response_model=Union[PlaneItem, CarItem])
async def read_item(item_id: str):
```

```
    return items[item_id]

# it can Union or anyOf  Union or anyOf



from fastapi import FastAPI, status
@app.post("/items/", status_code=status.HTTP_201_CREATED)
async def create_item(name: str):
    return {"name": name}
```

Lets Perform CRUD Operation



Always use Plurals thats the Standard Convention

Update - Put will change all the Fields

update - Patch will update only the specific Fields

We are storing all of our data in Memory Temporarily later we will be using the database

```
# Store Variables temporarily
my_posts = [
    {"title": "My Initial Post", "content":"My First Content", "id": 1}
]

@app.get("/posts")
def posts():
    return {"message": my_posts}

@app.post("/posts")
def  create_post(post:Post):
    print(post)
    print(type(post))
    print(post.dict())
    post_dict = post.dict()
    post_dict['id'] = randrange(0,100000)
    my_posts.append(post_dict)
    return {"data": post}
```

lets Get a Single Post

```
def find_post(id):
    for post in my_posts:
        if post["id"] == id :
            return post

@app.get('/posts/{id}')
def get_post(id):
    print(id)
    post = find_post(int(id))
    return {"data": post}
```

instead of us converting to particular datatype we can give this to Fast Api

```
@app.get('/posts/{id}')
def get_post(id:int):  # here we are telling FASTAPI we want ID as an integer , so fastapi will automaticallyu convert the values when need
    print(id)
    post = find_post(id)
    return {"data": post}
```

Path Order Matters

```
@app.get('/posts/{id}')
@app.get('/posts/latest')

latest will never be executed and it always Throw the Error
So CareFul on the Order
```

Updating the Status Code

```
@app.get('/posts/{id}')
def get_post(id:int, response: Response):
    print(id)
    post = find_post(id)
    if not post:
        response.status_code = status.HTTP_404_NOT_FOUND
        return {"message", f"post with id {id} not Found"}
    return {"data": post}
```

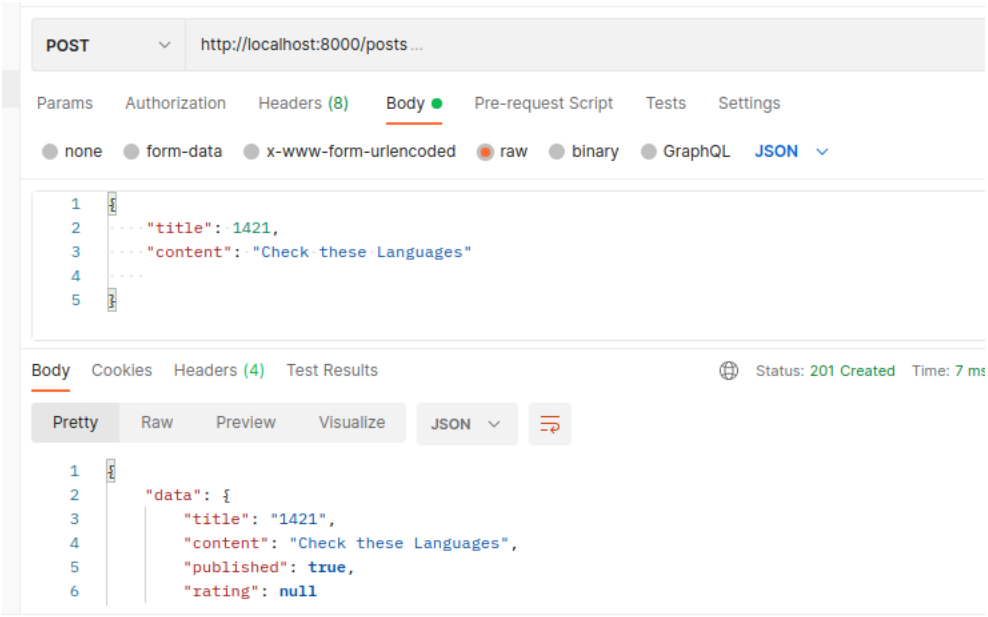
Lets Update the Above Code using Fast API HTTP Methods

```
@app.get('/posts/{id}')
def get_post(id:int, response: Response):
    print(id)
    post = find_post(id)
    if not post:
        raise HTTPException(status_code=HTTP_404_NOT_FOUND, detail=f"post with id {id} is not Found")
    return {"data": post}
```

Here we are calling the FASTAPI HTTPException method , which makes the code more cleaner

Lets udpate the status code

```
@app.post("/posts", status_code=status.HTTP_201_CREATED)
def  create_post(post:Post):
    print(post)
    print(type(post))
    print(post.dict())
    post_dict = post.dict()
    post_dict['id'] = randrange(0,100000)
    my_posts.append(post_dict)
    return {"data": post}

status_code=status.HTTP_201_CREATED  ==> Using this we can update the status code to 201 which means we create a resource sucessfully
```



Delete

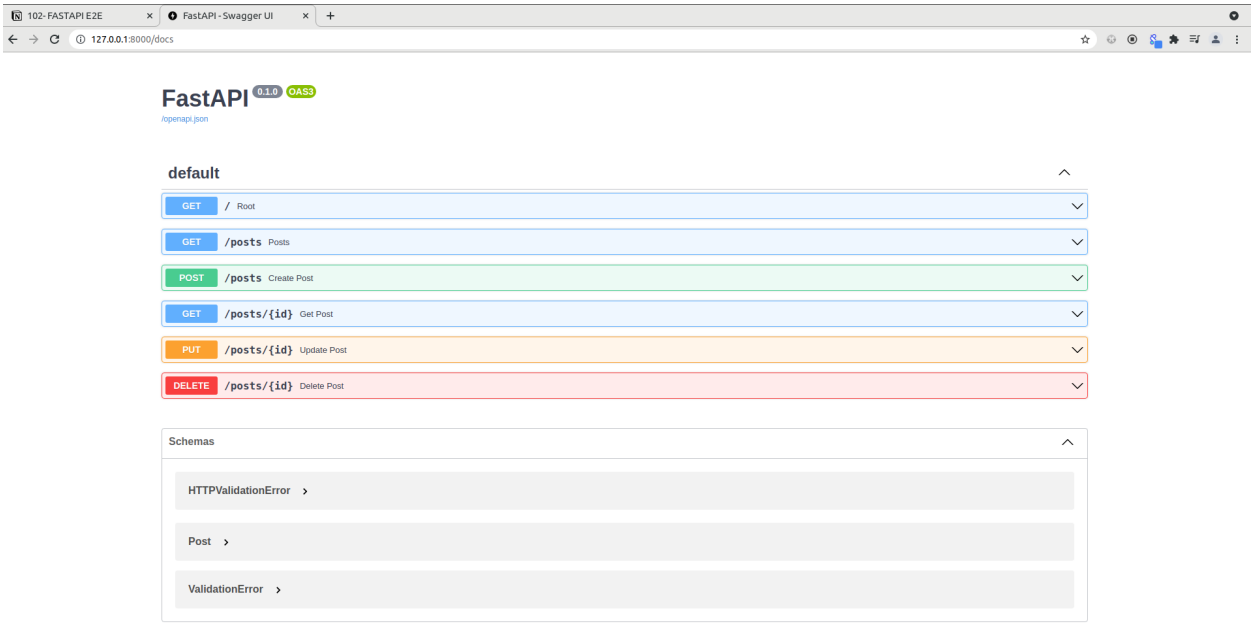
```
def find_post(id):
    for post in my_posts:
        if post["id"] == id :
            return post
def find_index_post(id):
    for index, post in enumerate(my_posts):
        if post['id'] == id:
            return index


@app.delete("/posts/{id}", status_code=status.HTTP_204_NO_CONTENT)
def delete_post(id: int):
    # find the index in the array that has the id
    index = find_index_post(id)
    # remove the Id from the array
    if index == None:
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail=f"id {id} doesnot exist")
    my_posts.pop(index)
    return Response(status_code=status.HTTP_204_NO_CONTENT)
```

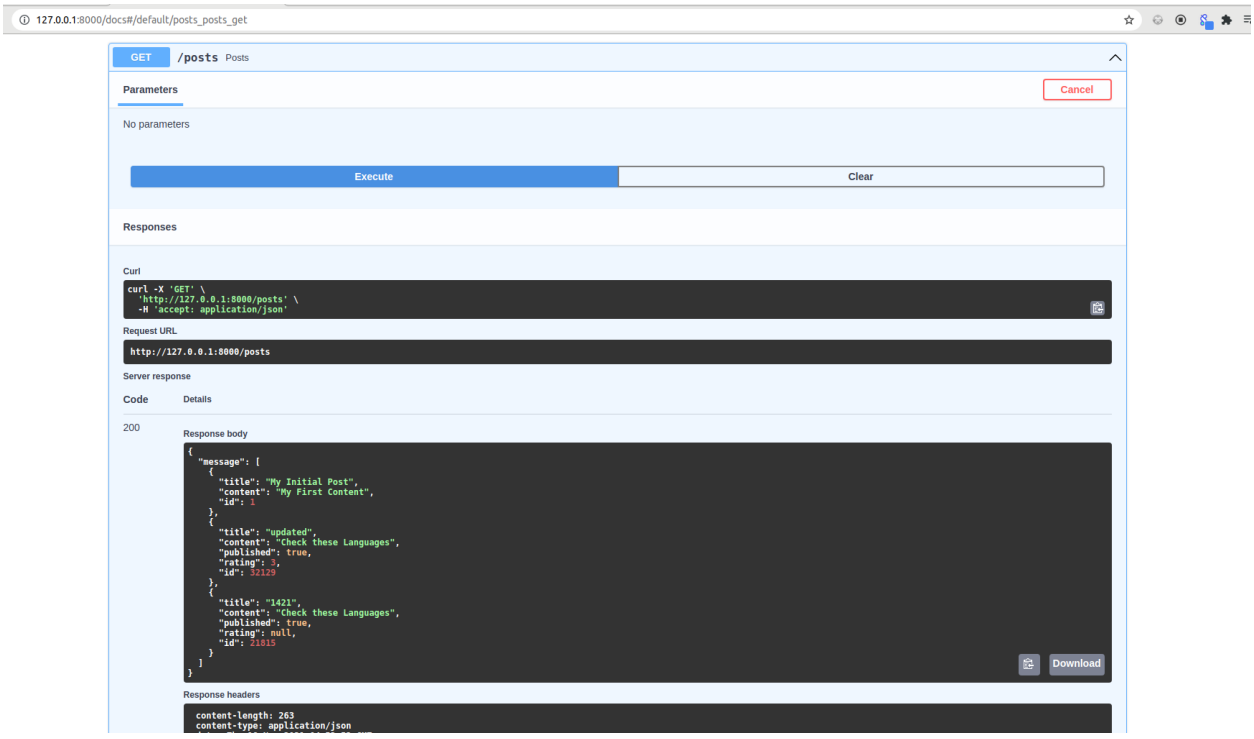
Update

```
@app.put("/posts/{id}")
def update_post(id:int, post:Post):
    print(post)
    index = find_index_post(id)
    if index == None:
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail=f"post with id {id} doesnot exists")
```

```
    post_dict = post.dict()
    post_dict['id'] = id
    my_posts[index] = post_dict
    return {'data': post_dict}
```

Builtin Support For Documentation





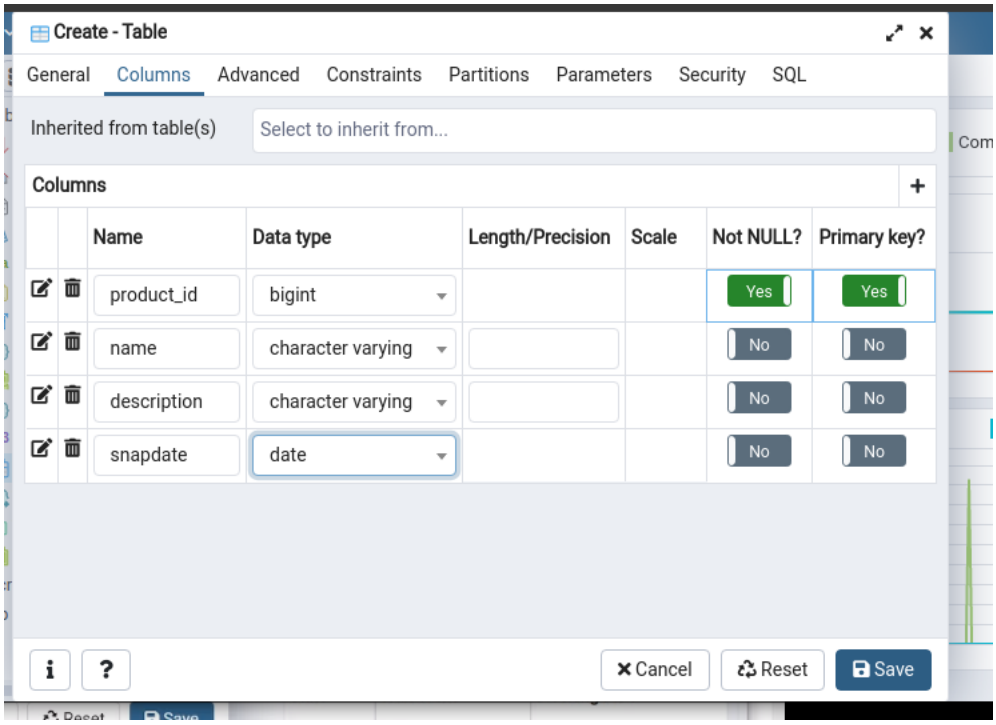
Lets Create a Folder app and move our main.py file over there

```
uvicorn app.main:app --reload
```

```
PROBLEMS  OUTPUT  TERMINAL  DEBUG CONSOLE                                    python3
INFO:     Shutting down
INFO:     Waiting for application shutdown.
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$ uvicorn app.main:app --reload
INFO:     Will watch for changes in these directories: ['/home/esak/esak_2022/learnapi_beginners']
INFO:     Uvicorn running on http://127.0.0.1:8000 (Press CTRL+C to quit)
INFO:     Started reloader process [10586] using watchgod
INFO:     Started server process [10588]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
```

Database

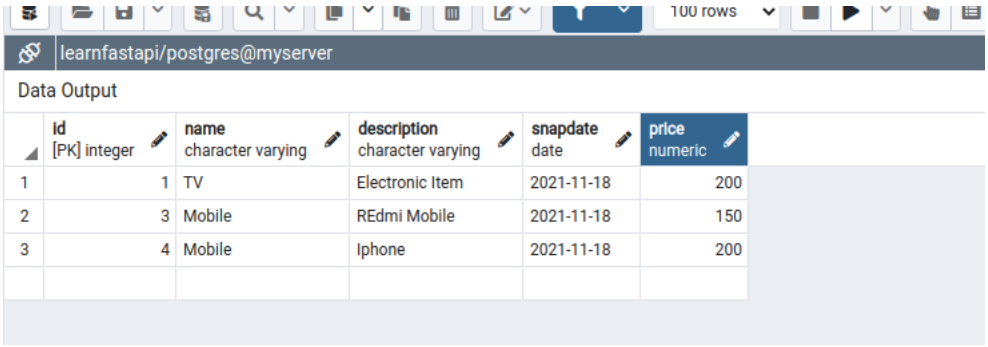
we are creating a sample table called products



Equivalent Code

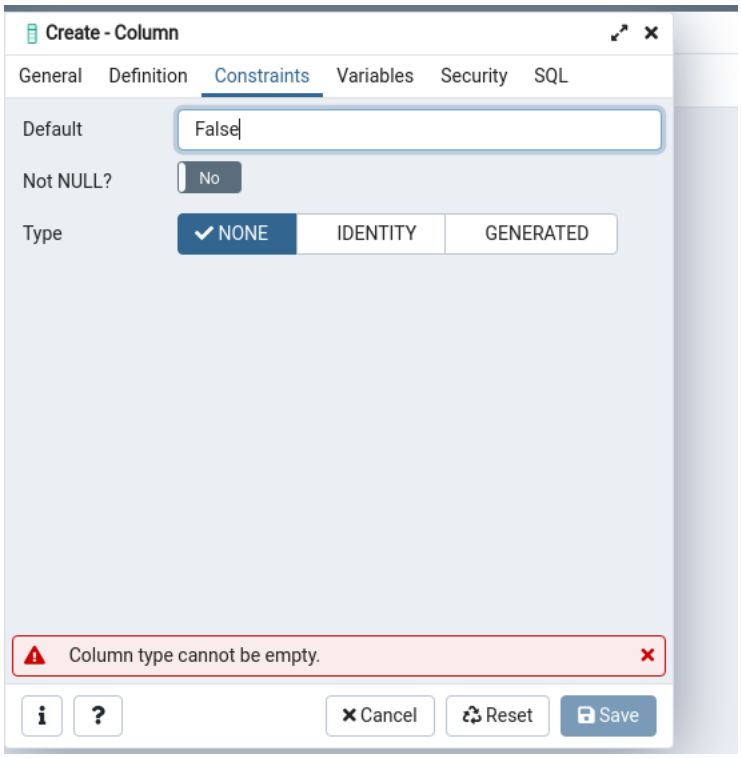
```
CREATE TABLE IF NOT EXISTS public.products
(
    id serial NOT NULL,  ------> For performing auto increment we have to use the serial
    name character varying,
    description character varying,
    snapdate date,
    price numeric,
    PRIMARY KEY (id)
);

ALTER TABLE public.products
    OWNER to postgres;
```

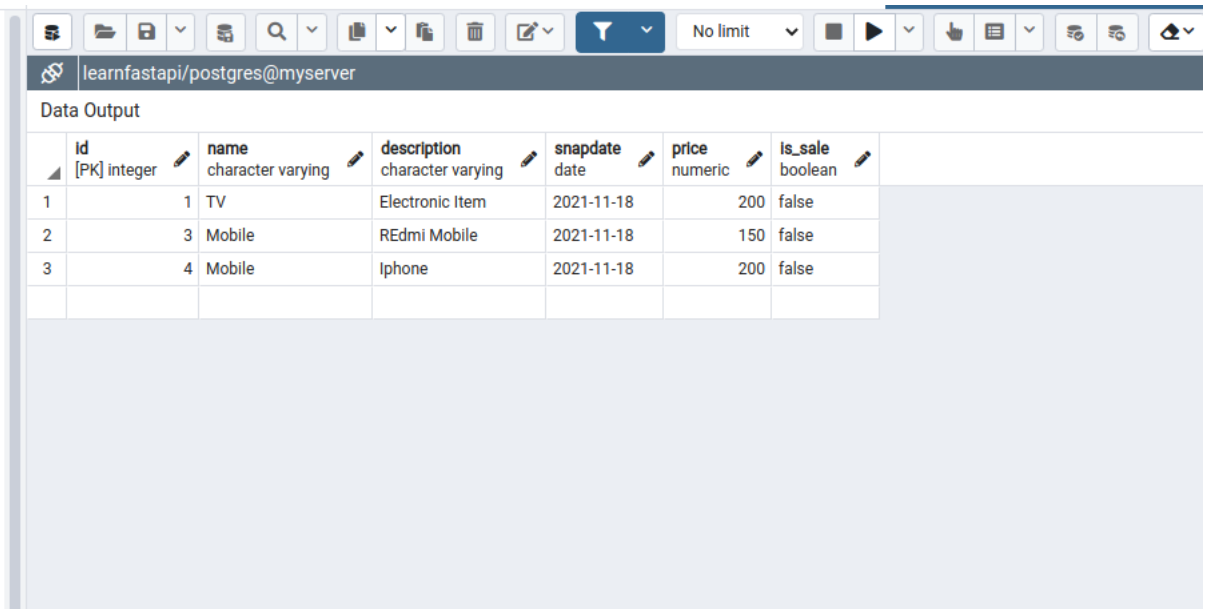
lets add some data



	id [PK] integer	name character varying	description character varying	snapdate date	price numeric
1	1	TV	Electronic Item	2021-11-18	200
2	3	Mobile	REdmi Mobile	2021-11-18	150
3	4	Mobile	Iphone	2021-11-18	200

Lets Add Another Column

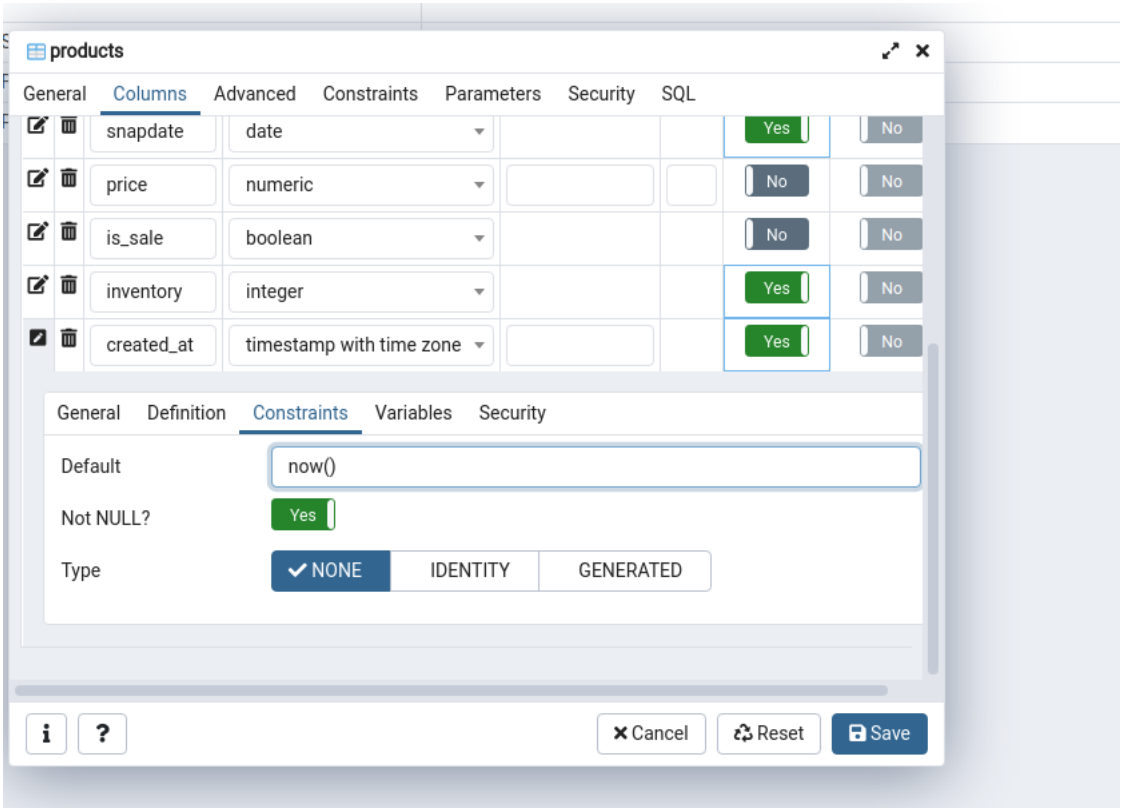




	id [PK] integer	name character varying	description character varying	snapdate date	price numeric	is_sale boolean
1	1	TV	Electronic Item	2021-11-18	200	false
2	3	Mobile	REdmi Mobile	2021-11-18	150	false
3	4	Mobile	Iphone	2021-11-18	200	false

Now the Constraint has been added sucessfully

we have added a timestamp field and we want postgress to fill it up . so we have added a default constraint called now()



We can add the data using the SQL statement

```
INSERT INTO products(name, description, price, is_sale, inventory)
VALUES('Laptop acer', 'Acer Laptop', 234, 'true', 213)
```

we want our api to have the original Data , as of now postgress is returning 1 for sucess o for failure

```
INSERT INTO products(name, description, price, is_sale, inventory)
VALUES('Laptop Sony', 'Sony Laptop', 234, 'true', 3) returning * ;
```

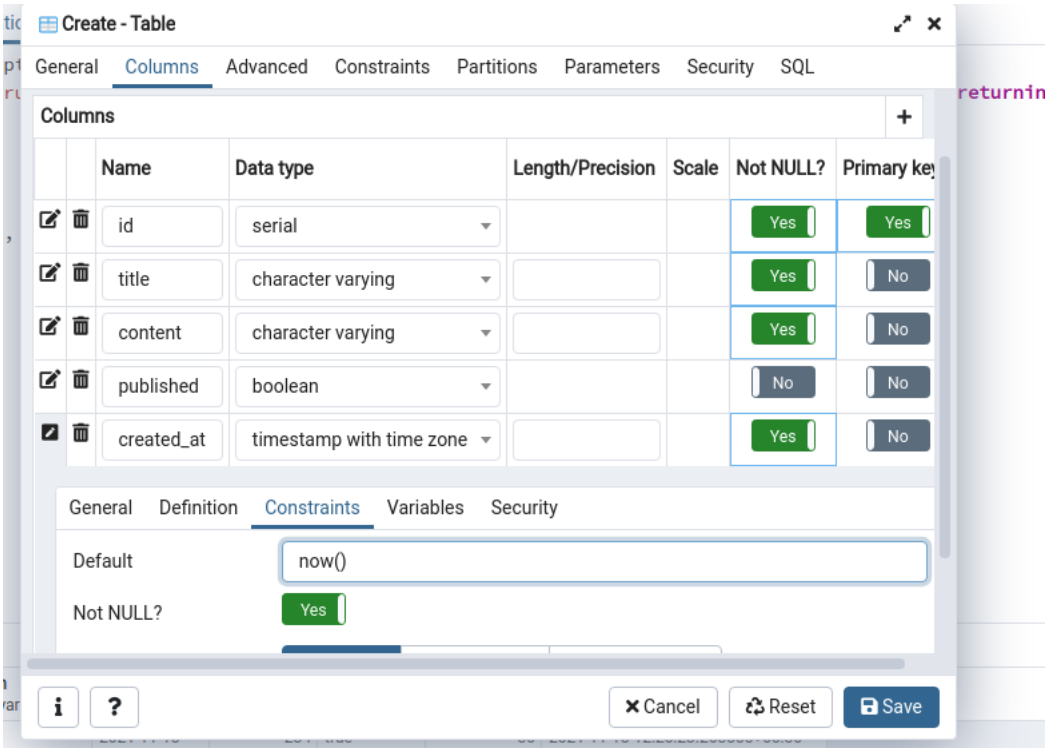
Adding Multiple values

```
INSERT INTO products(name, description, price, is_sale, inventory)
UpVALUES ('Shoe', 'Reebok', 234, 'true', 30) , ('shoe', 'Adidas', 300, 'true', 50) , ('shoe', 'spark', 25, 'true', 200) returning * ;Update
da
```

update

```
UPDATE products
SET description = 'spark - local', price = 30
WHERE id = 13 RETURNING *;
```

Working With Database With Python



Downloading and Installing Postgress driver

```
pip install psycopg2
```

To check the Connection

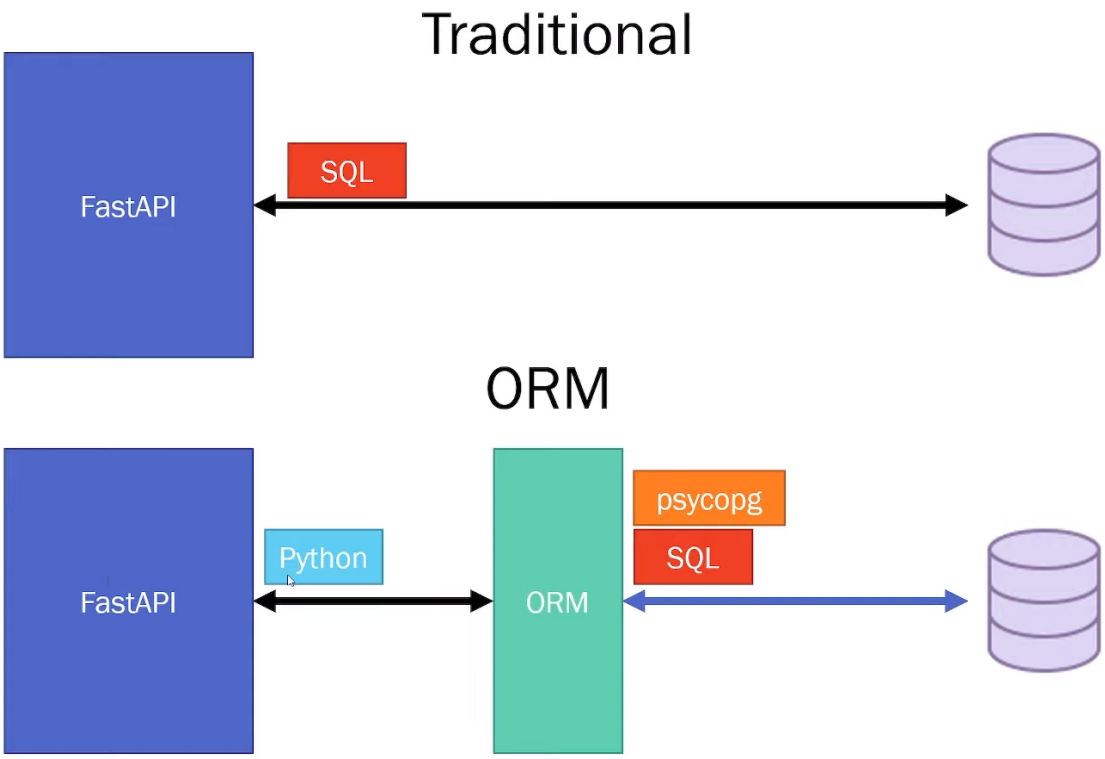
```
# Create Connection
while True:
    try:
        conn = psycopg2.connect(host ='localhost', database = 'learnfastapi',
        user='postgres', password='esak@123',  cursor_factory=RealDictCursor)
        cursor = conn.cursor()
        print("INFO: Database Connection was successfull")
        break
    except Exception as error:
        print(f"ERROR: {error}")
        print("ERROR: Connection FAILED")
        time.sleep(5)
```

Lets Retrieve all the data from the database

```
@app.get("/posts")
def posts():
    cursor.execute(""" SELECT * FROM posts""")
    posts = cursor.fetchall()
    return {"message": posts}


@app.post("/posts", status_code=status.HTTP_201_CREATED)
def  create_post(post:Post):
    cursor.execute(""" INSERT INTO posts (title, content, published )
              VALUES (%s, %s, %s ) RETURNING * """, (post.title, post.content, post.published))
    new_posts = cursor.fetchone()
    conn.commit()
    return {"data": new_posts}

@app.get('/posts/{id}')
def get_post(id:int):
    cursor.execute(""" SELECT * FROM POSTS WHERE id =  %s """, (str(id)))
    post = cursor.fetchone()
    if not post:
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND,
                detail=f"post with id {id} is not Found")
    return {"data": post}

@app.delete("/posts/{id}", status_code=status.HTTP_204_NO_CONTENT)
def delete_post(id: int):
    cursor.execute(""" DELETE FROM POSTS WHERE id = %s RETURNING * """, (str(id), ))
    post = cursor.fetchone()
    if post == None:
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail=f"id {id} doesnot exist")
    conn.commit()
    return Response(status_code=status.HTTP_204_NO_CONTENT)


@app.put("/posts/{id}")
def update_post(id:int, post:Post):
    cursor.execute( """ UPDATE POSTS SET TITLE = %s , CONTENT=%s, PUBLISHED=%s
                    WHERE id = %s RETURNING * """,
                            (post.title, post.content, post.published, str(id)) )
    post = cursor.fetchone()

    if post == None:
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail=f"post with id {id} doesnot exists")
    conn.commit()
    return {'data': post}
```

USING ORM

We perform all SQL operation using Python Code itself.



We can define Tables as python models

queries can be made exclusive through python code

sqlalachemy is one of the most popular ORM

install SQLAlchemy

```
pip install sqlalchemy
```

```
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$ pip install sqlalchemy
Collecting sqlalchemy
  Downloading SQLAlchemy-1.4.27-cp39-cp39-manylinux_2_5_x86_64.manylinux1_x86_64.manylinux_2_17_x86_64.manylinux2014_x86_64.whl (1.6 MB)
     |████████████████████████████████| 1.6 MB 5.2 MB/s
Collecting greenlet!=0.4.17
  Downloading greenlet-1.1.2-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (153 kB)
     |████████████████████████████████| 153 kB 8.1 MB/s
Installing collected packages: greenlet, sqlalchemy
Successfully installed greenlet-1.1.2 sqlalchemy-1.4.27
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$
```

Lets Create a new File called database.py

```
from sqlalchemy import create_engine
from sqlalchemy.ext.declarative import declarative_base
from sqlalchemy.orm import sessionmaker

SQLALCHEMY_DATABASE_URL = "postgresql://postgres:esak@123@localhost/learnfastapi"

engine = create_engine(SQLALCHEMY_DATABASE_URL)

SessionLocal = sessionmaker(autocommit=False, autoflush=False, bind=engine)

Base = declarative_base()
```

Lets Define our models

```
from typing import ContextManager

from sqlalchemy.sql.expression import null
from sqlalchemy.sql.sqltypes import String
from .database import Base
from sqlalchemy import Column, Integer, String, Boolean
class  Post(Base):
    __tablename__ = "posts"

    id = Column(Integer, primary_key=True, nullable=False)
    title = Column(String, nullable=False)
    content = Column(String, nullable=False)
    published = Column(Boolean, default=True)
```

```
 __tablename__ = "posts"    will be created in Postgress , this is the table name inside postgress
all the models has to be extended from the BASE Class
```

Go to the maon.py File and add the below lIne

```
models.Base.metadata.create_all(bind=engine)

this will create models in postgress automatically if the table is not exists
```

Lets Create a Dependency

Every Time we get the Request we are getting the Session Object and we issue the SQL Command and we close the Database Connection.

```
from . import models
from .database import SessionLocal, engine

# creating Dependency
def get_db():
    db = SessionLocal()
    try:
        yield db
    finally:
        db.close()
```

Lets Update the Path Parameters

```
@app.get('/sql')
def get_posts(db:Session = Depends(get_db)):
    return {'message': "Sucess"}
```

Lets Update Our published Column to Have default constraints as True . Add the Below Line to our Model

```
published = Column(Boolean, server_default='TRUE', nullable=False)
```

This wont Make any Changes to the Table in Postgress. Sqlalchmey is not intelligent enough to make changes to the database. So we have use another software called **alembic . For Doing Migrations we have to use the ALEMBIC**

Lets

Lets Lets Update the Path

```
@app.get('/api/v1/posts')
def get_posts(db:Session = Depends(get_db)):
    # lets Access the databse Object
    posts = db.query(models.Post).all()
    return {'data': posts}
```

we are updating the Database using the ORM Models

```
@app.post('/api/v1/posts', status_code=status.HTTP_201_CREATED)
def create_posts(post:Post, db:Session = Depends(get_db)):
    # lets Access the databse Object
    new_posts = models.Post(title= post.title, content=post.content, published=post.published)
    # lets add this Post to Database
    db.add(new_posts)
    # Lets Commit the changes
    db.commit()
    # Lets Return the Updated data
    db.refresh(new_posts)

    return {'data': new_posts}
```

If we have 50 Plus column in our database we cant go and edit one by one instead we can unpack the dict like below

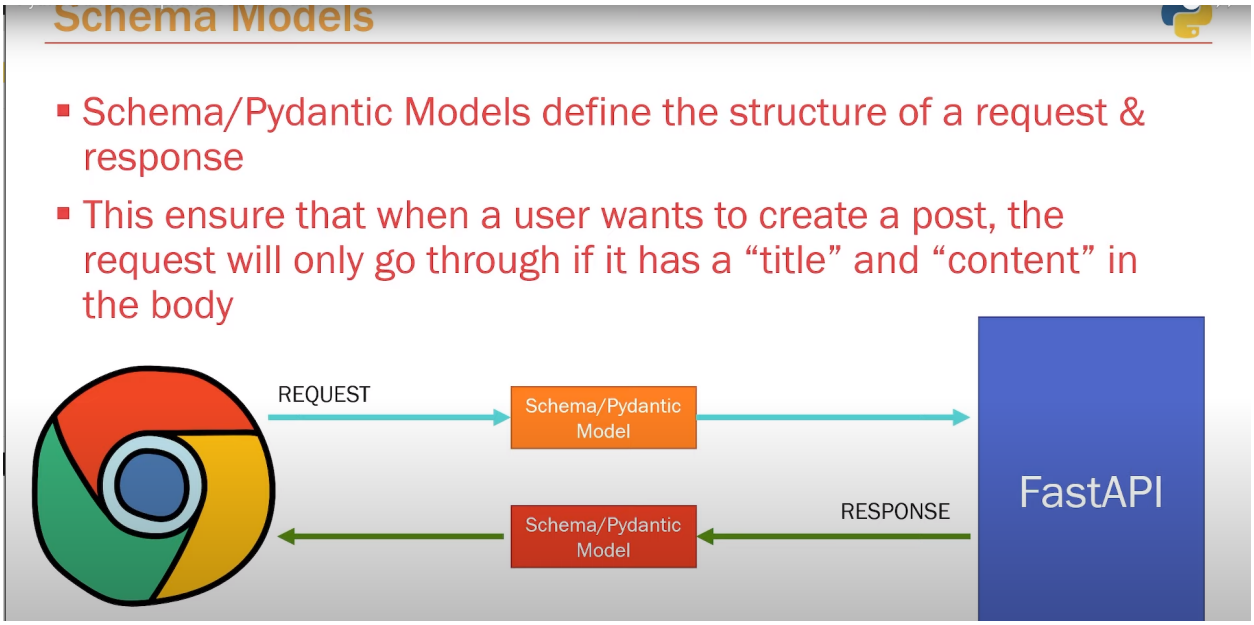
```
new_posts = models.Post(**post.dict())
```

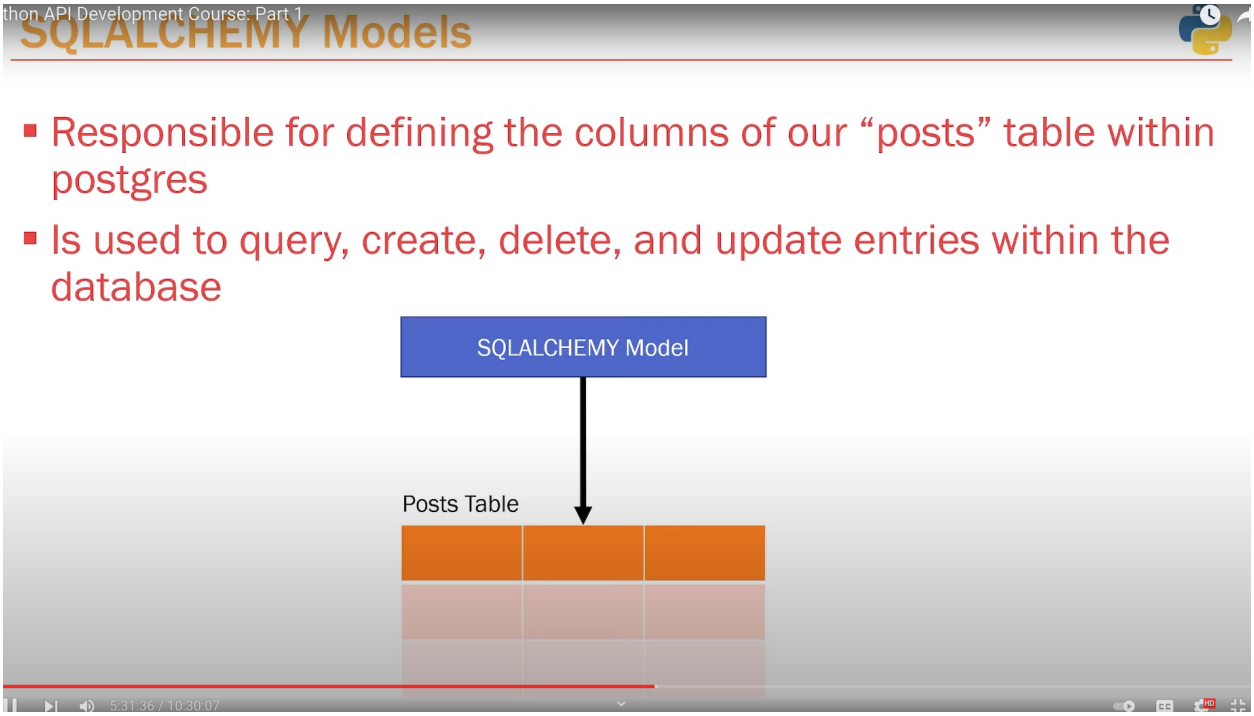
CRUD Operation

```
@app.get('/api/v1/posts')
def get_posts(db:Session = Depends(get_db)):
    # lets Access the databse Object
    posts = db.query(models.Post).all()
    return {'data': posts}

@app.post('/api/v1/posts', status_code=status.HTTP_201_CREATED)
def create_posts(post:Post , db:Session = Depends(get_db)):
    # lets Access the databse Object
    #new_posts = models.Post(title= post.title, content=post.content, published=post.published)
    new_posts = models.Post(**post.dict())
    # lets add this Post to Database
    db.add(new_posts)
    # Lets Commit the changes
    db.commit()
    # Lets Return the Updated data
    db.refresh(new_posts)

    return {'data': new_posts}



@app.get("/api/v1/posts/{id}")
def get_post(id:int, db:Session = Depends(get_db)):
    post = db.query(models.Post).filter(models.Post.id == id).first()
    if post is None:
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail="POst ID {id} is not created")
    return {"data": post}

@app.put("/api/v1/posts/{id}")
def update_post(id:int, post: Post, db:Session = Depends(get_db)):
    post_query = db.query(models.Post).filter(models.Post.id == id )
    dbpost = post_query.first()
    print(post)

    if dbpost is None:
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail = "POST ID {id} is not Found")

    post_query.update(post.dict(), synchronize_session=False)
    #new_posts = models.Post(**post.dict())

    db.commit()

    return {"data": post_query.first()}
```

```
@app.delete("/api/v1/posts/{id}")
def delete_post(id:int, db:Session = Depends(get_db)):
    post = db.query(models.Post).filter( models.Post.id == id )
    if post.first() is None:
        raise  HTTPException(status_code=HTTP_404_NOT_FOUND, detail= "POST ID {id} is not FOUND ")
    # delete the REcords
    post.delete(synchronize_session=False)
    db.commit()

    return {"data": "deleted"}
```

ORM VS Schema Models





Pydantic Model Deep Dive

Lets Create a New File called schema.py

```
class Post(BaseModel):
    title: str
    content: str
    published: bool = True
```

we can create Different Schema For Different Operation like update and create. Only the Fields satisfied the class property we can update it .

```
class PostBase(BaseModel):
    title: str
    content: str
    published: bool = True

class PostCreate(PostBase):
    pass
```

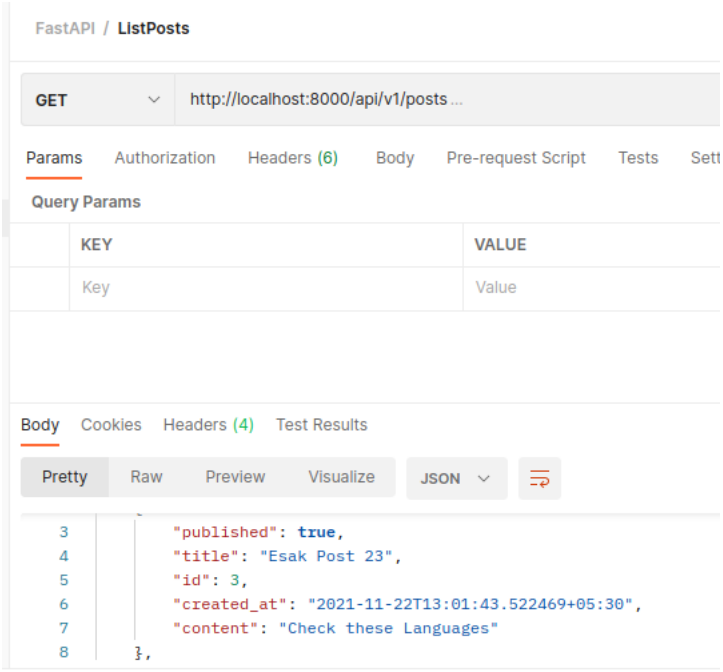
Lets Update the Schema for the response, we don't want to send all the data which returned from the table , we need to short it out.

1. Fastapi Convert the Dict into Json

so instead of return {"data":posts } we can rewrite its as return posts

```
@app.get("/api/v1/posts/{id}")
def get_post(id:int, db:Session = Depends(get_db)):
    post = db.query(models.Post).filter(models.Post.id == id).first()
    if post is None:
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail="POst ID {id} is not created")
    return post
```

2.Handling the Response



I get all the details from the database .

let say we want to restrict it and we done need to display the ID and created_at column

Create a new Schema Class for response

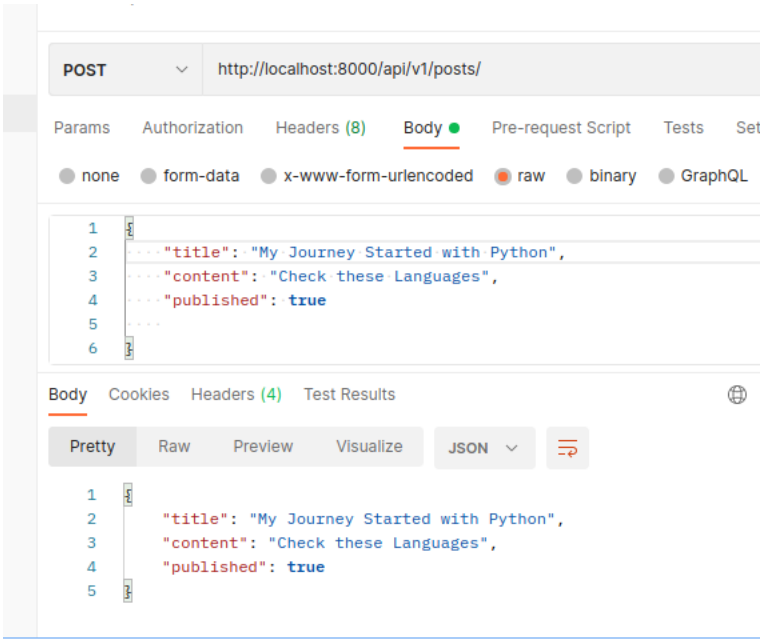
```
class PostResponse(BaseModel):
    title: str
    content:str
    published:bool

we will Get an Error saying like
pydantic.error_wrappers.ValidationError: 1 validation error for PostResponse
response
  value is not a valid dict (type=type_error.dict)

So we will update the PostResponse Class to have the below Code
Pydantic's orm_mode will tell the Pydantic model to read the data even if it is not a dict,
but an ORM model (or any other arbitrary object with attributes).


class PostResponse(BaseModel):
    title: str
    content:str
    published:bool

    class Config:
        orm_mode = True
```

Lets Update out Path Python Code to Handle the response Model

```
@app.post('/api/v1/posts', status_code=status.HTTP_201_CREATED, response_model=schemas.PostResponse)
def create_posts(post:schemas.PostCreate , db:Session = Depends(get_db)):
```

```
    # lets Access the databse Object
    #new_posts = models.Post(title= post.title, content=post.content, published=post.published)
    new_posts = models.Post(**post.dict())
    # lets add this Post to Database
    db.add(new_posts)
    # Lets Commit the changes
    db.commit()
    # Lets Return the Updated data
    db.refresh(new_posts)

    return  new_posts
```

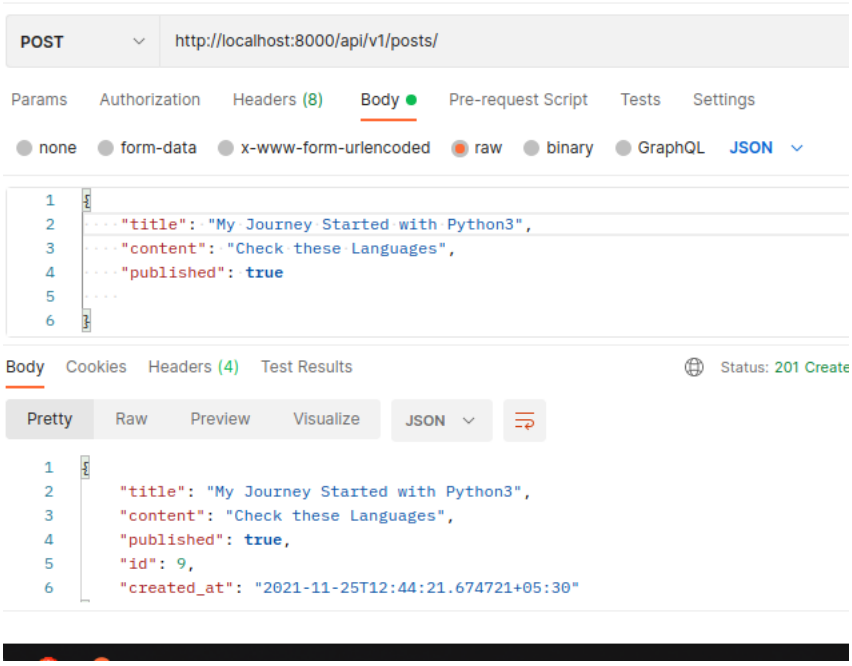
Now if we do a create response , our response will be restricted and we get what we have defined over the class



We dont Get the Id and Created_at Column as expected in our api response

Adding these Column Again and again is a painful task , so Lets Create a base class and we derive all the rquired or minimum field from it

```
All the required Fields
class PostBase(BaseModel):
    title: str
    content: str
    published: bool = True


Create the PostResponse Class
Here we add only the additional Fields

class PostResponse(PostBase):
    id: int
    created_at: datetime

    class Config:
        orm_mode = True
```



Lets add this response Model to the get path

```
@app.get('/api/v1/posts', response_model=schemas.PostResponse)
def get_posts(db:Session = Depends(get_db)):
    # lets Access the databse Object
    posts = db.query(models.Post).all()
    return  posts


we will be getting the Error Message
File "/home/esak/esak_2022/learnapi_beginners/venv/lib/python3.9/site-packages/fastapi/routing.py", line 137, in serialize_response
    raise ValidationError(errors, field.type_)
pydantic.error_wrappers.ValidationError: 4 validation errors for PostResponse
response -> title
  field required (type=value_error.missing)
response -> content
  field required (type=value_error.missing)
response -> id
  field required (type=value_error.missing)
response -> created_at
  field required (type=value_error.missing)
WARNING:  WatchGodReload detected file change in '['/home/esak/esak_2022/learnapi_beginners/app/main.py']'. Reloading...
```

If we understand the code we try to Pull a list of posts from the database . So we need to Mention this In our Response Model instead of saying it like a simple PostResponse , we have to define it as list of PostResponse schema

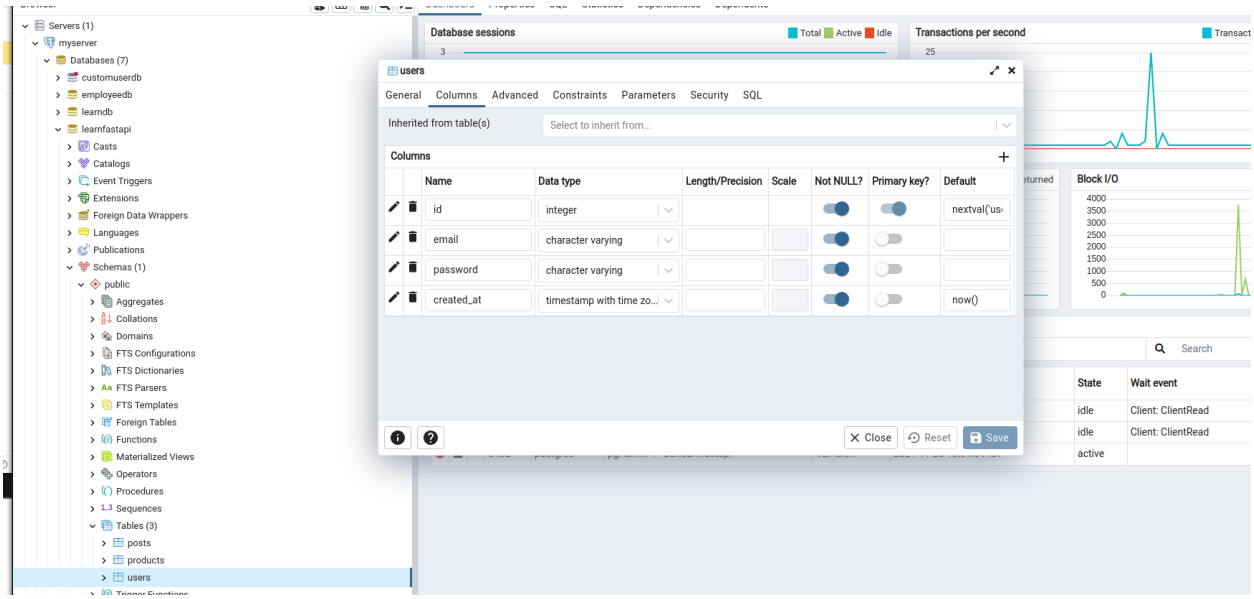
```
@app.get('/api/v1/posts', response_model=List[schemas.PostResponse])
def get_posts(db:Session = Depends(get_db)):
    # lets Access the databse Object
    posts = db.query(models.Post).all()
    return  posts

## response_model=List[schemas.PostResponse] => we are expecting the Respnse to be in this Format
## return posts ==> all the data is convert back to Json Automatically by the fast API
```

Lets Add Users

Lets Create a new User databsae Model

```
class User(Base):
    __tablename__ = "users"

    id = Column(Integer, primary_key=True, nullable=False)
    email = Column(String, nullable=False, unique=True)
    password = Column(String, nullable=False)
    created_at = Column(TIMESTAMP(timezone=True), nullable=False, server_default=text('now()'))
```

Reload the Application and verify the Database



Lets Create Path operation for user

Lets Create a Pydantic Schema

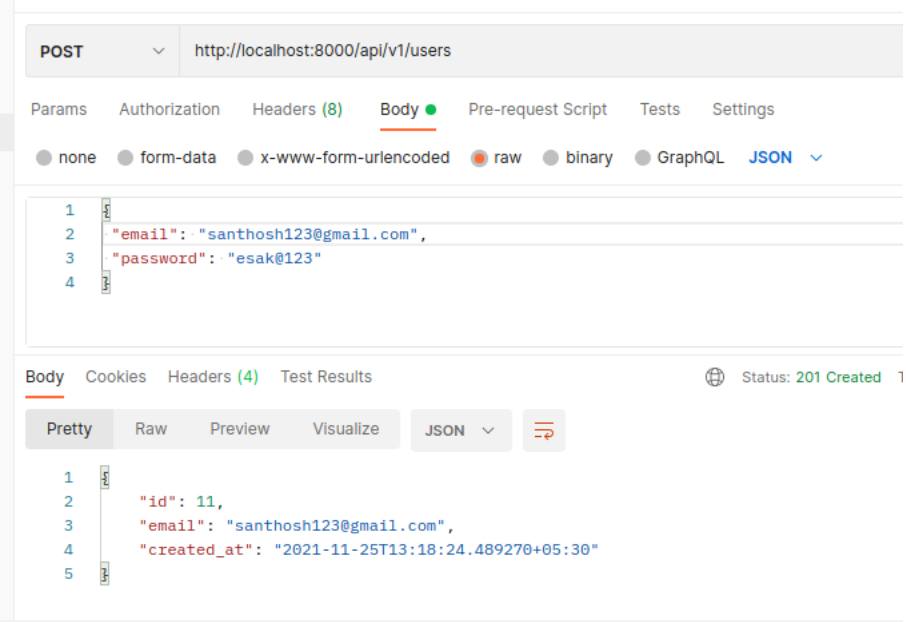
```
class UserCreate(BaseModel):
    email: EmailStr
    password: str

EmailStr  --> will accept an Email , not any punch of Characters
```

Lets Create a new Response Model

```
class UserResponse(BaseModel):
    id: int
    email: EmailStr
    created_at: datetime

    class Config:
        orm_mode = True
```

```
@app.post("/api/v1/users", status_code=status.HTTP_201_CREATED, response_model=schemas.UserResponse)
def create_user(user: schemas.UserCreate, db:Session = Depends(get_db) ):
    new_user = models.User(**user.dict())
```

```
    db.add(new_user)
    db.commit()
    db.refresh(new_user)
    return new_user
```



Hashing the Password

```
For hashing the Password we are going to use the Algorithm called Bcrypt
and we are using the passlib library to that


pip install passlib[bcrypt]
```

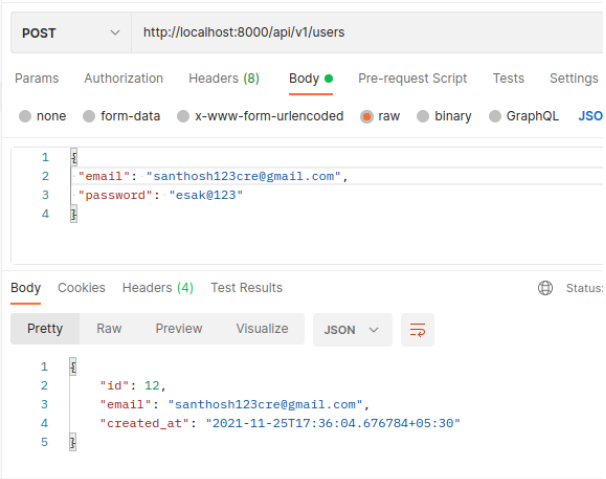
```
INFO:     Stopping reloader process [5207]
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$ pip install passlib[bcrypt]
Collecting passlib[bcrypt]
  Downloading passlib-1.7.4-py2.py3-none-any.whl (525 kB)
     |████████████████████████████████| 525 kB 5.9 MB/s
Collecting bcrypt>=3.1.0
  Downloading bcrypt-3.2.0-cp36-abi3-manylinux2010_x86_64.whl (63 kB)
     |████████████████████████████████| 63 kB 526 kB/s
Collecting cffi>=1.1
  Downloading cffi-1.15.0-cp39-cp39-manylinux_2_12_x86_64.manylinux2010_x86_64.whl (444 kB)
     |████████████████████████████████| 444 kB 4.0 MB/s
Requirement already satisfied: six>=1.4.1 in ./venv/lib/python3.9/site-packages (from bcrypt>=3.1.0->passlib[bcrypt]) (1.16.0)
Collecting pycparser
  Downloading pycparser-2.21-py2.py3-none-any.whl (118 kB)
     |████████████████████████████████| 118 kB 10.2 MB/s
Installing collected packages: pycparser, cffi, passlib, bcrypt
Successfully installed bcrypt-3.2.0 cffi-1.15.0 passlib-1.7.4 pycparser-2.21
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$
```

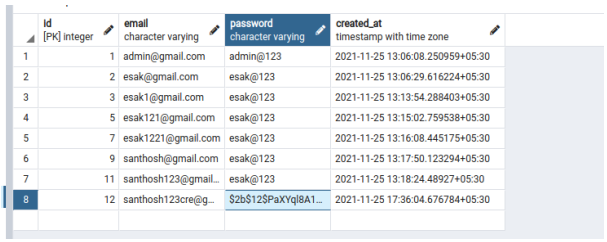
Lets Create the User Password Hashed

```


from passlib.context import CryptContext
pwd_context = CryptContext(schemes=["bcrypt"], deprecated='auto')

@app.post("/api/v1/users", status_code=status.HTTP_201_CREATED, response_model=schemas.UserResponse)
def create_user(user: schemas.UserCreate, db:Session = Depends(get_db) ):

    # Creating the Hashing Password
    hashed_password = pwd_context.hash(user.password)
    # Assign the Hashed Password to the User Object
    user.password = hashed_password
    new_user = models.User(**user.dict())
```

```
    db.add(new_user)
    db.commit()
    db.refresh(new_user)
    return new_user
```

Lets add a new user





	id [PK] integer	email character varying	password character varying	created_at timestamp with time zone
1	1	admin@gmail.com	admin@123	2021-11-25 13:06:08.250959+05:30
2	2	esak@gmail.com	esak@123	2021-11-25 13:06:29.616224+05:30
3	3	esak1@gmail.com	esak@123	2021-11-25 13:13:54.288403+05:30
4	5	esak121@gmail.com	esak@123	2021-11-25 13:15:02.759538+05:30
5	7	esak1221@gmail.com	esak@123	2021-11-25 13:16:08.445175+05:30
6	9	santhosh@gmail.com	esak@123	2021-11-25 13:17:50.123294+05:30
7	11	santhosh123@gmail...	esak@123	2021-11-25 13:18:24.48927+05:30
8	12	santhosh123cre@g...	$2b$12$PaXYql8A1...	2021-11-25 17:36:04.676784+05:30

Now the Password Is hashed

Route For Fetching the User Information

```
@app.get("/api/v1/users/{id}", response_model=schemas.UserResponse)
def get_user(id:int, db:Session = Depends(get_db)):
    db_user = db.query(models.User).filter(models.User.id == id).first()
    print(db_user)
    if  db_user is None:
        raise HTTPException(status_code=HTTP_404_NOT_FOUND, detail=f"User with Id - {id} Not Found")
    return db_user
```

Routers

Lets Split our Path Operation and organize our Code little bit better

```
from fastapi import APIRouter

router = APIRouter()

Now we can call the path Parameters using the aouter Tag
@router.post("/api/v1/users", status_code=status.HTTP_201_CREATED, response_model=schemas.UserResponse)
def create_user(user: schemas.UserCreate, db:Session = Depends(get_db) ):

    # Creating the Hashing Password
    hashed_password = utils.hash(user.password)
    # Assign the Hashed Password to the User Object
    user.password = hashed_password
    new_user = models.User(**user.dict())
    db.add(new_user)
    db.commit()
    db.refresh(new_user)
    return new_user
```

Now add the Below Line to the main File

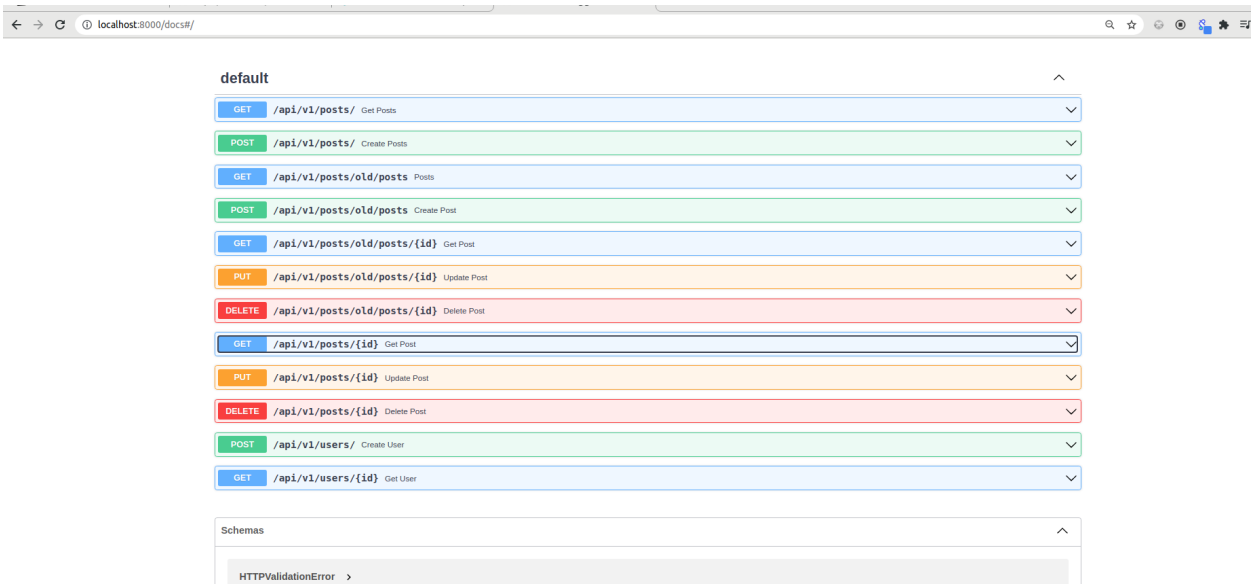
```
app.include_router(post.router)
app.include_router(user.router)

Once the REsponse Comes Here , first It will go to the POST File and look all the routes its has
```

It will be really useful if we have lot of Routes to be add to our Folder

Lets Update the Router

```
"/api/v1/users"   ---> "/"
"/api/v1/users/{id}"  ---> "/{id}"


For Doing this we have to Update the APIRouter() property
# Creating a Router
router = APIRouter(
    prefix='/api/v1/users'
)
```

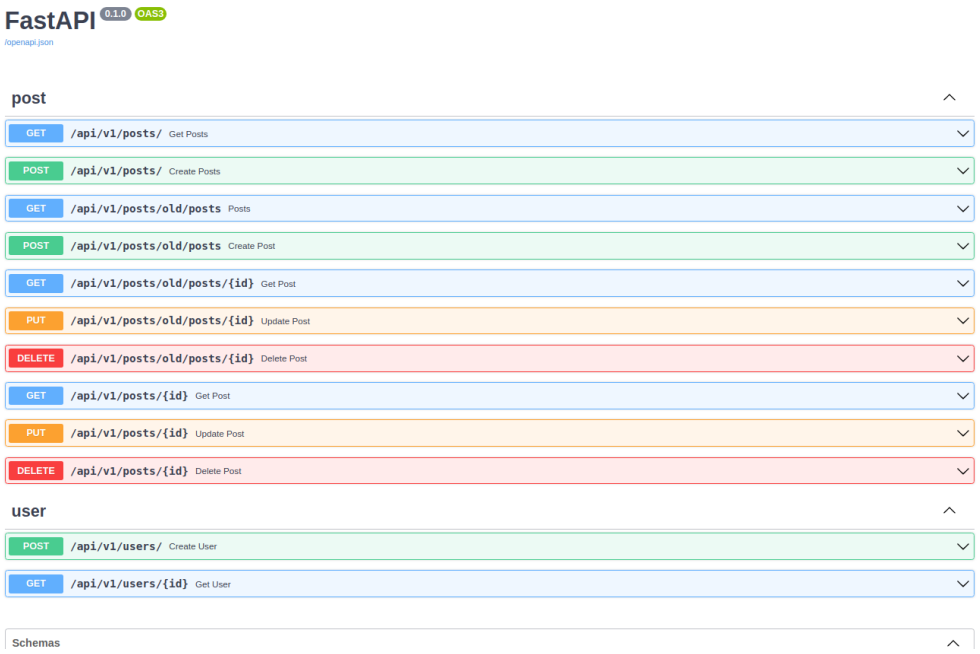
we can check the Swagger Docs as below



we can Group routes based on the responsibility ,

we need to add the below Code

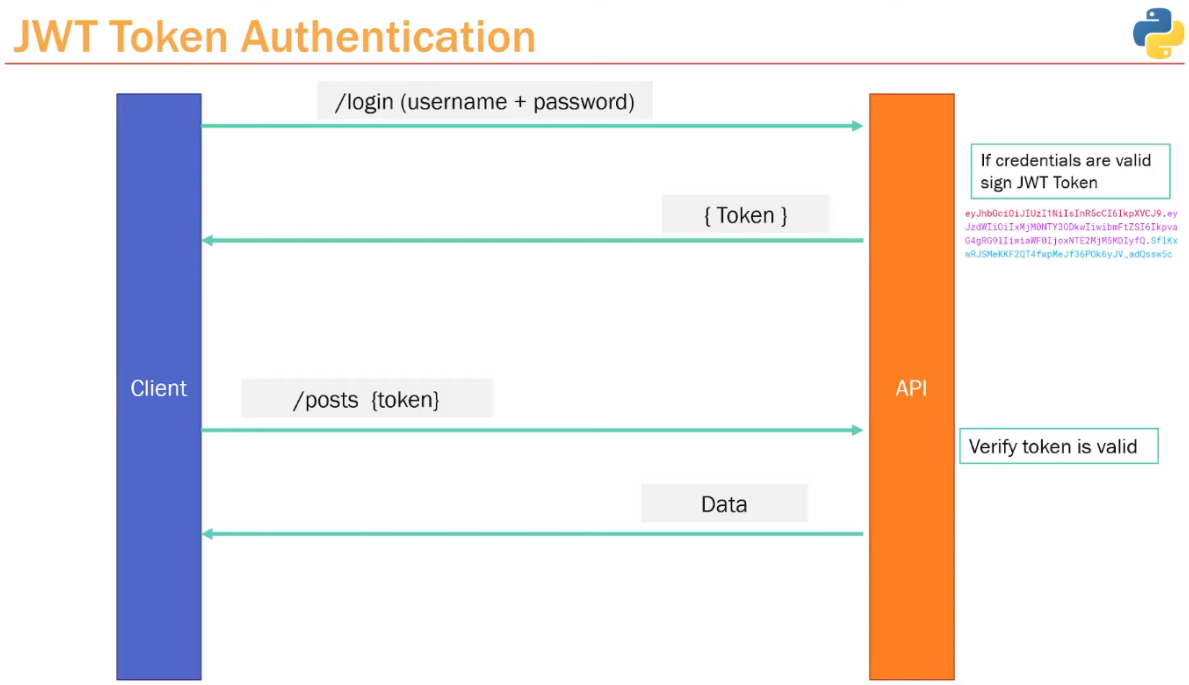
```
router = APIRouter(
    prefix='/api/v1/posts',
    tags= ['post']
)
```



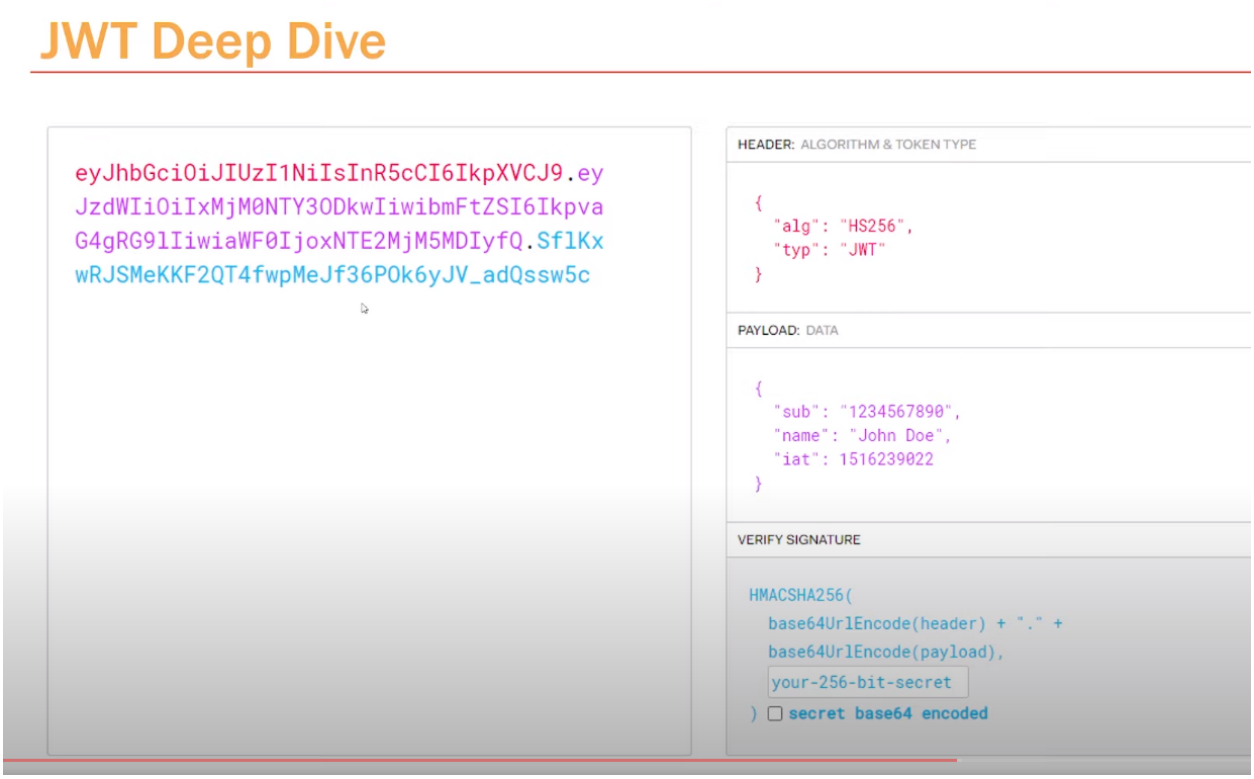
Authentication

we can Authentication in two ways

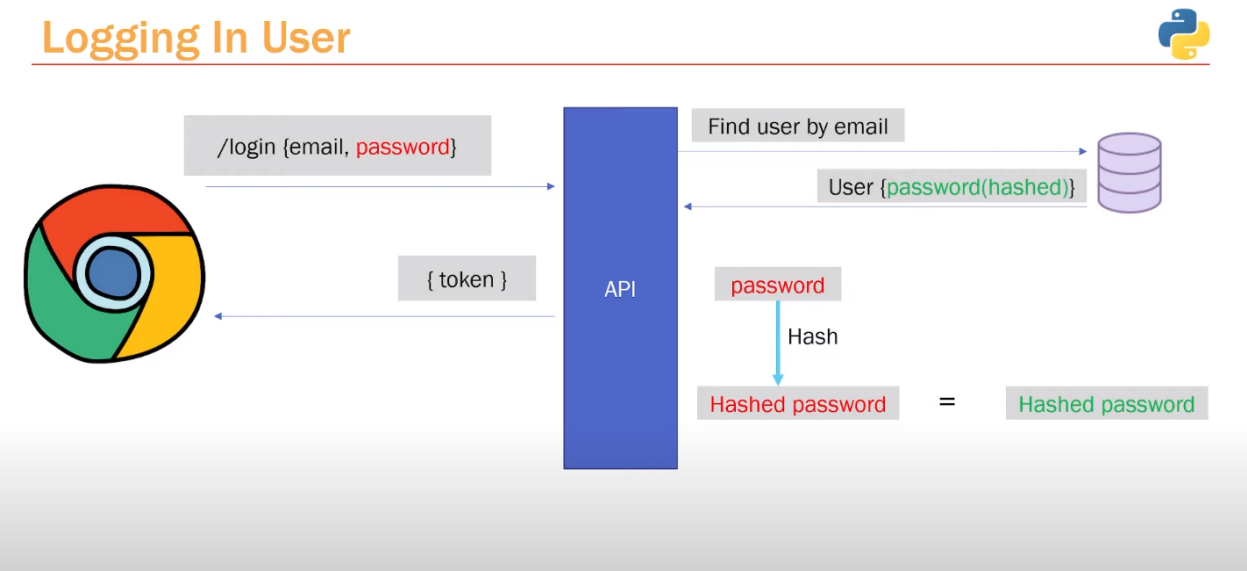
1. Session Based
2. Token based



JWT TOKEN



Logging Route



Lets Create a user Schema to Verify the request

```
# Defining the login Schema

class UserLogin(BaseModel):
    email: EmailStr
    password: str
```

Lets Create the login Routes

```
@router.post('/login')
def login(user_credentials: schemas.UserLogin , db:Session = Depends(get_db)):
    db_user = db.query(models.User).filter(models.User.email == user_credentials.email ).first()
    if db_user is None:
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail="Invalid Credentials")

    # hasing the provided Password
    if not utils.verifyPassword(user_credentials.password, db_user.password):
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail="Invalid Credentials")

    # CReate Token

    return {"Token": "Token"}
```

Lets Create the Token

1. Install python-jose

```
pip install python-jose[cryptography]
```

```
esak@esakpc:~/esak_2022/learnapi_beginners$ source /home/esak/esak_2022/learnapi_beginners/venv/bin/activate
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$ pip install python-jose[cryptography]
Collecting python-jose[cryptography]
  Downloading python_jose-3.3.0-py2.py3-none-any.whl (33 kB)
Collecting ecdsa!=0.15
  Downloading ecdsa-0.17.0-py2.py3-none-any.whl (119 kB)
     |████████████████████████████████| 119 kB 5.2 MB/s
Collecting rsa
  Downloading rsa-4.8-py3-none-any.whl (39 kB)
Collecting pyasn1
  Downloading pyasn1-0.4.8-py2.py3-none-any.whl (77 kB)
     |████████████████████████████████| 77 kB 624 kB/s
Collecting cryptography>=3.4.0
  Downloading cryptography-36.0.0-cp36-abi3-manylinux_2_24_x86_64.whl (3.6 MB)
     |████████████████████████████████| 3.6 MB 7.2 MB/s
Requirement already satisfied: cffi>=1.12 in ./venv/lib/python3.9/site-packages (from cryptography>=3.4.0->python-jose[cryptography]) (1.15.0)
Requirement already satisfied: pycparser in ./venv/lib/python3.9/site-packages (from cffi>=1.12->cryptography>=3.4.0->python-jose[cryptography]) (2.21)
Requirement already satisfied: six>=1.9.0 in ./venv/lib/python3.9/site-packages (from ecdsa!=0.15->python-jose[cryptography]) (1.16.0)
Installing collected packages: pyasn1, rsa, ecdsa, python-jose, cryptography
Successfully installed cryptography-36.0.0 ecdsa-0.17.0 pyasn1-0.4.8 python-jose-3.3.0 rsa-4.8
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$
```

Lets Create Function

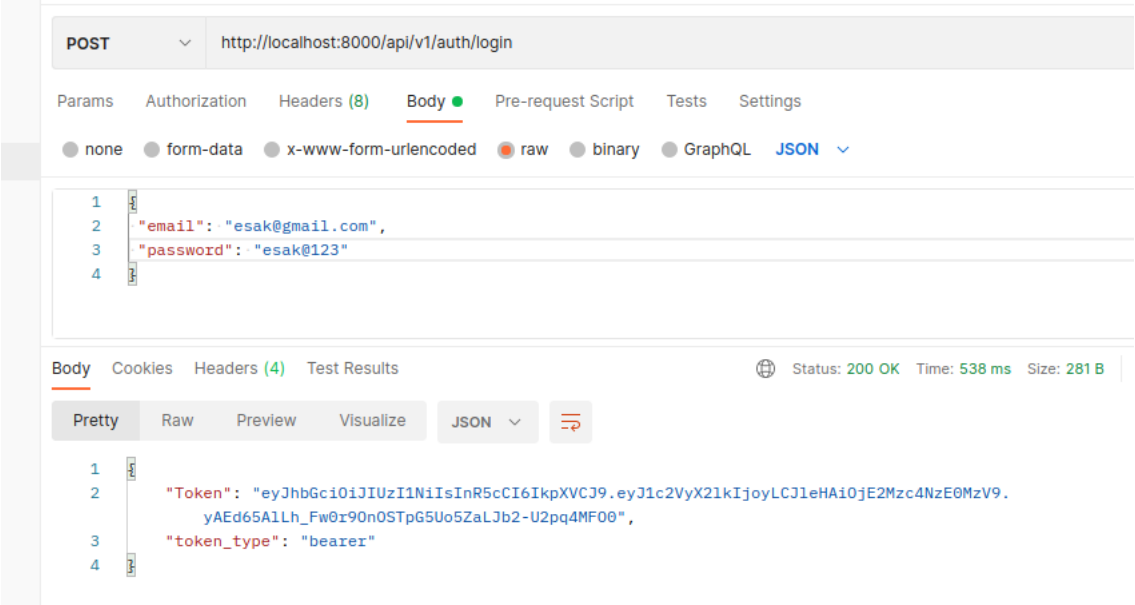
```
from jose import JWTError, jwt
from datetime import datetime, timedelta

# SECRET KEY
# METADATA/ ALGORITHM
# EXPIRATION TIME

SECRET_KEY= "0258712wsdasdfesak12324374lopiutyyus"
ALGORITHM= "HS256"
ACCESS_TOKEN_EXPIRE_MINUTES= 30


def create_access_token(data:dict):
    to_encode = data.copy()
    expire = datetime.now() + timedelta(minutes=ACCESS_TOKEN_EXPIRE_MINUTES)
    to_encode.update({"exp": expire})

    encoded_jwt = jwt.encode(to_encode, SECRET_KEY, algorithm=ALGORITHM)

    return encoded_jwt
```

Lets Update the Login Route Path

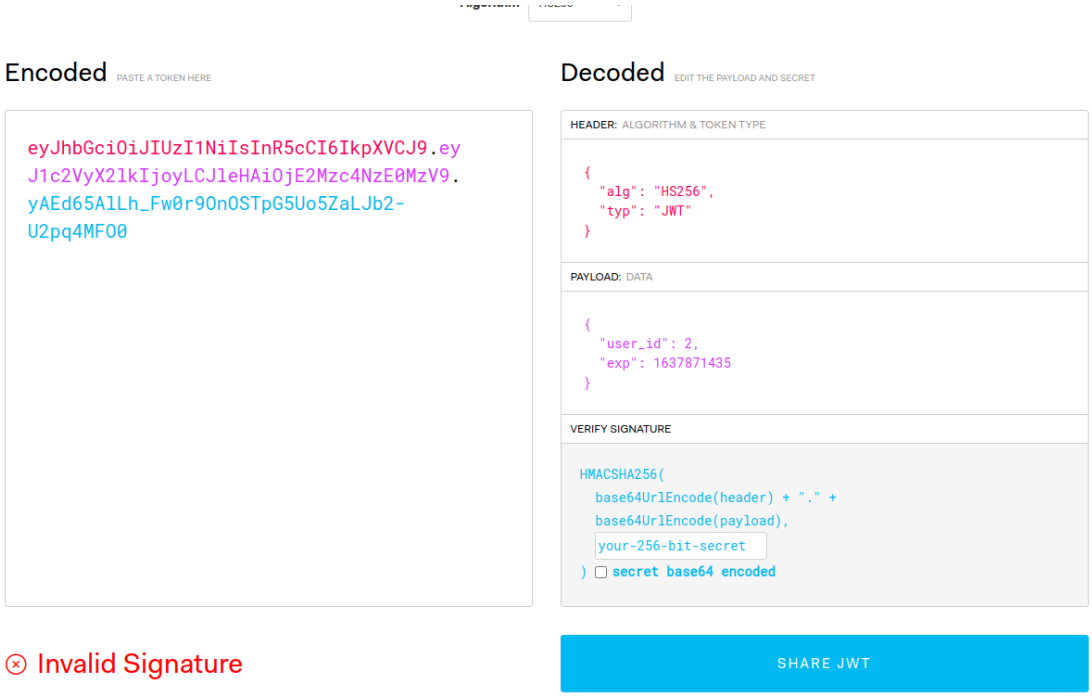
```
@router.post('/login')
def login(user_credentials: schemas.UserLogin , db:Session = Depends(get_db)):
    db_user = db.query(models.User).filter(models.User.email == user_credentials.email ).first()
```

```
    if db_user is None:
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail="Invalid Credentials")

    # hasing the provided Password
    if not utils.verifyPassword(user_credentials.password, db_user.password):
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail="Invalid Credentials")

    # CReate Token
    access_token = oauth2.create_access_token(data = {"user_id":db_user.id})

    return {"Token": access_token , "token_type": "bearer"}
```

Lets Check it



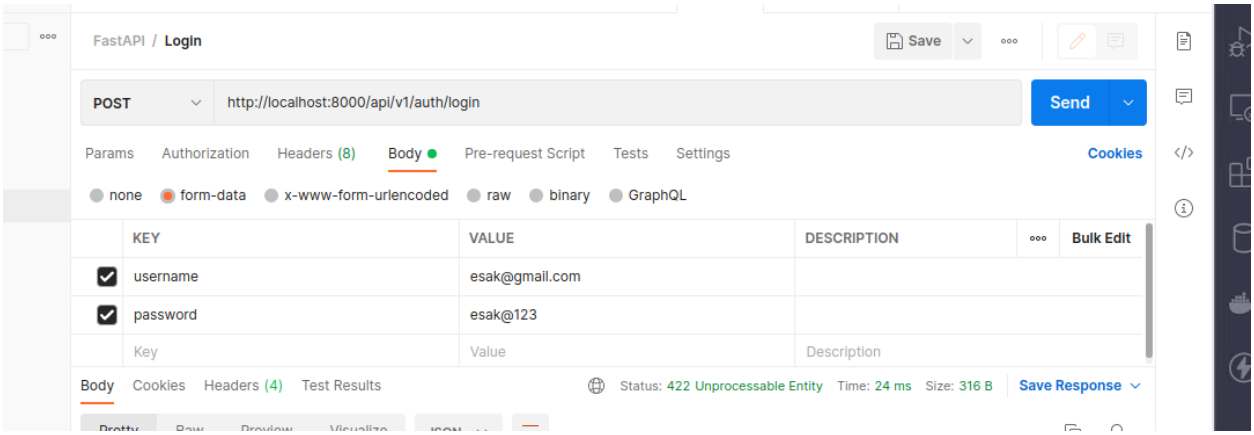
Lets Verify the Token



Lets Use FastApi Security Module

```
@router.post('/login')
def login(user_credentials: OAuth2PasswordRequestForm = Depends() , db:Session = Depends(get_db)):
    # By Default OAuth2PasswordRequestForm store the email in the Field called userName
    # if the user send email or username or anythin it stores in the username field
    # it Returns username, password
    db_user = db.query(models.User).filter(models.User.email == user_credentials.username ).first()
    if db_user is None:
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail="Invalid Credentials")

    # hasing the provided Password
    if not utils.verifyPassword(user_credentials.password, db_user.password):
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail="Invalid Credentials")

    # CReate Token
    access_token = oauth2.create_access_token(data = {"user_id":db_user.id})

    return {"Token": access_token , "token_type": "bearer"}
```

We dont send these Details using form-data



To Create a New User we have to Login with Proper Credentials

```
@router.post("/", status_code=status.HTTP_201_CREATED, response_model=schemas.UserResponse)
def create_user(user: schemas.UserCreate, db:Session = Depends(get_db) , get_current_user: int = Depends(oauth2.get_current_user)):
```

This Method depends on the oauth2.get_current_user method

```
token is coming from a request


def get_current_user(token:str = Depends(oauth2_scheme)):
    cred_exception = HTTPException(
        status_code=status.HTTP_401_UNAUTHORIZED,
        detail= "Could Not validate Credentials",
        headers = {"WWW-Authenticate": "bearer"}
    )

    return verify_access_token(token, cred_exception)
```

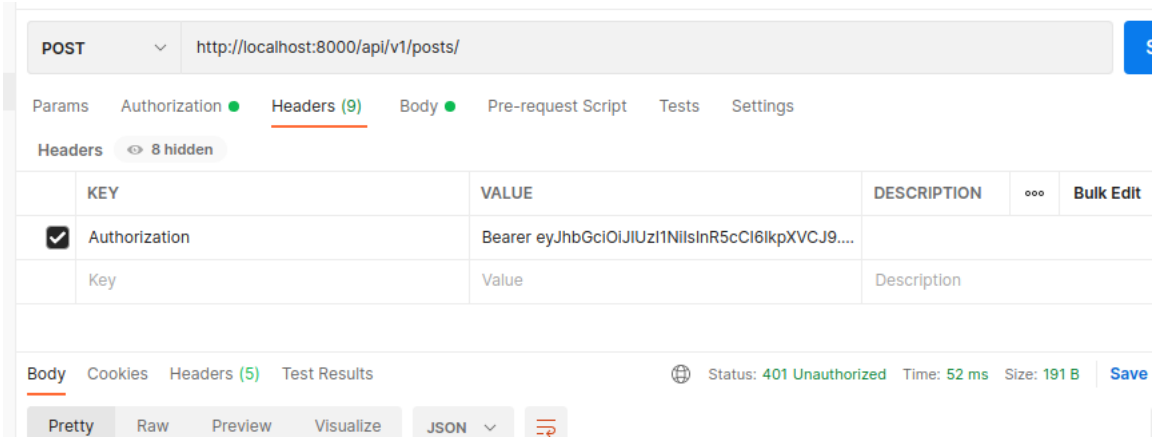
Lets Understand verify_access_token

```
def verify_access_token(token:str, cred_exception) :
    try:
        payload = jwt.decode(token, SECRET_KEY, algorithms=[ALGORITHM])
        id:str = payload.get('user_id')
        if id is None:
            raise cred_exception

        token_data = schemas.TokenData(id = id)

    except JWTError as e:
        raise cred_exception

    return token_data
```

For Creating a Token

```
from fastapi import Depends, status
from fastapi.exceptions import HTTPException
from jose import JWTError, jwt
from datetime import datetime, timedelta
from . import schemas
from fastapi.security import OAuth2PasswordBearer

oauth2_scheme =  OAuth2PasswordBearer(tokenUrl="login")

# SECRET KEY
```

```
# METADATA/ ALGORITHM
# EXPIRATION TIME

SECRET_KEY= "0258712wsdasdfesak12324374lopiutyyus"
ALGORITHM= "HS256"
ACCESS_TOKEN_EXPIRE_MINUTES= 30


def create_access_token(data:dict):
    to_encode = data.copy()
    expire = datetime.now() + timedelta(minutes=ACCESS_TOKEN_EXPIRE_MINUTES)
    to_encode.update({"exp": expire})

    encoded_jwt = jwt.encode(to_encode, SECRET_KEY, algorithm=ALGORITHM)

    return encoded_jwt
```



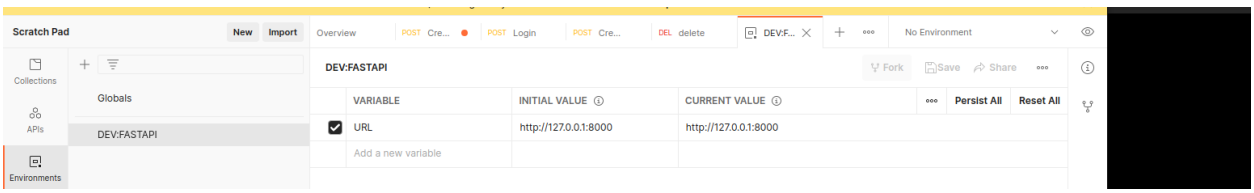
/code

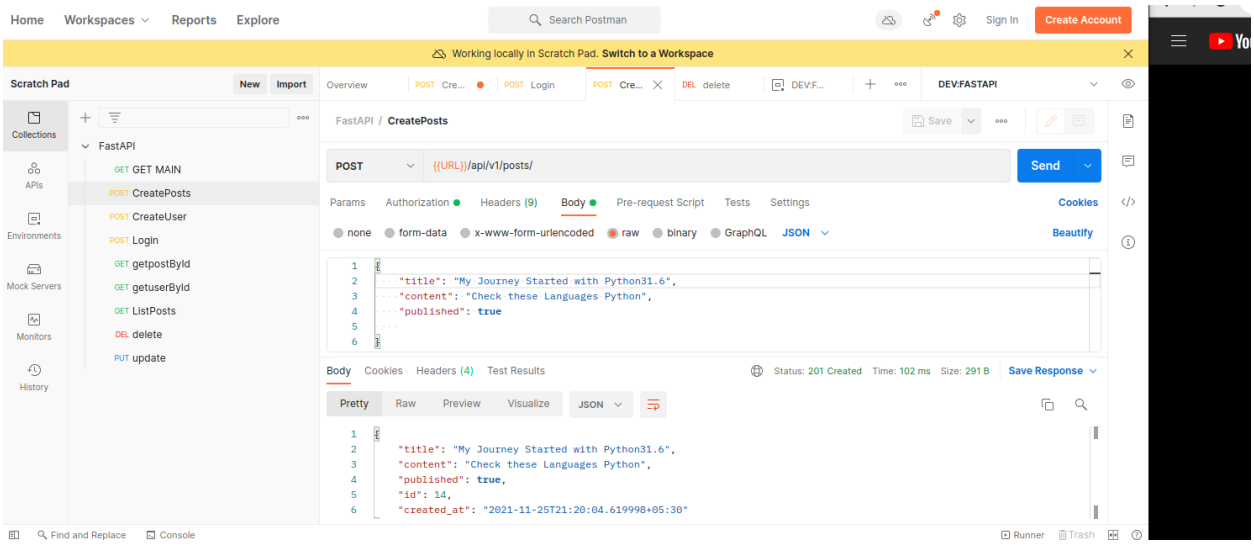
```
Authorization  Bearer eyJhbGciOiJI23131235cCI6IkpXVCJ9.2323c4NTQ3Nzh9.zIPrYQH0p4coZc9o8fnaMjMmI4hoEddtQ9sdfsdfsdfsd
```

Create Token schema

```
# Defie the token

class Token(BaseModel):
    Token: str
    token_type: str

class TokenData(BaseModel):
    id: Optional[str] = None
```

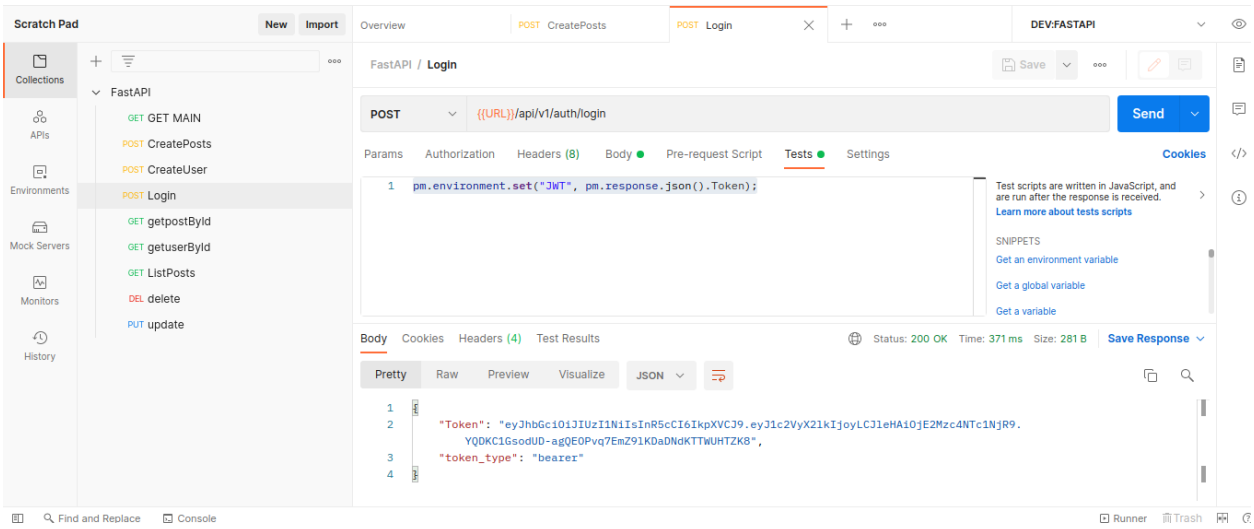
Adding Env In Postman



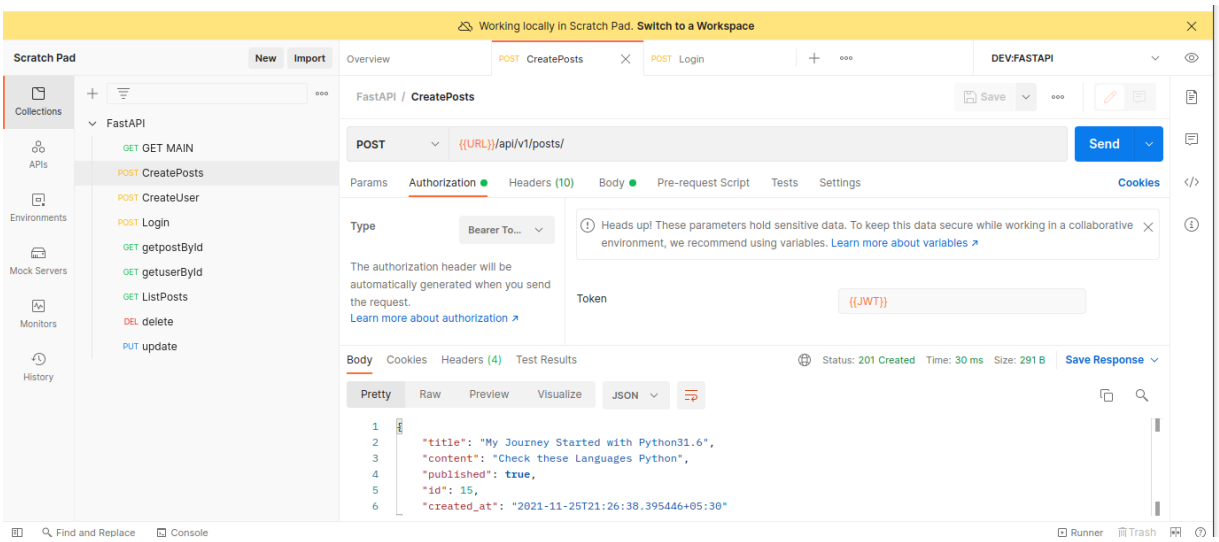


When we create the Token using the Login Endpoint we want postman to automatically set the Environment Variable

```
pm.environment.set("JWT", pm.response.json().Token);
```



Setting this in path variables



Setting up Realtionships

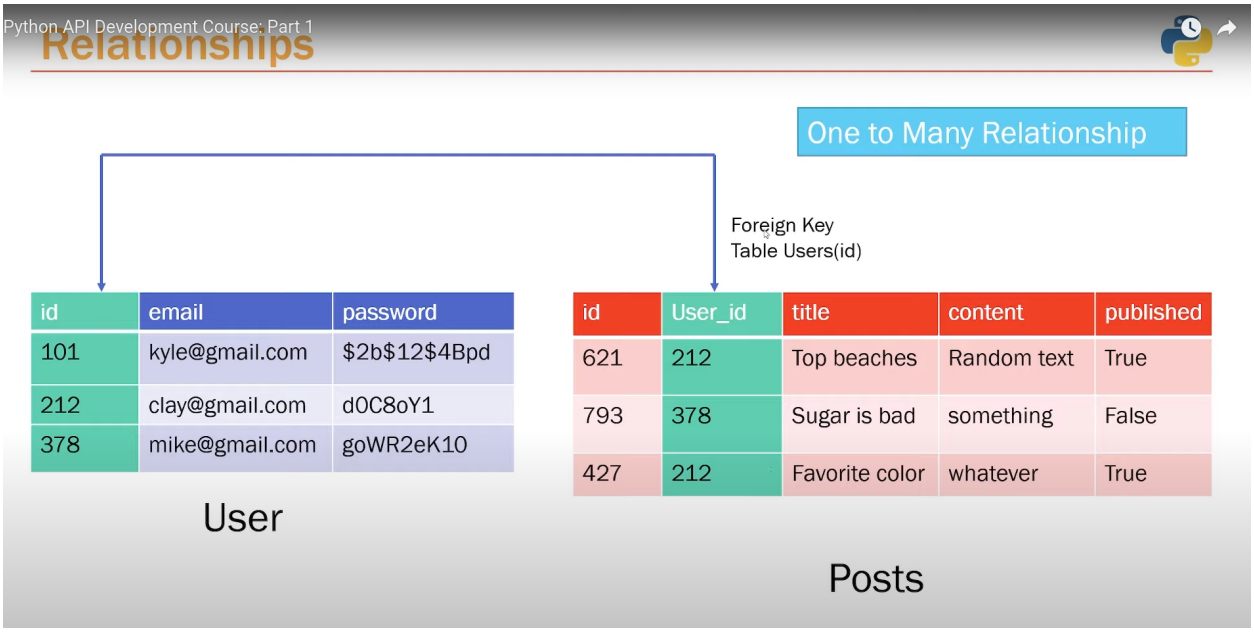
id	email	password
101	kyle@gmail.com	$2b$12$4Bpd
212	clay@gmail.com	d0C8oY1
378	mike@gmail.com	goWR2eK10

User

id	title	content	published
621	Top beaches	Random text	True
793	Sugar is bad	something	False
427	Favorite color	whatever	True

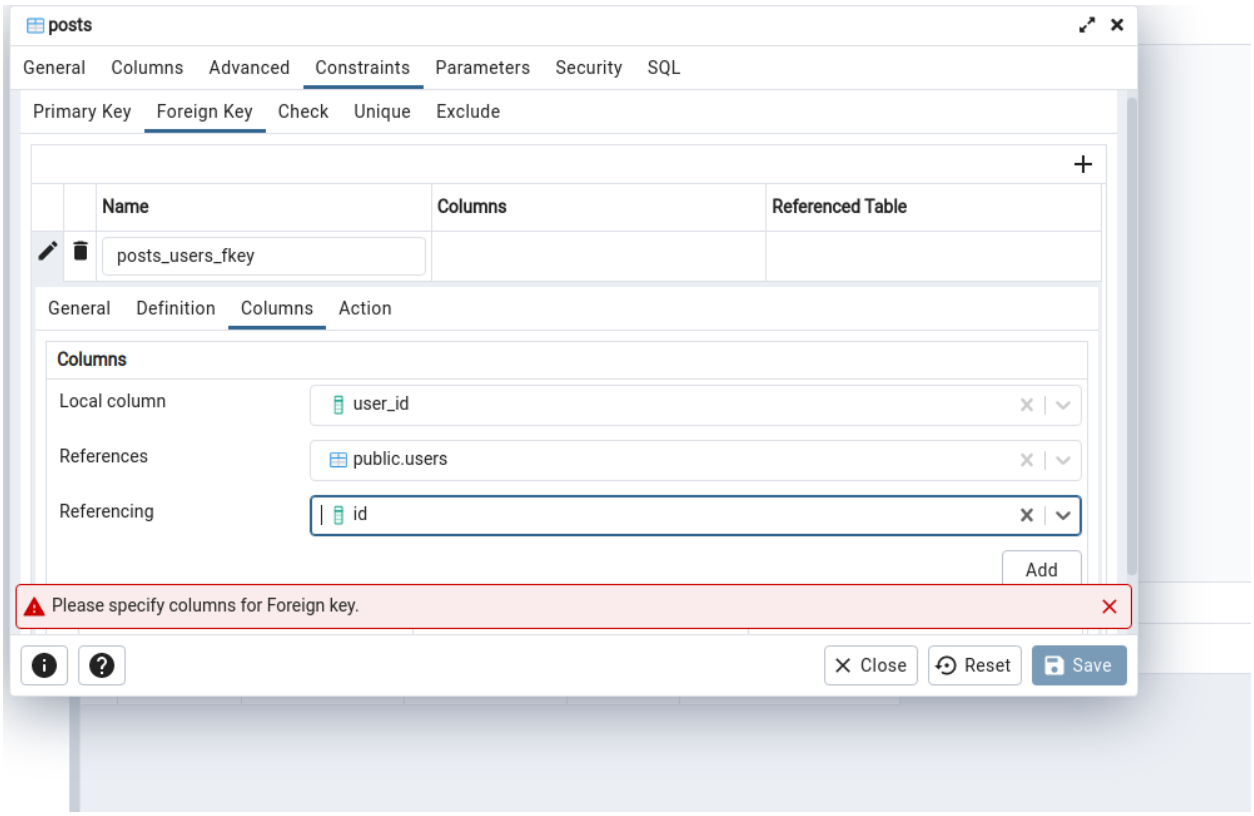
Posts

we are going to create a relationship between these 2 tables . we setup the Foreign Key



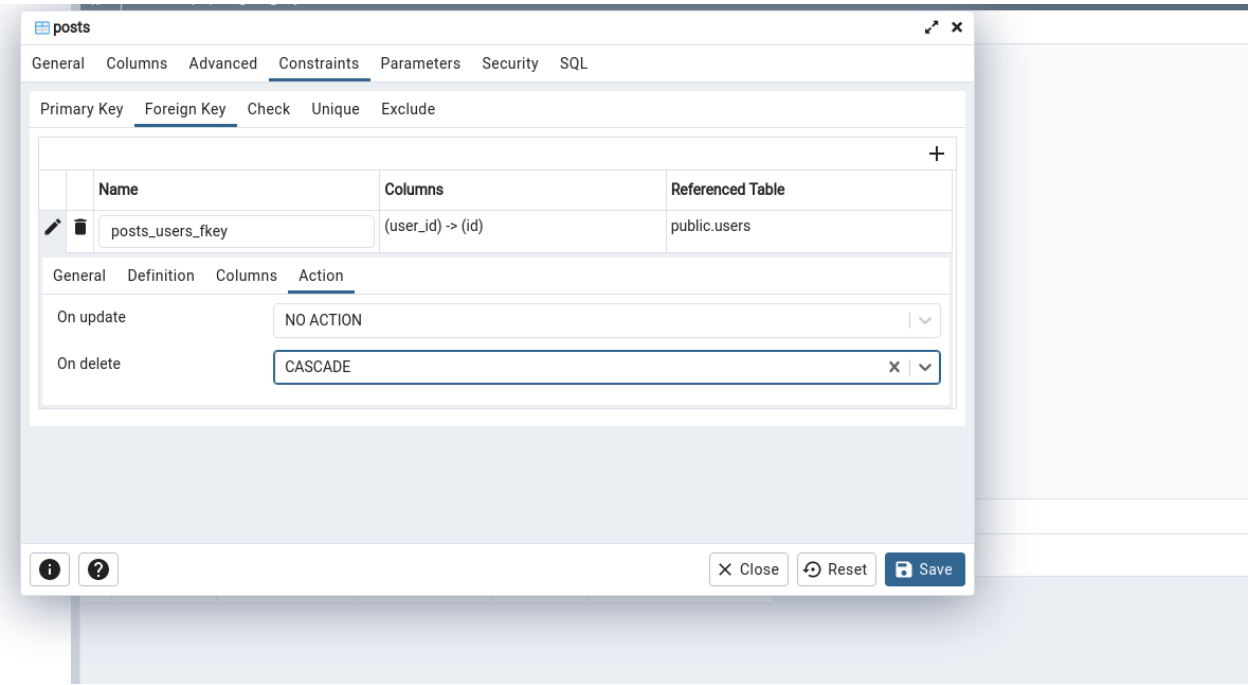
This is an Example of One To Many Relationship , one user can create many posts as they want

Lets Update the POST TABLE



we also need to Choose the action

CASCADE =⇒ So if a user is deleted all the respective posts also be deleted



Lets add these Column and Constraint using sqlAlchemy code ,

we have created a new Column named user_id and we make it as a Foreign Key

```
class  Post(Base):
    __tablename__ = "posts"

    id = Column(Integer, primary_key=True, nullable=False)
    user_id = Column(Integer, ForeignKey("users.id", ondelete="CASCADE" ), nullable=False )
    title = Column(String, nullable=False)
    content = Column(String, nullable=False)
    published = Column(Boolean, server_default='TRUE', nullable=False)
    created_at = Column( TIMESTAMP(timezone=True), nullable=False, server_default=text('now()'))
```

Lets update the schema

```
class PostResponse(PostBase):
    id: int
    created_at: datetime
    user_id: int

    class Config:
        orm_mode = True
```

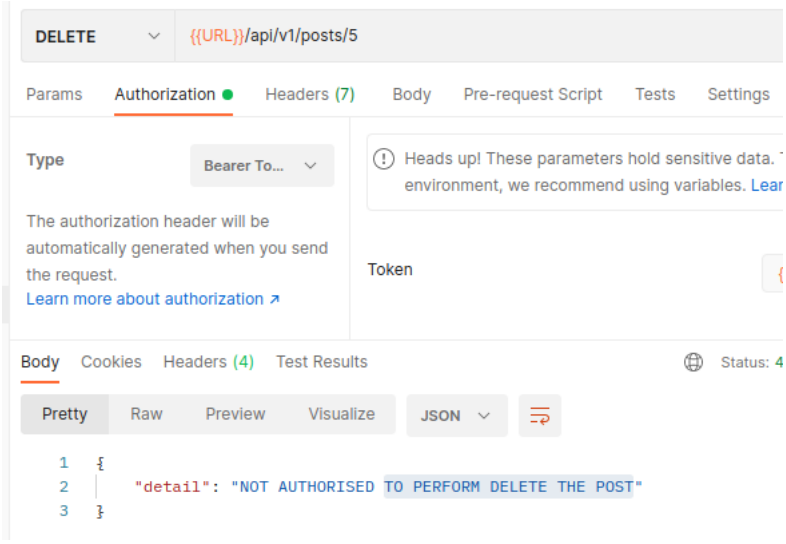
Lets Update the Create Post

```
@router.post('/', status_code=status.HTTP_201_CREATED, response_model=schemas.PostResponse)
def create_posts(post:schemas.PostCreate , db:Session = Depends(get_db), current_user: int = Depends(oauth2.get_current_user)):
    print(current_user.email)
    print(current_user.id)
    # lets Access the databse Object
    #new_posts = models.Post(title= post.title, content=post.content, published=post.published)
    new_posts = models.Post(user_id =current_user.id , **post.dict())
    # lets add this Post to Database
    db.add(new_posts)
    # Lets Commit the changes
    db.commit()
    # Lets Return the Updated data
    db.refresh(new_posts)
```

```
    return  new_posts
```

Lets Delete only the Post we have posted or he owns

```
@router.delete("/{id}")
def delete_post(id:int, db:Session = Depends(get_db), user:int = Depends(oauth2.get_current_user)):
    post_query = db.query(models.Post).filter( models.Post.id == id )
    # Above Db.query() will return a query Object
    # inorder to convert it to POst Object we have to use the first() method
    post = post_query.first()
    if post is None:
        raise  HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail= "POST ID {id} is not FOUND ")
    if post.user_id != user.id :
        raise HTTPException(status_code=HTTP_403_FORBIDDEN, detail="NOT AUTHORISED TO PERFORM DELETE THE POST")
    # delete the REcords
    post.delete(synchronize_session=False)
    db.commit()

    return {"data": "deleted"}
```



Update the post

```
@router.put("/{id}", response_model=schemas.PostResponse)
def update_post(id:int, post: schemas.PostCreate, db:Session = Depends(get_db), user:int = Depends(oauth2.get_current_user)):
    post_query = db.query(models.Post).filter(models.Post.id == id )
    dbpost = post_query.first()
    print(post)

    if dbpost is None:
        raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail = "POST ID {id} is not Found")

    if dbpost.user_id != user.id :
        raise HTTPException(status_code=HTTP_403_FORBIDDEN, detail="NOT AUTHORISED TO PERFORM DELETE THE POST")

    post_query.update(post.dict(), synchronize_session=False)
    #new_posts = models.Post(**post.dict())

    db.commit()

    return  post_query.first()
```

Return only the Posts Created by the user

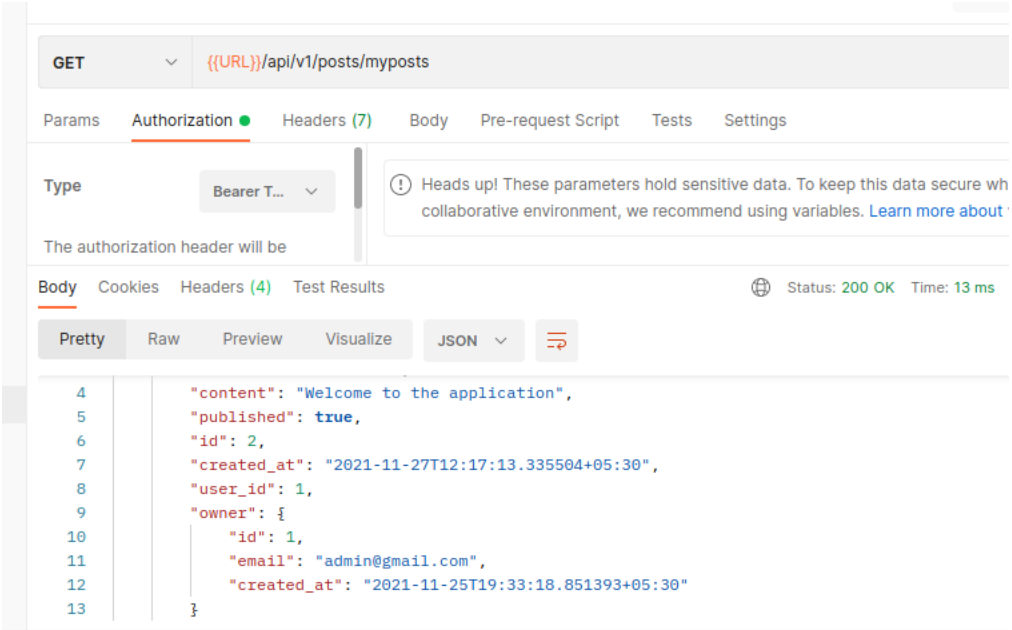
```
@router.get('/myposts', response_model=List[schemas.PostResponse])
def get_posts(db:Session = Depends(get_db), current_user = Depends(oauth2.get_current_user)):
    # lets Access the databse Object
    posts = db.query(models.Post).filter(models.Post.user_id == current_user.id ).all()
    return  posts
```

We maintain the foreign key relationship with the user table , so we will get the id of the user but its not useful at the front end . we need to have the Username to be displayed in the Frontend. so we can achieve this using sql alchemy

```
class  Post(Base):
    __tablename__ = "posts"

    id = Column(Integer, primary_key=True, nullable=False)
    user_id = Column(Integer, ForeignKey("users.id", ondelete="CASCADE" ), nullable=False )
    title = Column(String, nullable=False)
    content = Column(String, nullable=False)
    published = Column(Boolean, server_default='TRUE', nullable=False)
    created_at = Column( TIMESTAMP(timezone=True), nullable=False, server_default=text('now()'))

    owner = relationship("User") # it basically fetch the user based on the user_id
```

Lets Update the Pydantic Model

```
class PostResponse(PostBase):
    id: int
    created_at: datetime
    user_id: int
    owner: UserResponse

    class Config:
        orm_mode = True
```



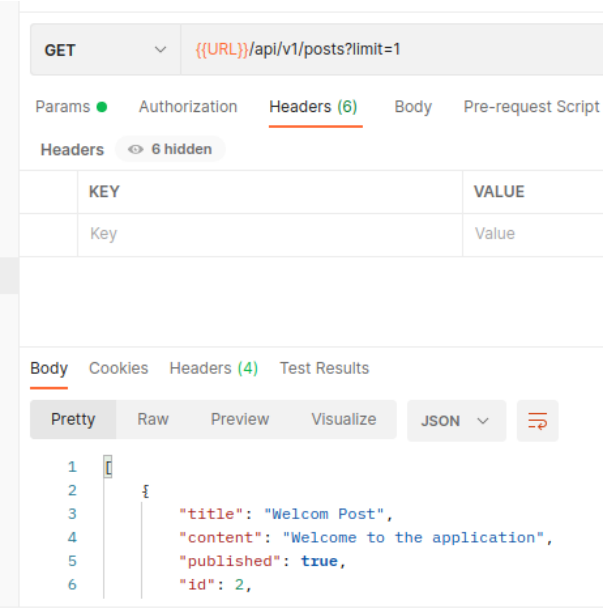
Query Parameters

Everything on the right of the Question marl is called the query parameters

we want our user to choose how many posts they want to see

```
@router.get('/', response_model=List[schemas.PostResponse])
def get_posts(db:Session = Depends(get_db), limit:int = 10 ):
    # Query Parameter
    print(limit)
    # lets Access the databse Object
    posts = db.query(models.Post).limit(limit).all()
    return  posts
```

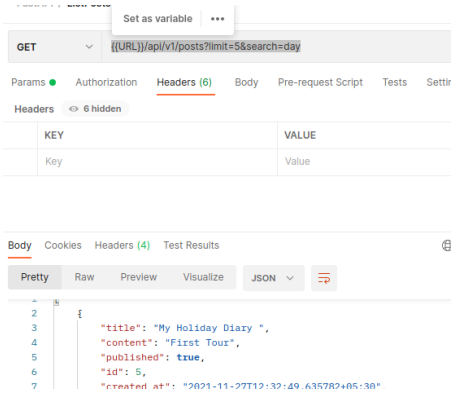
For implementing Pagination in the Front end this skip parameter will be useful , First page we display 20 items and then in the second page we display next 20 items so we need to skip the first 20 when we displays the second page and so on



we have to provide the limit in the Function as an parameter

we want the user to search on some content , we have to search based on the title

```
{{URL}}/api/v1/posts?limit=5&search=day
if we want to search for words having  spaces we have to use %20
{{URL}}/api/v1/posts?limit=5&search=day%20on

{{URL}}/api/v1/posts?search=aAdmin%20POst
```



Creating Environemt Variables

Using pydantic we can have our env variabls

```
from pydantic import BaseSettings


class Settings(BaseSettings):
    database_hostname: str = "localhost"
    database_port: str = "5432"
    database_password: str = "esak@123"
    database_name: str = "learnfastapi"
    database_username: str = "postgres"
    secret_key: str = "0258712wsdasdfesak12324374lopiutyyus"
    algorithm: str = "HS256"
    access_token_expire_minutes: int = 30

    class Config:
        env_file = ".env"


settings = Settings()
```

we are setting the env variables in the class as default variables we can also provide it in the env file as below

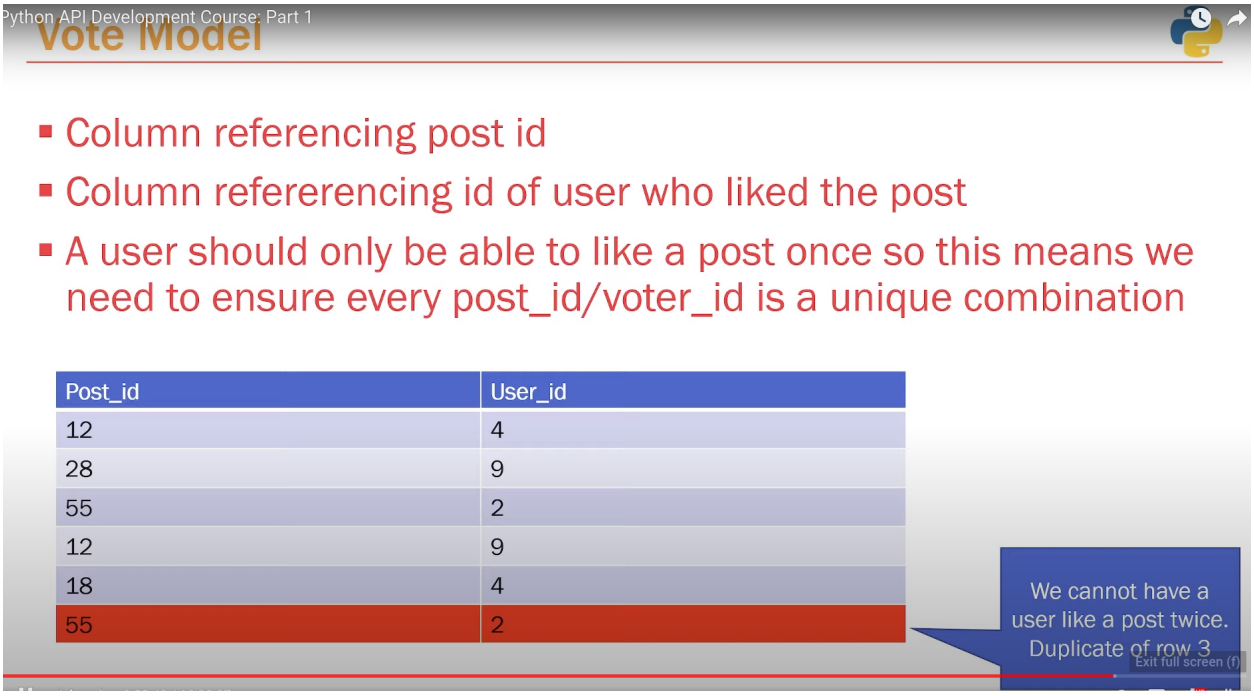
```
class Settings(BaseSettings):
    database_hostname: str
    database_port: str
    database_password: str
    database_name: str
    database_username: str
    secret_key: str
    algorithm: str
    access_token_expire_minutes: int

    class Config:
        env_file = "app/.env"


settings = Settings()
```

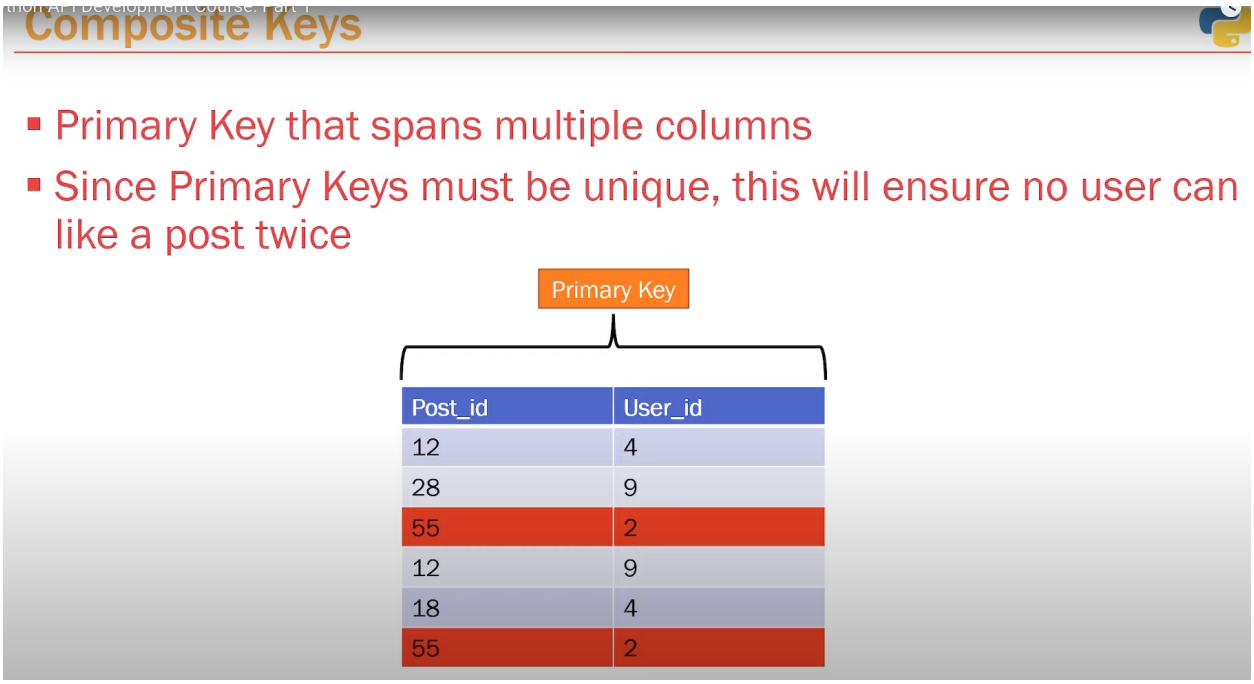
and we need to add this env file to the calsss using the Config

```
DATABASE_HOST_NAME=localhost
DATABASE_PASSWORD=esak@123
DATABASE_PORT=5432
DATABASE_NAME=learnfastapi
DATABASE_USERNAME=postgres
SECRET_KEY=0258712wsdasdfesak12324374lopiutyyus
ALGORITHM=HS256
ACCESS_TOKEN_EXPIRE_MINUTES=30
```

Build the Like/Voting System

1. User Should be able to like a post
2. should only be able to like a post once
3. retrieving posts should also fetch the number of likes for the post





Lets Create a new table votes

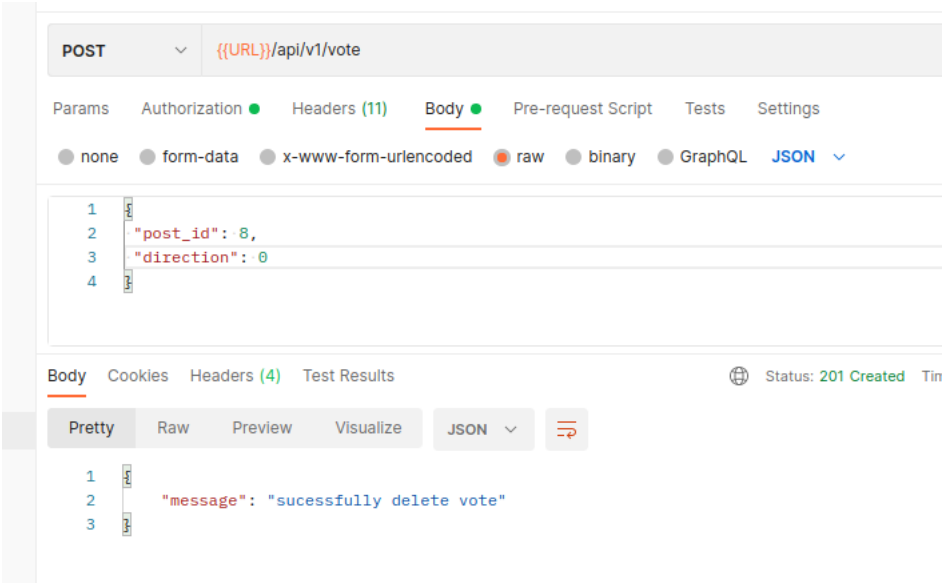
```
##  Creating a new Table votes
class Vote(Base):
```

```
    __tablename__ = "votes"

    post_id = Column(Integer, ForeignKey('posts.id', ondelete='CASCADE'), primary_key=True) # refering the Posts Table Id Column
    user_id = Column(Integer, ForeignKey('users.id', ondelete='CASCADE'), primary_key=True)
```

Create Vote Route

lets create a new route

```
from fastapi import FastAPI, HTTPException, status, Response, Depends, APIRouter
from sqlalchemy.orm.session import Session
from .. import schemas, database, models, oauth2

router = APIRouter(
    prefix= "/api/v1/vote",
    tags= ['vote']

)

@router.post("/", status_code=status.HTTP_201_CREATED)
def vote(vote: schemas.Vote, db:Session = Depends(database.get_db), current_user: int = Depends(oauth2.get_current_user)):
    vote_query = db.query(models.Vote).filter(models.Vote.post_id == vote.post_id, models.Vote.user_id == current_user.id)
    found_vote = vote_query.first()
    if vote.direction == 1:
        print("upvoting")
        if found_vote:
            raise HTTPException(status_code=status.HTTP_409_CONFLICT, detail=f"User {current_user.id} has already voted on of post {vote.po
        new_vote = models.Vote(post_id = vote.post_id, user_id = current_user.id)
        db.add(new_vote)
        db.commit()
        return {"message": "sucessfully added"}

    else:
        if not found_vote:
            raise HTTPException(status_code=status.HTTP_404_NOT_FOUND, detail=f"Vote Doesnot Exists")
        vote_query.delete(synchronize_session=False)
        db.commit()
        return {"message": "sucessfully delete vote"}
```



Now we want the aggregated Votes for a Post

lets update the Code

```
@router.get('/', response_model=List[schemas.PostOut])
def get_posts(db:Session = Depends(get_db), limit:int = 10, skip:int = 0, search:Optional[str] = "" ):
    # Query Parameter
    print(limit)
    # lets Access the databse Object
    posts = db.query(models.Post).filter(models.Post.title.contains(search)).limit(limit).offset(skip).all()
    # By default it will be left Inner Join
    #
    results = db.query(models.Post, func.count(models.Vote.post_id).label('votes')).join(models.Vote, models.Vote.post_id == models.Post.id
    #print(results)
    return  results
```

we have updated the get post Method

we have created a Left Outer Join

```
results = db.query
(models.Post.id, models.Post, func.count(models.Vote.post_id).label('votes')).
join(models.Vote, models.Vote.post_id == models.Post.id, isouter=True).
group_by(models.Post.id).all()
```

For the Above Query Response will be like

```
{
        "id": 4,  ---> we have select this Column in our query
        "Post": {  ---> Name is Post because of Our Model Name is Post and all of its field are populated within the Double Quotes
            "title": "My Journey Started with Python31.6",
            "content": "Check these Languages Python",
            "published": true,
            "id": 4,
            "created_at": "2021-11-27T12:27:03.124094+05:30",
            "user_id": 2,
            "owner": {
                "id": 2,
                "email": "esak@gmail.com",
                "created_at": "2021-11-25T19:33:34.789176+05:30"
            }
        },
        "votes": 0   --> Another Column which we specified in the Query
    },
```

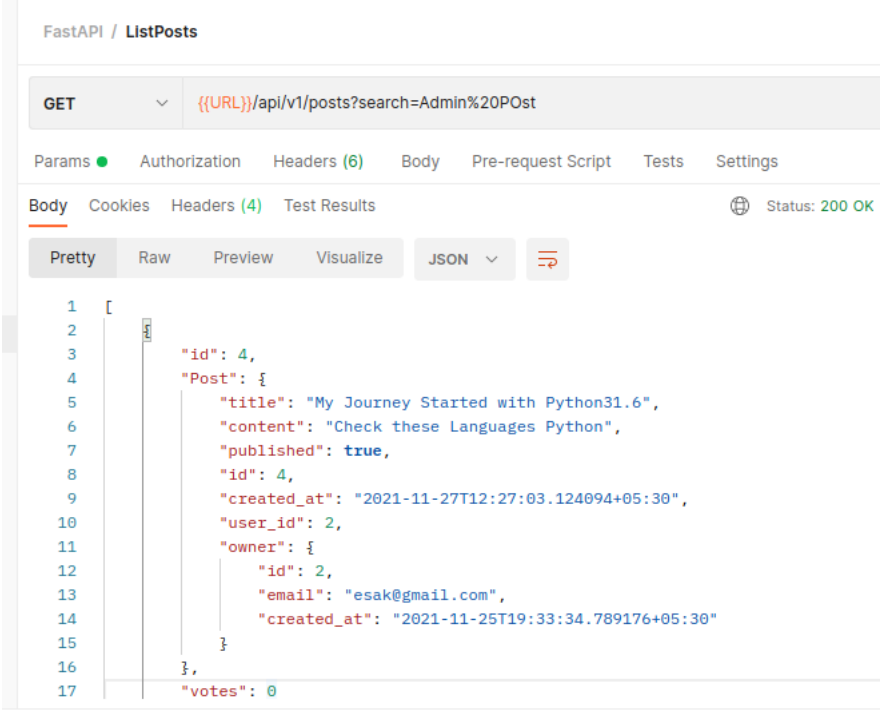
Lets Update the Schema

```
# Schema class For Votes and post Join
class PostOut(BaseModel):
    Post: PostResponse
    votes: int

    class Config:
        orm_mode = True
```

Response of a Single Post

```
{
        "Post": {
            "title": "My Journey Started with Python31.6",
            "content": "Check these Languages Python",
            "published": true,
            "id": 4,
            "created_at": "2021-11-27T12:27:03.124094+05:30",
            "user_id": 2,
            "owner": {
                "id": 2,
                "email": "esak@gmail.com",
                "created_at": "2021-11-25T19:33:34.789176+05:30"
            }
```

```
        },
        "votes": 0
    },
```



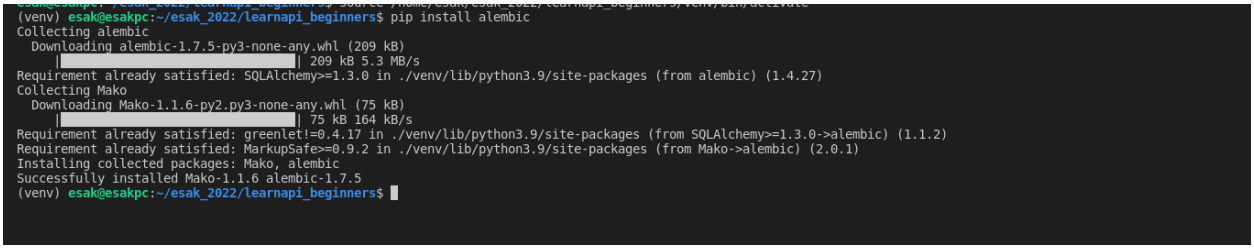

```
URL PATH WILL BE LIKE
{{URL}}/api/v1/posts?search=Admin%20POst&limit=2&skip=4
```

Database Migration

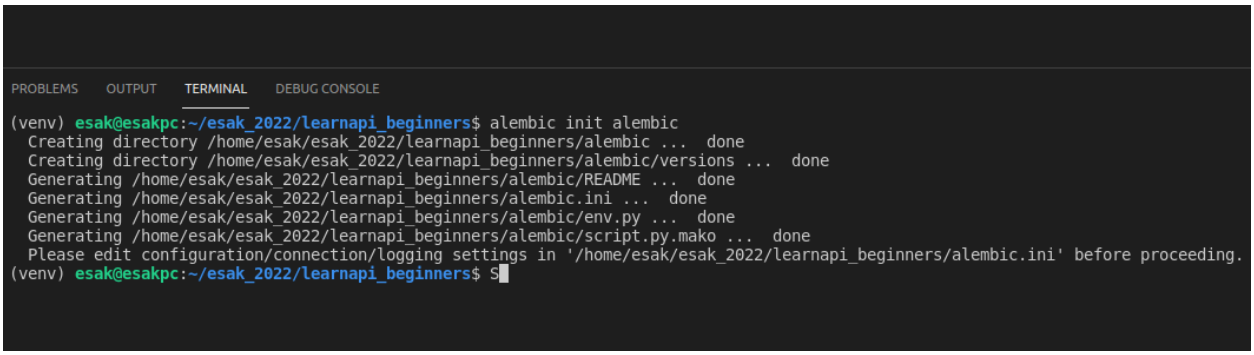
sqlalchemy has limitations to migrate the data , so we are going to use another tool called Alembic

- Developers can track changes to code and rollback code easily with GIT. Why can’t we do the same for database models/tables
- Database migrations allow us to incrementally track changes to database schema and rollback changes to any point in time
- We will use a tool called Alembic to make changes to our database
- Alembic can also automatically pull database models from Sqlalchemy and generate the proper tables

```
pip install alembic
```




```
alembic init alembic ==> Initiates a directory


it will create a alembic directory
go to the env.py File and import the Base Class from our sqlalchmey models
```



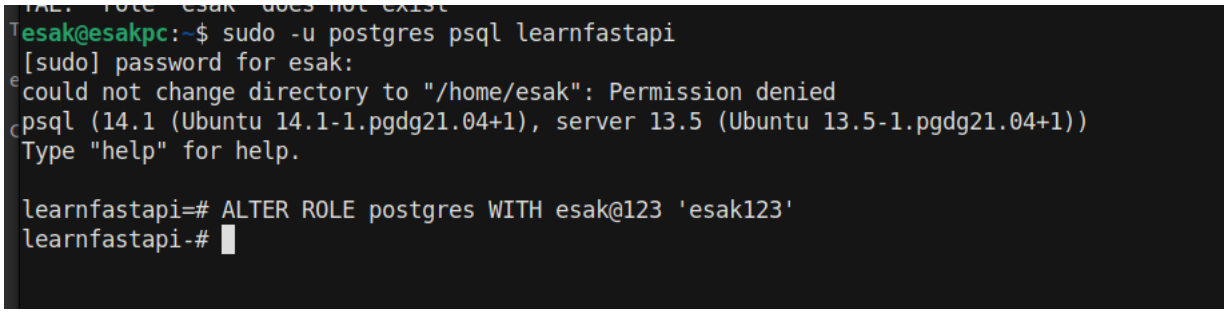
Add the Following to the env file

```
from app.models import Base
target_metadata = Base.metadata
```

Go to Alembic.ini and update the postgress URI

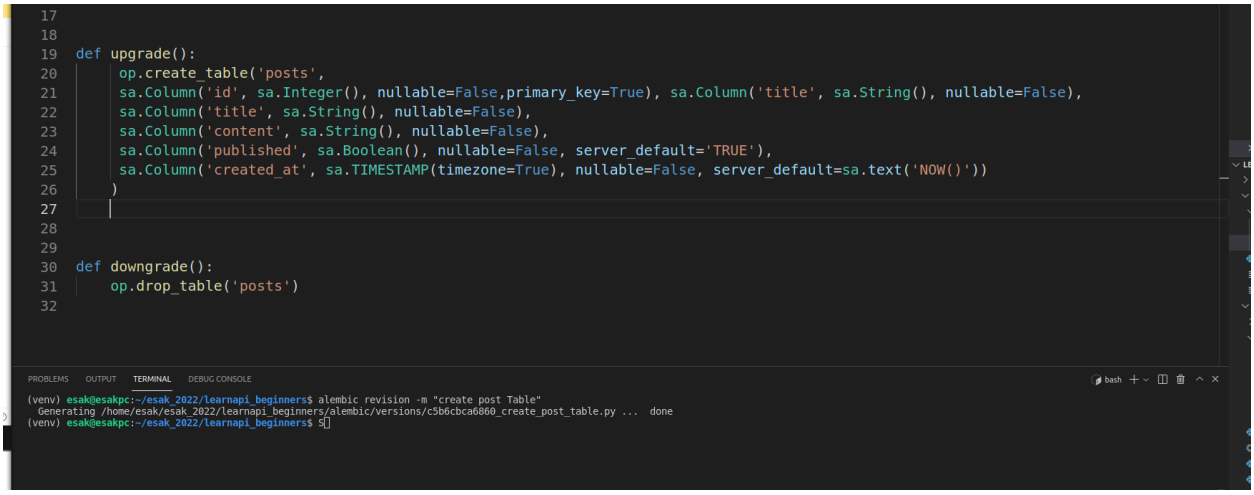
```
sqlalchemy.url = postgresql+psycopg2://postgres:esak@123@localhost:5432//learnfastapi

Since it was hard coded we can override this env.py File

from app.models  import Base
from app.config import settings
from urllib.parse import quote

# this is the Alembic Config object, which provides
# access to the values within the .ini file in use.

# Getting the Database URL
db_url = f'postgresql://{settings.database_username}:%s@{settings.database_hostname}/{settings.database_name}' % quote('esak@123')

config = context.config
config.set_main_option(
    "sqlalchemy.url " , db_url

)
```

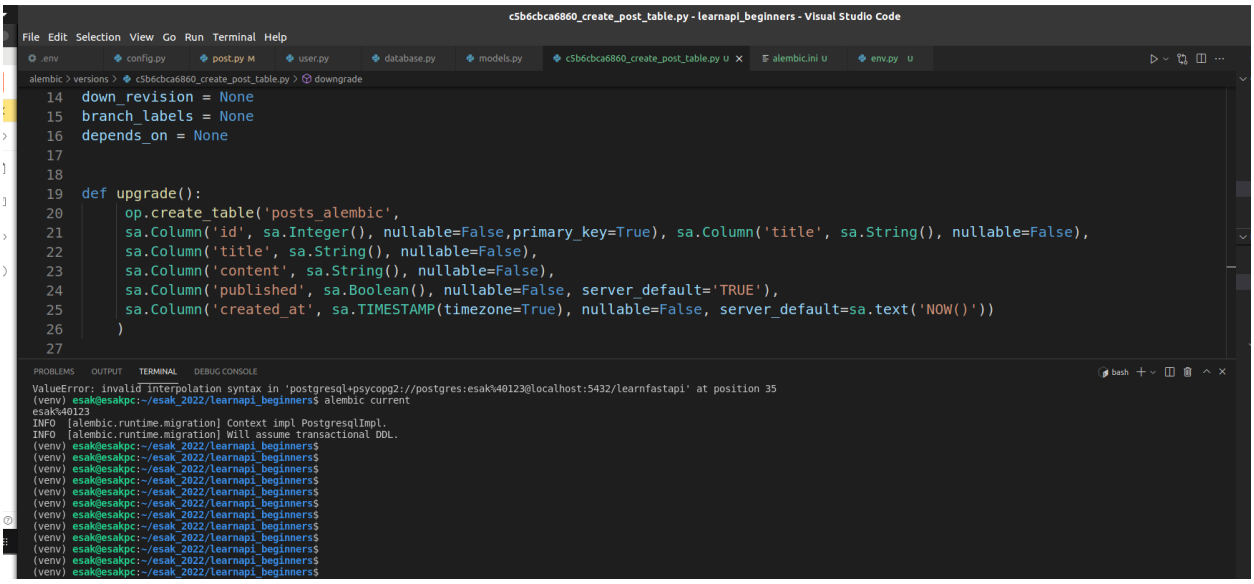
Change the password

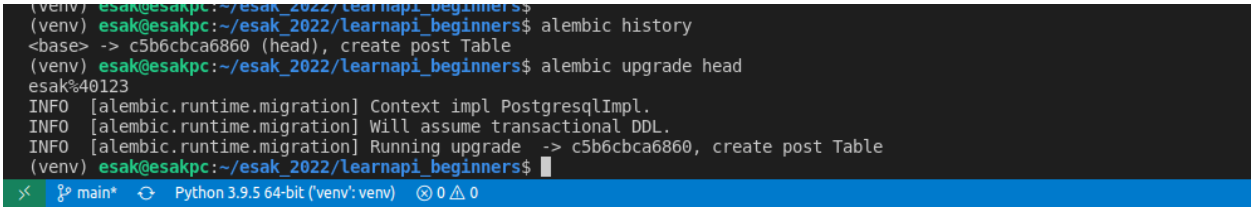


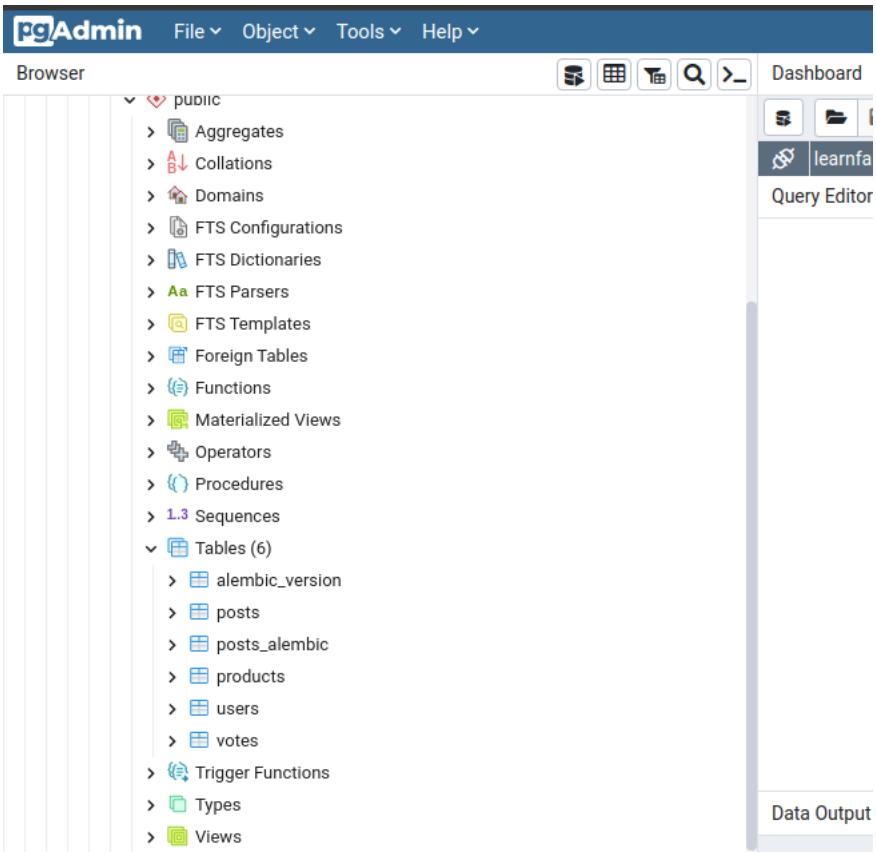
Using Models

we can create the Alembic Models manually




c5b6cbca6860_create_post_table.py - learnapi_beginners - Visual Studio Code
File Edit Selection View Go Run Terminal Help
down_revision = None
branch_labels = None
depends_on = None
def upgrade():
op.create_table('posts_alembic',
sa.Column('id', sa.Integer(), nullable=False,primary_key=True), sa.Column('title', sa.String(), nullable=False),
sa.Column('title', sa.String(), nullable=False),
sa.Column('content', sa.String(), nullable=False),
sa.Column('published', sa.Boolean(), nullable=False, server_default='TRUE'),
sa.Column('created_at', sa.TIMESTAMP(timezone=True), nullable=False, server_default=sa.text('NOW()'))
)
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
ValueError: invalid interpolation syntax in 'postgresql+psycopg2://postgres:esak%40123@localhost:5432/learnfastapi' at position 35
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$ alembic current
esak%40123
INFO [alembic.runtime.migration] Context impl PostgresqlImpl.
INFO [alembic.runtime.migration] Will assume transactional DDL.


(venv) esak@esakpc:~/esak_2022/learnapi_beginners$ alembic history
<base> -> c5b6cbca6860 (head), create post Table
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$ alembic upgrade head
esak%40123
INFO [alembic.runtime.migration] Context impl PostgresqlImpl.
INFO [alembic.runtime.migration] Will assume transactional DDL.
INFO [alembic.runtime.migration] Running upgrade -> c5b6cbca6860, create post Table
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$
main* Python 3.9.5 64-bit ('venv': venv) 0 0


pgAdmin File Object Tools Help
Browser
Dashboard
public
Aggregates
Collations
Domains
FTS Configurations
FTS Dictionaries
FTS Parsers
FTS Templates
Foreign Tables
Functions
Materialized Views
Operators
Procedures
Sequences
Tables (6)
alembic_version
posts
posts_alembic
products
users
votes
Trigger Functions
Types
Views
Query Editor
Data Output

it also support automatic Upgrades . alembic is intelligent enough to build the new additional added fields into the postgres table based on the models we have

```
alembic: error: unrecognized arguments: add another column
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$ alembic revision --autogenerate -m "add models to alembic "
esak%40123
INFO  [alembic.runtime.migration] Context impl PostgresqlImpl.
INFO  [alembic.runtime.migration] Will assume transactional DDL.
INFO  [alembic.ddl.postgresql] Detected sequence named 'products_id_seq' as owned by integer column 'products(id)', assuming SERIAL and omitting
INFO  [alembic.autogenerate.compare] Detected removed table 'products'
INFO  [alembic.ddl.postgresql] Detected sequence named 'posts_alembic_id_seq' as owned by integer column 'posts_alembic(id)', assuming SERIAL and omitting
INFO  [alembic.autogenerate.compare] Detected removed table 'posts_alembic'
  Generating /home/esak/esak_2022/learnapi_beginners/alembic/versions/542240f1f283_add_models_to_alembic.py ...  done
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$
```

> IF we have any new Tables apart From Schema it will be deleted when we execute this Command

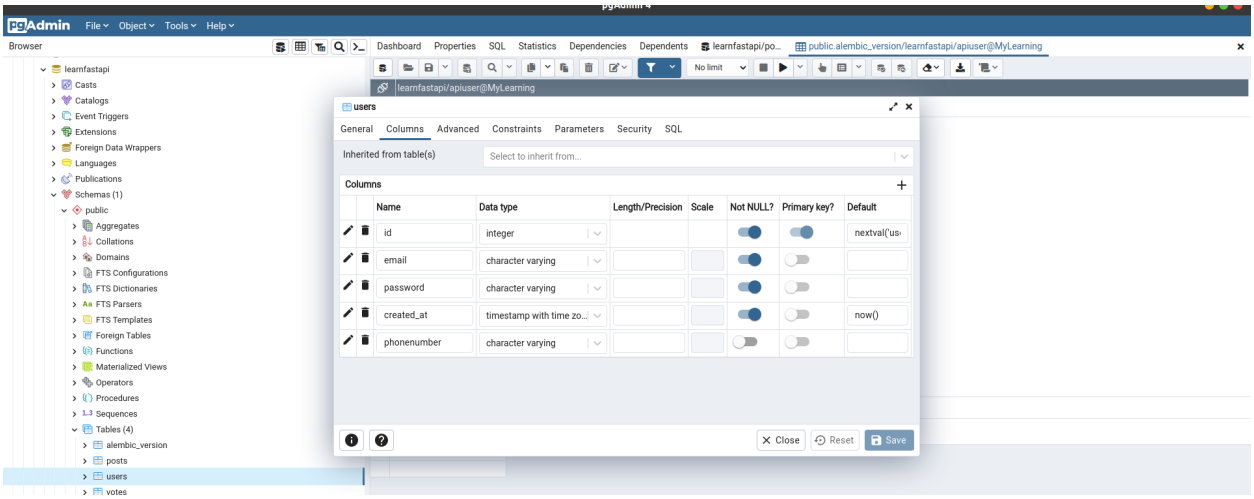
Lets add a New Column to user Model

```
class User(Base):
    __tablename__ = "users"

    id = Column(Integer, primary_key=True, nullable=False)
    email = Column(String, nullable=False, unique=True)
    password = Column(String, nullable=False)
    phonenumber=Column(String)
    created_at = Column(TIMESTAMP(timezone=True), nullable=False, server_default=text('now()'))
```

I have added the New Column called phone Number

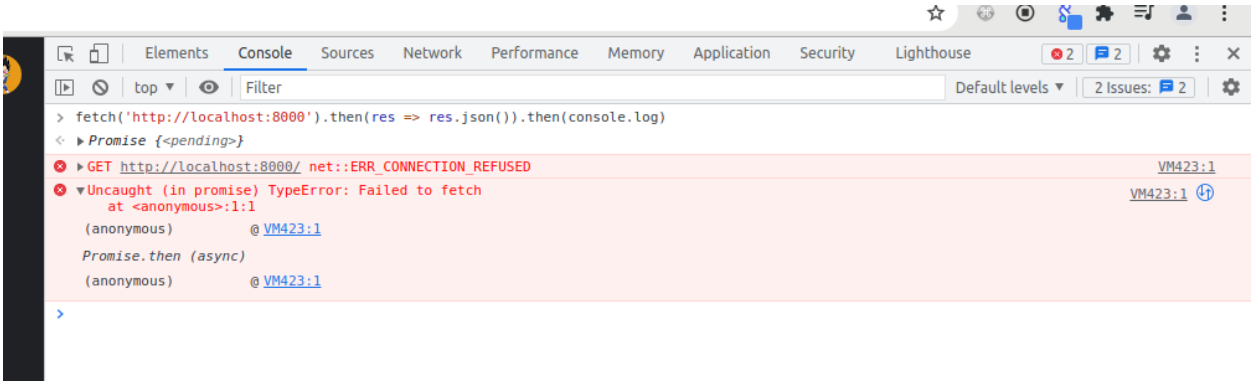
lets Run Alembic

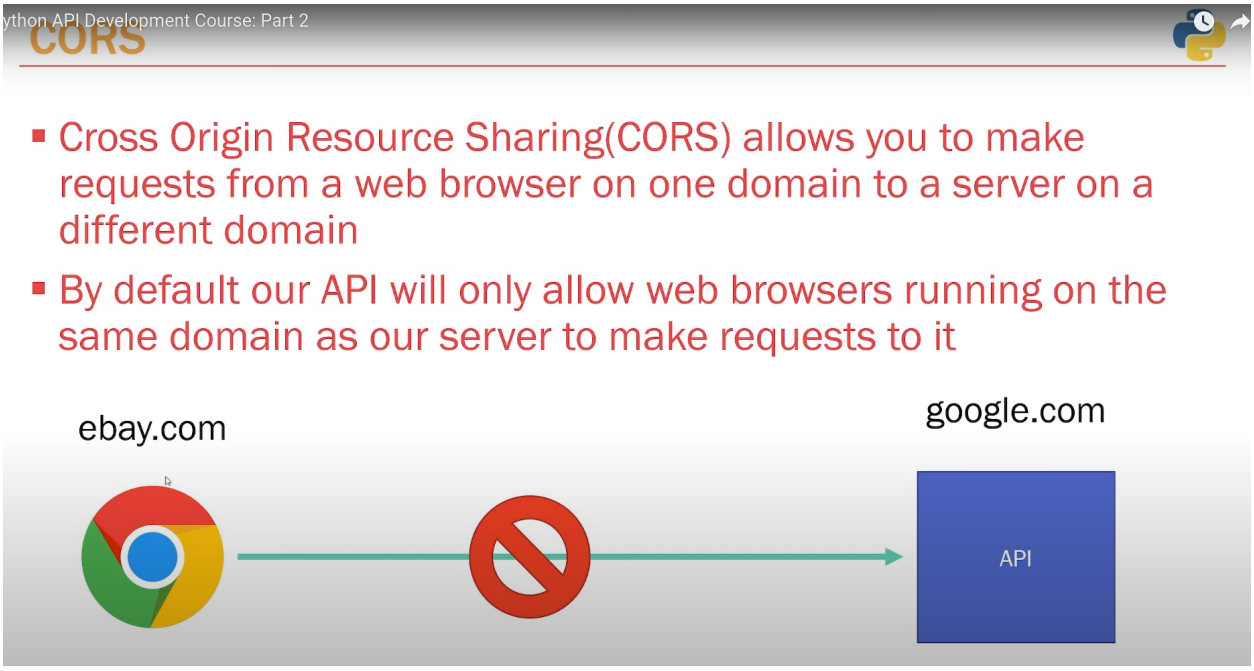
```
alembic revision --autogenerate -m "update user Model"
alembic upgrade head
```



So Far we used postman to send the request . request can come from anywhere including the Frontend application in JS from a webbrowser

When we send the request from the Browser we get the below error





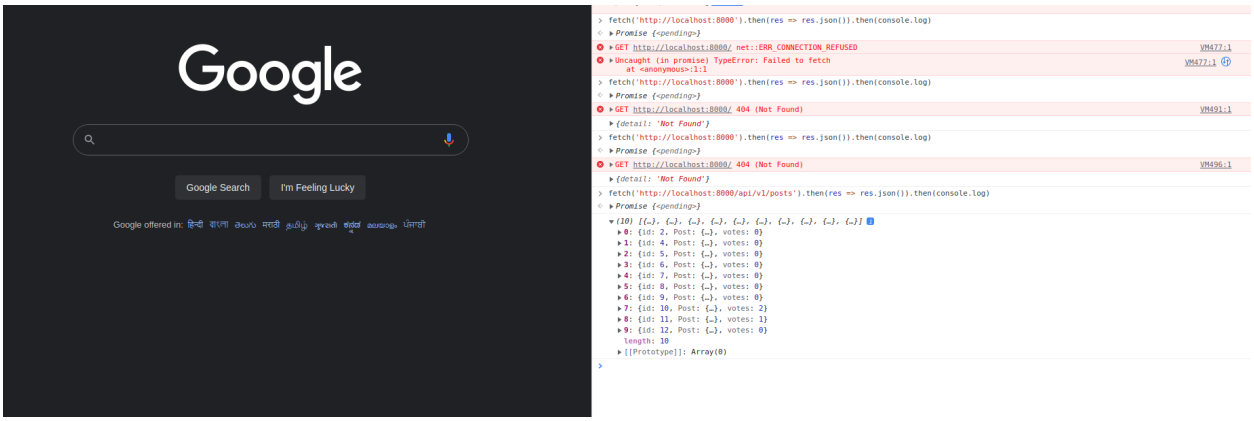
Update the Middleware Settings

we have to update the domains inside the origin so that these domain can communicate with each other

```
from fastapi import FastAPI
from .database import  engine
from . import models
from .routers import post, user, auth, vote
from .config import settings
# setting up Cors
from fastapi.middleware.cors import CORSMiddleware

print(settings.database_username)

# Creating the SQLALCHMEY Conenction
# Since we have the Alembic Now we dont need the below line
#models.Base.metadata.create_all(bind=engine)

# Creating the FATAPI APP
app = FastAPI()

# ADDING Middleware
```

```
origins = [
    "http://localhost",
    "http://localhost:8080",
    "https://www.google.com"
]

app.add_middleware(
    CORSMiddleware,
    allow_origins=origins,
    allow_credentials=True,
    allow_methods=["*"],
    allow_headers=["*"],
)

# ADDING ROUTER ROUTES
app.include_router(post.router)
app.include_router(user.router)
app.include_router(auth.router)
app.include_router(vote.router)
```

After that google.com domain can send request to our API



Deployment

1. Setup Ubuntu machine

Create an Ec2 Machine in AWS (ubuntu) and execute the Following Commands

```
sudo apt update && sudo apt upgrade
sudo apt install python3-pip -y
sudo pip3 install virtualenv
sudo apt install postgresql postgresql-contrib -y
sudo apt-get install python3-virtualenv
apt install python3.8-venv


vi .env
set -o allexport; source /home/ubuntu/.env; set +o allexport;

update this to .profile File
```

```
ubuntu@ip-172-31-85-183:~$ psql -U postgres
psql: error: FATAL:  Peer authentication failed for user "postgres"
ubuntu@ip-172-31-85-183:~$
```

we need to login as postgress user and we can connect to it

```
sudo -i -u postgres


# logg into database
psql

# change Password
\password
esak123

# to Exit the postgress
\q
```

```
ubuntu@ip-172-31-85-183: /etc/postgresql/12/main
ubuntu@ip-172-31-85-183:/etc/postgresql/12/main$ ls
conf.d  environment  pg_ctl.conf  pg_hba.conf  pg_ident.conf  postgresql.conf  start.conf
ubuntu@ip-172-31-85-183:/etc/postgresql/12/main$ sudo vi postgresql.conf
ubuntu@ip-172-31-85-183:/etc/postgresql/12/main$ sudo vi pg_hba.conf
ubuntu@ip-172-31-85-183:/etc/postgresql/12/main$ pwd
/etc/postgresql/12/main
ubuntu@ip-172-31-85-183:/etc/postgresql/12/main$
```

By Default postgres uses peer authentication , using that we cant connect with pgadmin so we have updated peer to md5

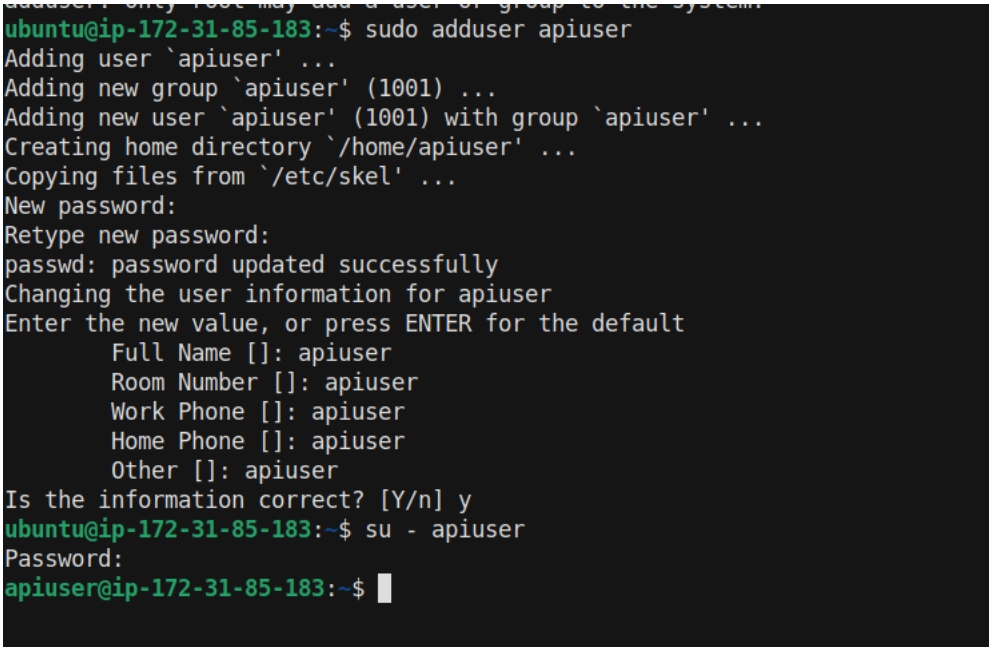
```
# DO NOT DISABLE!
# If you change this first entry you will need to make sure that the
# database superuser can access the database using some other method.
# Noninteractive access to all databases is required during automatic
# maintenance (custom daily cronjobs, replication, and similar tasks).
#
# Database administrative login by Unix domain socket
local   all             postgres                                md5

# TYPE  DATABASE        USER            ADDRESS                 METHOD

# "local" is for Unix domain socket connections only
local   all             all                                     md5
# IPv4 local connections:
host    all             all             0.0.0.0/0               md5
# IPv6 local connections:
host    all             all             ::/0                    md5
# Allow replication connections from localhost, by a user with the
# replication privilege.
local   replication     all                                     peer
host    replication     all             127.0.0.1/32               md5
host    replication     all             ::1/128                 md5
```

After changing the COnfiguration restart the Application

```
sudo systemctl restart postgresql

# Now Logn

psql -U postgres
```

Create a Non Root User

```
sudo adduser apiuser
su - apiuser
```



Give sudo access

```
sudo usermod -aG sudo apiuser
```

Clone the Git Repo

```
git clone reponame .

username esakki2021
password token
```

```
(venv) apiuser@ip-172-31-85-183:~/app/src$ pwd
/home/apiuser/app/src
(venv) apiuser@ip-172-31-85-183:~/app/src$ cd ..
(venv) apiuser@ip-172-31-85-183:~/app$
(venv) apiuser@ip-172-31-85-183:~/app$ ls -lrt
total 8
drwxrwxr-x 4 apiuser apiuser 4096 Dec  5 06:00 venv
drwxrwxr-x 5 apiuser apiuser 4096 Dec  5 06:06 src
(venv) apiuser@ip-172-31-85-183:~/app$ cd src/
(venv) apiuser@ip-172-31-85-183:~/app/src$ pip install -r requirements.txt
```

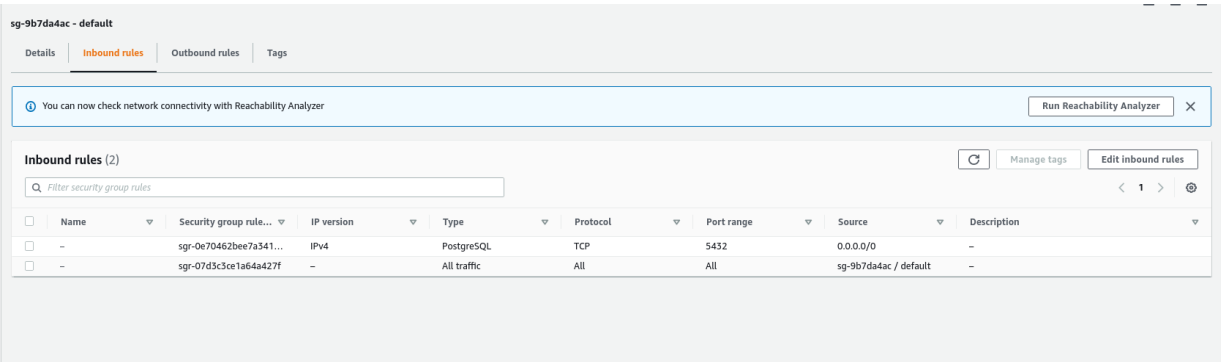
```
apiuser@ip-172-31-85-183:~/app/src$ sudo apt install libpq-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
Suggested packages:
  postgresql-doc-12
The following NEW packages will be installed:
  libpq-dev
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 136 kB of archives.
After this operation, 589 kB of additional disk space will be used.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 libpq-dev amd64 12.9-0ubuntu0.20.04.1 [136 kB]
Fetched 136 kB in 0s (6303 kB/s)
Selecting previously unselected package libpq-dev.
(Reading database ... 103264 files and directories currently installed.)
Preparing to unpack .../libpq-dev_12.9-0ubuntu0.20.04.1_amd64.deb ...
Unpacking libpq-dev (12.9-0ubuntu0.20.04.1) ...
Setting up libpq-dev (12.9-0ubuntu0.20.04.1) ...
Processing triggers for man-db (2.9.1-1) ...
apiuser@ip-172-31-85-183:~/app/src$
```

Start the application

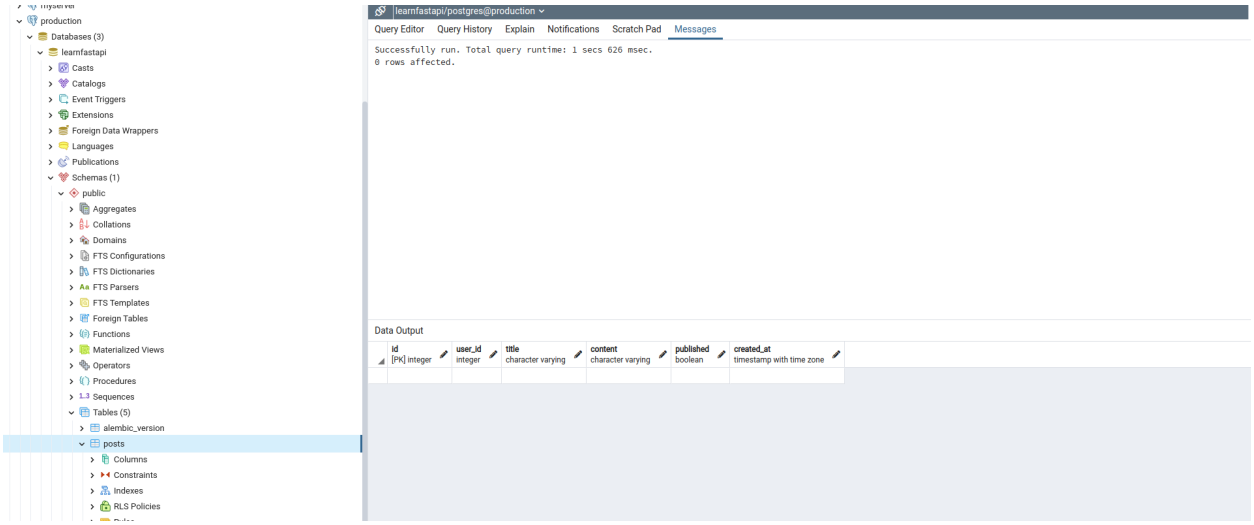
```
uvicorn app.main:app
```

Create RDS Instance

Udpate the Security group to include the 5432 port



Verify that we can connect with pgadmin

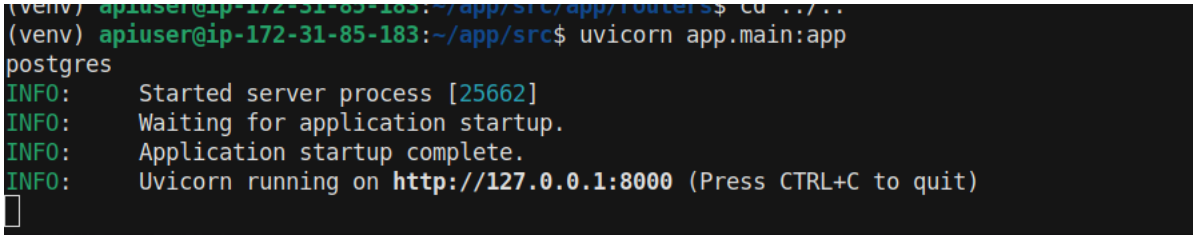


Run DB MIGRATION Tool

```
alembic upgrade head
```

Now Start the App

```
uvicorn app.main:app
but it throws the error

to Overcome this

uvicorn --host 0.0.0.0 app.main:app
```



Run Files using Gunicorn

```
gunicorn -w 4 -k uvicorn.workers.UvicornWorker app.main:app --bind 0.0.0.0
```

we want this Command to start automatically

```
Lets Create our own service
cd /etc/systemd/system
vi apiserver.service
```

```
[Unit]
Description=demo fastapi application
After=network.target

[Service]
User=sanjeev
Group=sanjeev
WorkingDirectory=/home/sanjeev/app/src/
Environment="PATH=/home/sanjeev/app/venv/bin"
EnvironmentFile=/home/sanjeev/.env
ExecStart=/home/sanjeev/app/venv/bin/gunicorn -w 4 -k uvicorn.workers.UvicornWorker app.main:app --bind 0.0.0.0:8000

[Install]
WantedBy=multi-user.target
```

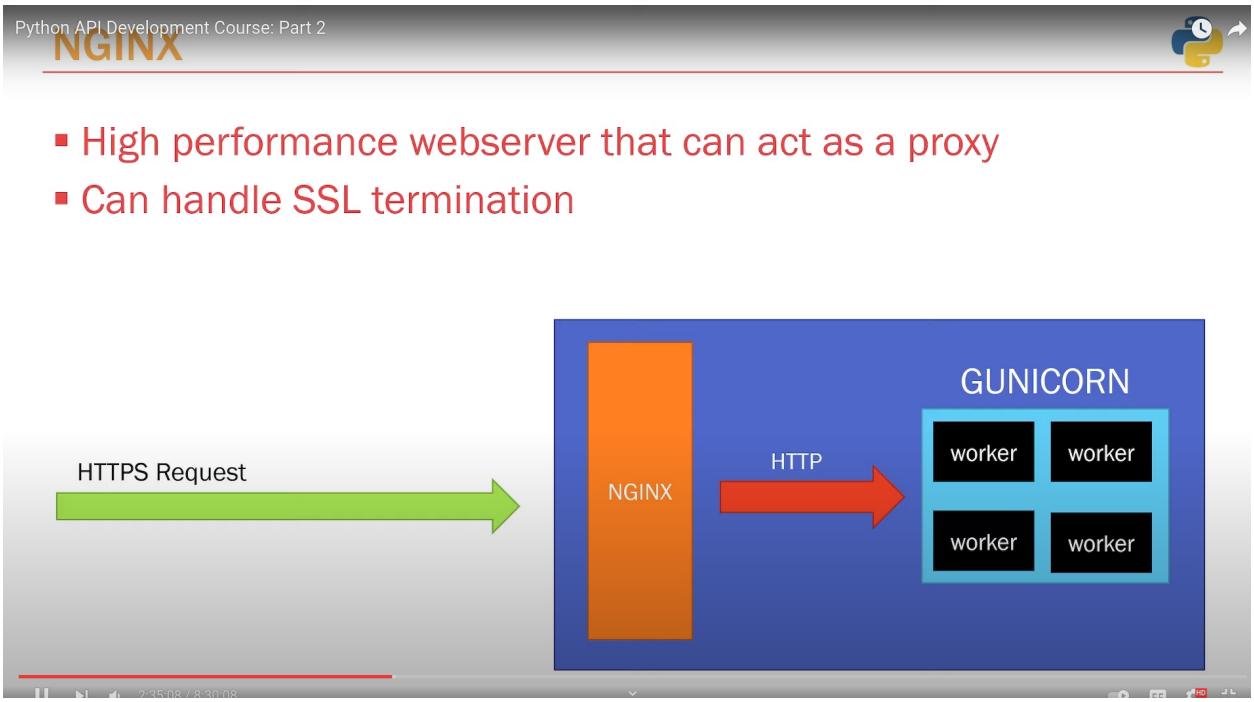
```
cd /etc/systemd/system/
sudo vi apiserver.service # copy the Content to it

systemctl start apiserver
systemctl status apiserver
systemctl restart apiserver
```

Start the Service Automatically when it reboots

```
sudo systemctl enable api
```

NGINX

nginx will be act as a proxy Server



```
sudo apt install nginx
systemctl start nginx

cd /etc/nginx/sites-available/
```

We need to Update the Configuration File

```
server {
        listen 80 default_server;
        listen [::]:80 default_server;

        server_name _; # replace with specific domain name like sanjeev.com

        location / {
                proxy_pass http://localhost:8000;
                proxy_http_version 1.1;
                proxy_set_header X-Real-IP $remote_addr;
                proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
                proxy_set_header Upgrade $http_upgrade;
                proxy_set_header Connection 'upgrade';
                proxy_set_header Host $http_host;
                proxy_set_header X-NginX-Proxy true;
                proxy_redirect off;
        }

}
```

Now restart the service

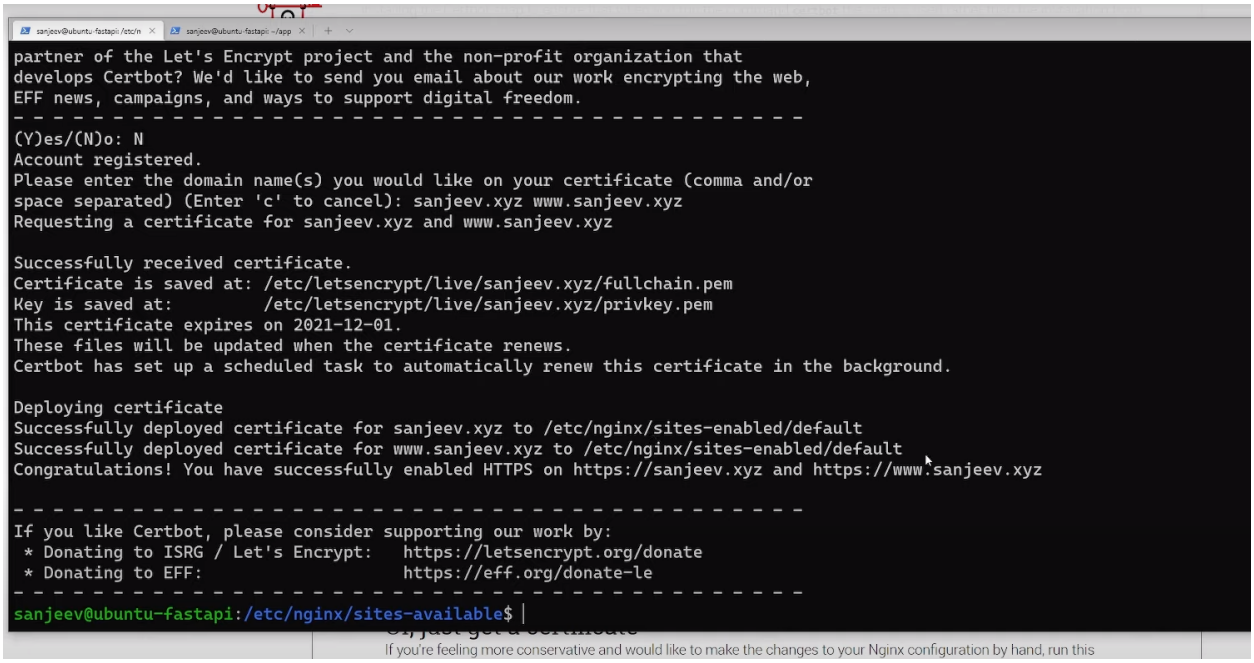
```
systemctl restart nginx
```

Enable the HTTPS

But a Domain Name from aws or any third party and setup in the Route53

Now we are going to enable the https

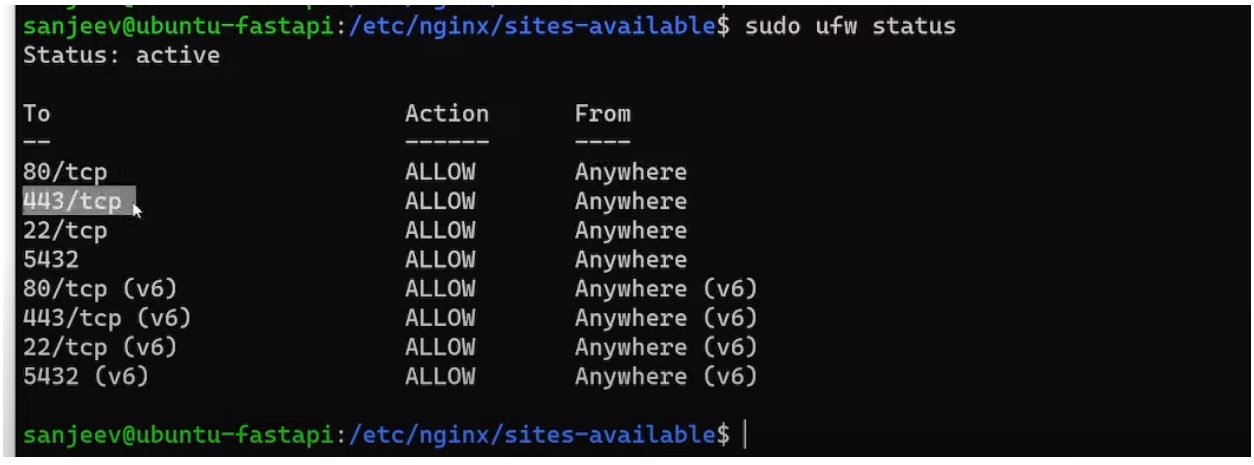
```
sudo apt install snapd
sudo snap install --classic certbot
sudo certbot --nginx
```



Setup a Firewall

we use security groups for handling Firewals

```
sudo ufw allow http
sudo ufw allow https
sudo ufw allow ssh
sudo ufw allow 5432

## Enable the Firewall
sudo ufw enable
```



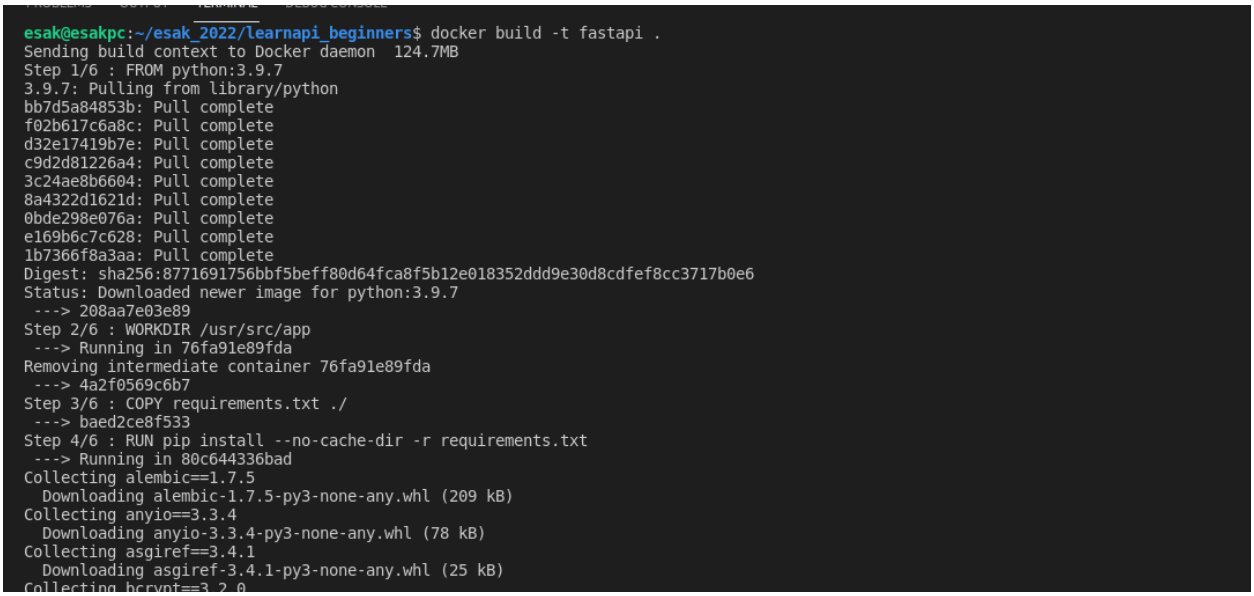
Dockerize the Application

Lets Create Docker Images

```
FROM python:3.9.7

WORKDIR /usr/src/app

COPY requirements.txt ./

RUN pip install --no-cache-dir -r requirements.txt

COPY  . .

CMD ["uvicorn", "app.main:app", "--host", "0.0.0.0" , "--port", "8000" ]
```

Lets build this

```
docker build -t fastapi .
```



Write the Docker Compose File

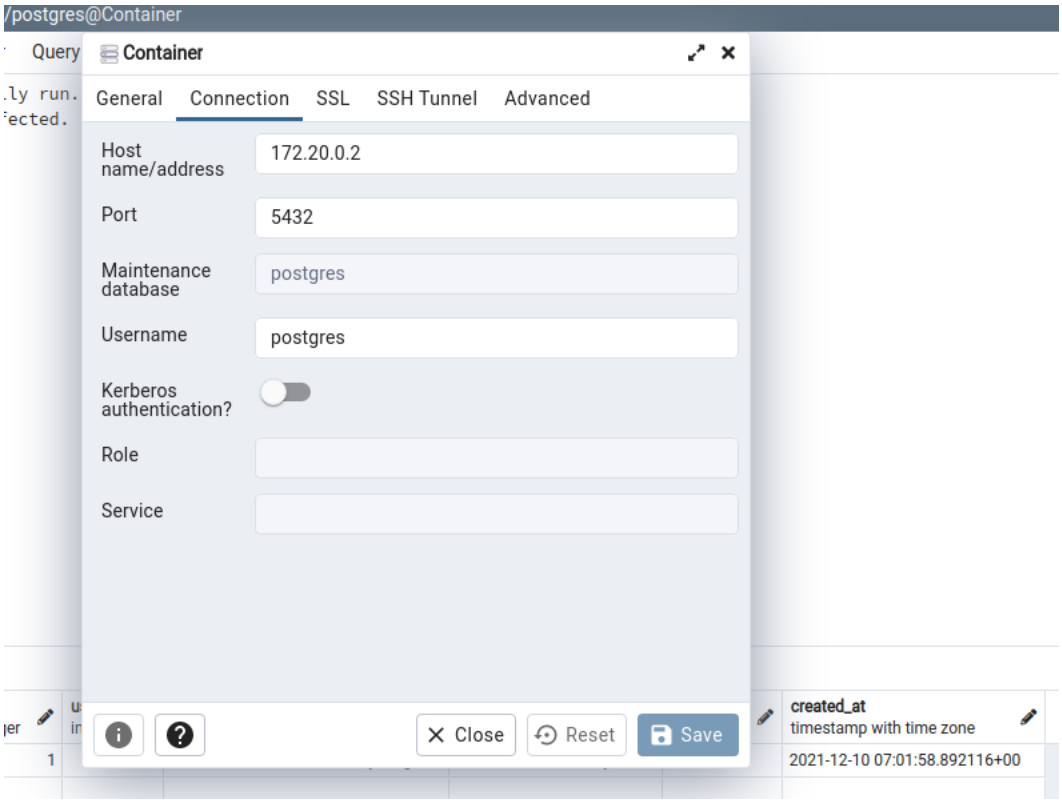
```
version: '3'
services:
  api:
    build: .
    ports:
      - 8000:8000
```

```
PROBLEMS  OUTPUT  TERMINAL  DEBUG CONSOLE
esak@esakpc:~/esak_2022/learnapi_beginners$ docker-compose up -d
Creating network "learnapi_beginners_default" with the default driver
Building api
Sending build context to Docker daemon  124.7MB
Step 1/6 : FROM python:3.9.7
 ---> 208aa7e03e89
Step 2/6 : WORKDIR /usr/src/app
 ---> Using cache
 ---> 4a2f0569c6b7
Step 3/6 : COPY requirements.txt ./
 ---> Using cache
 ---> baed2ce8f533
Step 4/6 : RUN pip install --no-cache-dir -r requirements.txt
 ---> Using cache
 ---> 2a7a9dd0faff
Step 5/6 : COPY . .
 ---> 20391ab03985
Step 6/6 : CMD ["uvicorn", "app.main:app", "--host", "0.0.0.0" , "--port", "8000" ]
 ---> Running in 617159030fd4
Removing intermediate container 617159030fd4
 ---> b9b3c4d21cbf
Successfully built b9b3c4d21cbf
Successfully tagged learnapi_beginners_api:latest
WARNING: Image for service api was built because it did not already exist. To rebuild this image you must use `docker-compose build` or `docker-compose up --build`.
Creating learnapi_beginners_api_1 ... done
esak@esakpc:~/esak_2022/learnapi_beginners$ docker ps
CONTAINER ID   IMAGE                   COMMAND                  CREATED         STATUS         PORTS                                       NAMES
c32d5eaea6fc   learnapi_beginners_api   "uvicorn app.main:ap…"   8 seconds ago   Up 4 seconds   0.0.0.0:8000->8000/tcp, :::8000->8000/tcp   learnapi_beginners_api_1
esak@esakpc:~/esak_2022/learnapi_beginners$
```

Adding Postgress Service

we need to add the docker Ip Address

```
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$ docker inspect -f '{{range.NetworkSettings.Networks}}{{.IPAddress}}{{end}}' 6805a3434dde
172.20.0.2
```



Now we can access the POSTGRESS CONTAINER from our host PGADMIN

Docker Stores all the data in the FOllowing Location

```
The contents of the /var/lib/docker directory vary depending on the driver Docker is using for storage.
```

Docker File

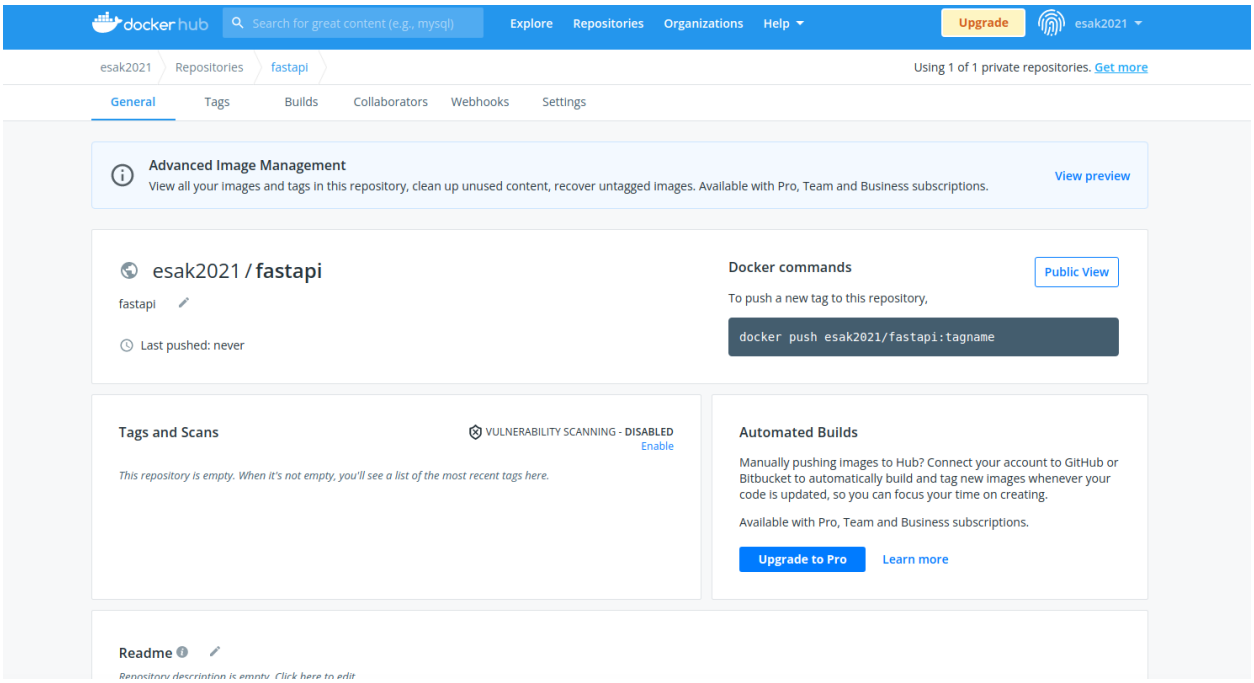
```
FROM python:3.9.7

WORKDIR /usr/src/app

COPY requirements.txt ./

RUN pip install --no-cache-dir -r requirements.txt

COPY  . .

CMD ["uvicorn", "app.main:app", "--host", "0.0.0.0" , "--port", "8000" ]
```

Docker-Compose File

```
version: '3'
services:
  api:
    build: .
    depends_on:
      - postgres
    ports:
      - 8000:8000
    volumes: # example of Bind Mount
      - ./:/usr/src/app:ro
    command: uvicorn app.main:app --host 0.0.0.0 --port 8000 --reload   # weoverride the code

    # env_file:
    #   - app/.env
    environment:
      - ALGORITHM=HS256
      - DATABASE_HOSTNAME=postgres
      - DATABASE_PASSWORD=password123
      - DATABASE_PORT=5432
      - DATABASE_NAME=fastapi
      - DATABASE_USERNAME=postgres
      - SECRET_KEY=0258712wsdasdfesak12324374lopiutyyus
      - ACCESS_TOKEN_EXPIRE_MINUTES=30

  postgres:
    image: postgres
    environment:
      - POSTGRES_PASSWORD=password123
      - POSTGRES_DB=fastapi

    volumes:
      - postgres-db:/var/lib/postgresql/data

volumes:
  postgres-db:
```

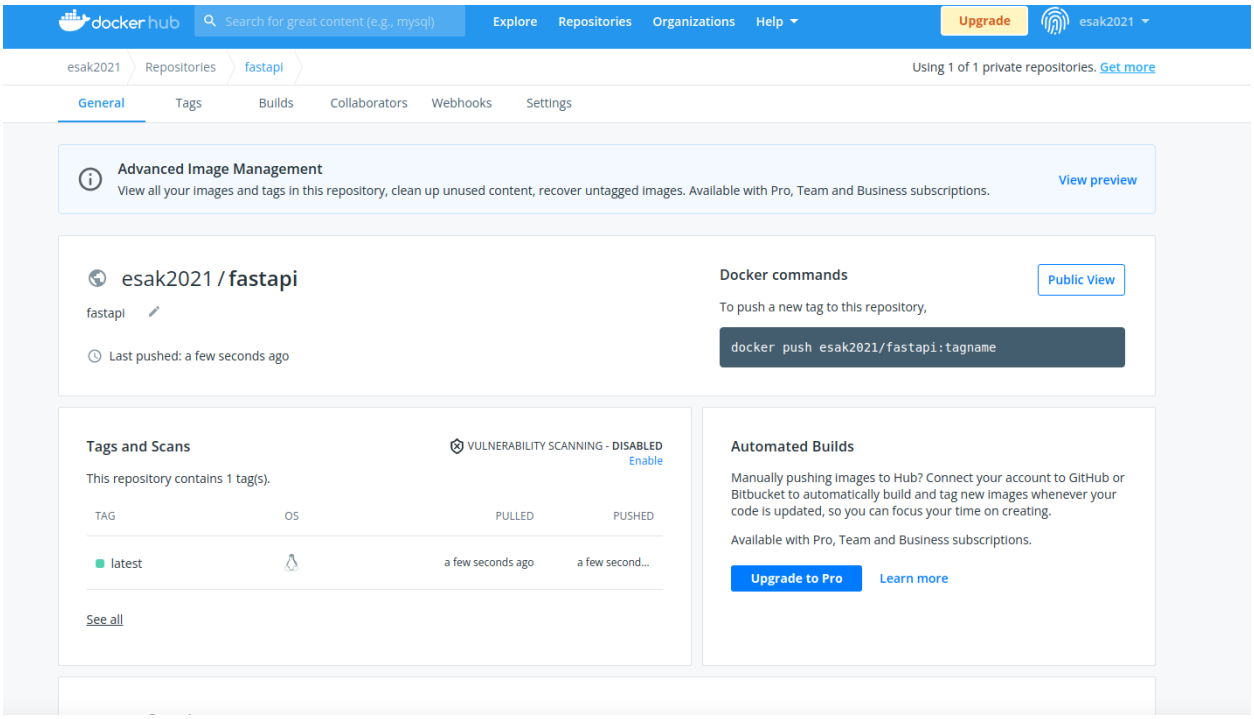
We have these Images build and created in our Local

Lets Push these to DockerHub




```
Login to DockerHub

Create tag for the Local Image s
By deault latest will be used
docker image tag learnapi_beginners_api esak2021/fastapi


## Push the image to docker hub
docker push esak2021/fastapi
```

```
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$ docker image ls
REPOSITORY                  TAG           IMAGE ID       CREATED          SIZE
esak2021/fastapi            latest        f6d082773122   9 minutes ago    1.15GB
learnapi_beginners_api      latest        f6d082773122   9 minutes ago    1.15GB
<none>                      <none>        8984e13db7e3   32 minutes ago   1.15GB
<none>                      <none>        ab2e3fed57ac   39 minutes ago   1.15GB
postgres                    latest        e94a3bb61224   7 days ago       374MB
python                      3.9.7         208aa7e03e89   6 weeks ago      912MB
fourthproject_frontend      latest        e3eb25470bfb   3 months ago     303MB
fourthproject_backend       latest        26ea5cf8daed   3 months ago     94.9MB
nginx                       latest        dd34e67e3371   3 months ago     133MB
python                      3.9-alpine    d4d6be1b90ec   3 months ago     45.1MB
gcr.io/k8s-minikube/kicbase v0.0.25       8768eddc4356   5 months ago     1.1GB
node                        15.13-alpine  3d9a0ea05233   8 months ago     112MB
(venv) esak@esakpc:~/esak_2022/learnapi_beginners$ docker push esak2021/fastapi
Using default tag: latest
The push refers to repository [docker.io/esak2021/fastapi]
91a9d6c99c25: Pushing [=>                                                 ]  3.752MB/121.6MB
17fc7fdc7da9: Pushing [=====>                                             ]  13.51MB/121.8MB
087d02f7f2bd: Pushing [==================================================>]  4.096kB
f074ddf286c4: Pushing  3.072kB
f77bec5d5162: Mounted from library/python
7b656b8058c4: Waiting
02a38a00d553: Waiting
7fcd2600f5ad: Waiting
8f56c3340629: Waiting
ba6e5ff31f23: Waiting
9f9f651e9303: Waiting
0b3c02b5d746: Waiting
62a747bf1719: Waiting
```



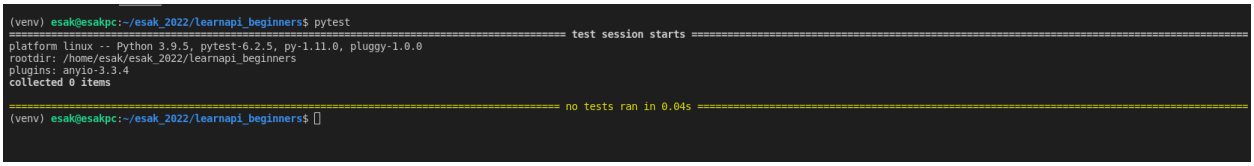
Lets Update our docker compose file for production Setup

```
version: '3'
services:
  api:
    image: esak2021/fastapi
```

```
    depends_on:
      - postgres
    ports:
      - 80:8000
    # volumes: # example of Bind Mount
    #   - ./:/usr/src/app:ro
    #command: uvicorn app.main:app --host 0.0.0.0 --port 8000 --reload   # weoverride the code

    # env_file:
    #   - app/.env
    environment:
      - ALGORITHM=HS256
      - DATABASE_HOSTNAME=${DATABASE_HOSTNAME}
      - DATABASE_PASSWORD=${DATABASE_PASSWORD}
      - DATABASE_PORT=${DATABASE_PORT}
      - DATABASE_NAME=${DATABASE_NAME}
      - DATABASE_USERNAME=${DATABASE_USERNAME}
      - SECRET_KEY=${SECRET_KEY}
      - ACCESS_TOKEN_EXPIRE_MINUTES=${ACCESS_TOKEN_EXPIRE_MINUTES}

  postgres:
    image: postgres
    environment:
      - POSTGRES_PASSWORD=${DATABASE_PASSWORD}
      - POSTGRES_DB=${DATABASE_NAME}

    volumes:
      - postgres-db:/var/lib/postgresql/data

volumes:
  postgres-db:
```

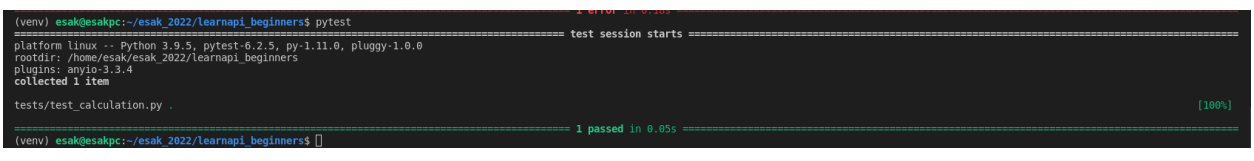
Adding Test Cases

we are using a library called 'pytest'



Lets Create out Test in the app Folder and create a File called test_calculation.py . Always the File should Start with test_* and add our test case .

```
from app.calculation import add
def test_add():
    assert 5 == add(1, 4)


test_add()

To Run this we have to use
pytest
pytest -v for more verbose
pytest -v -s To include the print statement as well
```

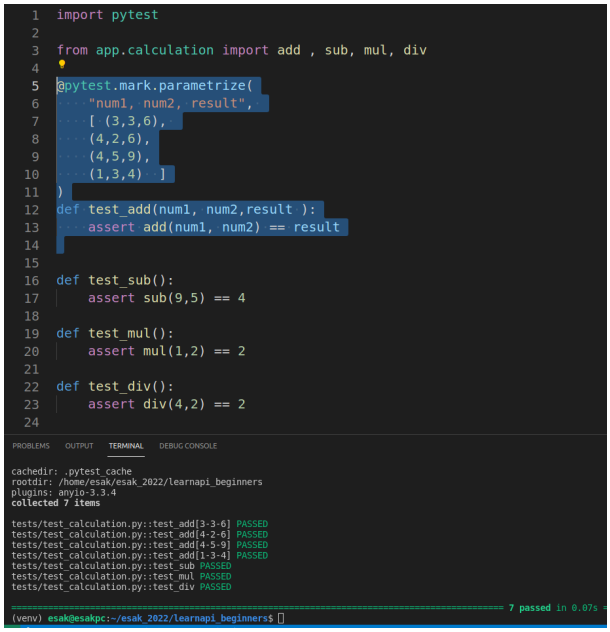


Write the Test Cases as below

```
from app.calculation import add , sub, mul, div

def test_add():
    assert 5 == add(1, 4)


def test_sub():
    assert sub(9,5) == 4

def test_mul():
    assert mul(1,2) == 2

def test_div():
    assert div(4,2) == 2
```

We want to add more testcases then we have to do paramerization

```
@pytest.mark.parametrize(
    "num1, num2, result",
    [ (3,3,6),
    (4,2,6),
    (4,5,9),
    (1,3,4)  ]
)
def test_add(num1, num2,result ):
    assert add(num1, num2) == result
```



We are going to write test cases for the belwo code

```
class BankAccount():
    def __init__(self, starting_balance=0) -> None:
        self.balance = starting_balance

    def deposit(self, amount):
        self.balance += amount

    def withdraw(self, amount):
        self.balance -= amount

    def collect_interest(self):
        self.balance *= 1.1
```

```
def test_bank_set_init_amount():
    bank = BankAccount(500)
    assert bank.balance == 500

def test_bank_default_amount():
```

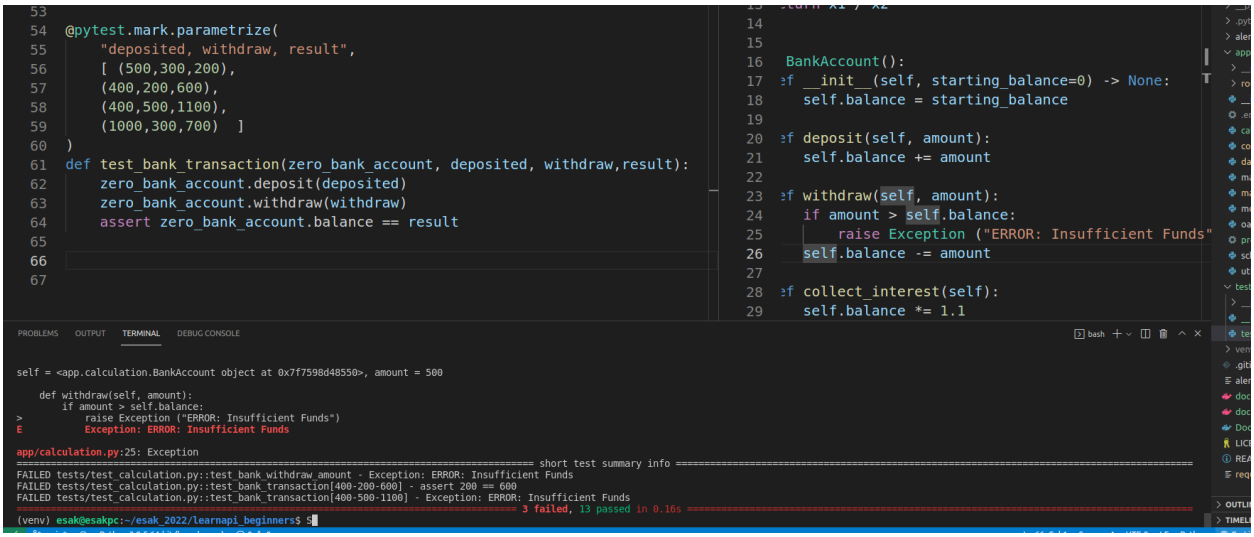
```
    bank = BankAccount()
    assert bank.balance == 0

def test_bank_withdraw_amount():
    bank = BankAccount(500)
    bank.withdraw(100)
    assert bank.balance == 400

def test_bank_deposit_amount():
    bank = BankAccount(50)
    bank.deposit(10)
    assert bank.balance == 60

def test_bank_interest_amount():
    bank = BankAccount(50)
    bank.collect_interest()
    assert round(bank.balance, 2) == 55.00
```

in all of our test cases we are repeating the creation of bank object to overcome this , we have to use **fixtures . Fixtures will be called if we define them in the method parameters**

```
## Creating a Fixture for our Bank account class

@pytest.fixture
def zero_bank_account():
    return BankAccount()

@pytest.fixture
def bank_account():
    return BankAccount(50)


def test_bank_set_init_amount(bank_account):
    assert bank_account.balance == 50

def test_bank_default_amount(zero_bank_account):
    assert zero_bank_account.balance == 0

def test_bank_withdraw_amount(bank_account):
    bank_account.withdraw(100)
    assert bank_account.balance == 400

def test_bank_deposit_amount(bank_account):
    bank_account.deposit(10)
    assert bank_account.balance == 60

def test_bank_interest_amount(bank_account):
    bank_account.collect_interest()
    assert round(bank_account.balance, 2) == 55.00
```

Lets Parameterize the Test

```
@pytest.mark.parametrize(
    "deposited, withdraw, result",
    [ (500,300,200),
    (400,200,600),
    (400,500,1100),
    (1000,300,700)  ]
)
def test_bank_transaction(zero_bank_account, deposited, withdraw,result):
    zero_bank_account.deposit(deposited)
    zero_bank_account.withdraw(withdraw)
    assert zero_bank_account.balance == result
```



if we except an Exception from the Code , then we can handle the scenario as below

```
def test_insufficient_funds(bank_account):
    with pytest.raises(Exception):
        bank_account.withdraw(200)
```

we want to stop the test when there is an Failure

```
pytest -v -x
```

Test Our Application

we want to create our own test databse

```
from fastapi.testclient import TestClient
from app.database import get_db, Base
from app.main import app
from app import schemas
from app.config import settings
from sqlalchemy import create_engine
from sqlalchemy.orm import sessionmaker
from sqlalchemy.ext.declarative import declarative_base

import  pytest

TEST_HOST_URL=f'postgresql://{settings.database_username}:{settings.database_password}@172.21.0.2:5432/testfastapi'
# create Engine
engine = create_engine(TEST_HOST_URL)

print(f"INFO:: USERNAME ::{settings.database_username}")
print(f"INFO:: PASSWORD ::{settings.database_password}")
print(f"INFO:: HOSTNAME ::{settings.database_hostname}")

TestingSessionLocal = sessionmaker(autocommit=False, autoflush=False, bind=engine)




@pytest.fixture(scope="module")
def session():
    Base.metadata.drop_all(bind=engine)
    Base.metadata.create_all(bind=engine)
```

```
    db = TestingSessionLocal()
    try:
        yield db
    finally:
        db.close()


@pytest.fixture(scope="module")
def client(session):
    def override_get_db():

        try:
            yield session
        finally:
            session.close()
    app.dependency_overrides[get_db] = override_get_db
    yield TestClient(app)


def test_root(client):
    res = client.get("/")
    print(res.json())
    print(res.json().get('message'))
    assert res.json().get('message') == 'Welcome to api'
    assert res.status_code == 200


def test_create_user(client):
    res = client.post(
        "/api/v1/users/", json={"email": "hello123@gmail.com", "password": "password123"})
    print(res)
    print(res.status_code)
    print(res.json())
    new_user = schemas.UserResponse(**res.json())
    assert new_user.email == "hello123@gmail.com"
    assert res.status_code == 201

# here the login test is dependednt on the above test case
# Each and every test should be independent
def test_user_login(client):
    res = client.post(
        "/api/v1/auth/login", data={"username": "hello123@gmail.com", "password": "password123"})
    print(res)
    print(res.status_code)
    print(res.json())

    assert res.status_code == 200
```

Lets Create a new File called conftest.py

in here we are going to create all of our fixtures inside of it. pytest will call these fixtures when ever needed

```
from fastapi.testclient import TestClient
from app.database import get_db, Base
from app.main import app
from app.config import settings
from sqlalchemy import create_engine
from sqlalchemy.orm import sessionmaker
from sqlalchemy.ext.declarative import declarative_base
from jose import JWTError, jwt
import  pytest

TEST_HOST_URL=f'postgresql://{settings.database_username}:{settings.database_password}@172.21.0.2:5432/testfastapi'
# create Engine
engine = create_engine(TEST_HOST_URL)

print(f"INFO:: USERNAME ::{settings.database_username}")
print(f"INFO:: PASSWORD ::{settings.database_password}")
print(f"INFO:: HOSTNAME ::{settings.database_hostname}")

TestingSessionLocal = sessionmaker(autocommit=False, autoflush=False, bind=engine)


@pytest.fixture(scope="function")
def session():
    Base.metadata.drop_all(bind=engine)
    Base.metadata.create_all(bind=engine)
    db = TestingSessionLocal()
```

```
    try:
        yield db
    finally:
        db.close()


@pytest.fixture(scope="function")
def client(session):
    def override_get_db():

        try:
            yield session
        finally:
            session.close()
    app.dependency_overrides[get_db] = override_get_db
    yield TestClient(app)

# Creating a Fixture
# this will create a user in the database
@pytest.fixture()
def create_test_user(client):

    user_data = {
        "email": "hello456@gmail.com",
        "password": "password123"
    }
    res = client.post("/api/v1/users/", json=user_data)
    assert res.status_code == 201
    print(res.json())
    new_user = res.json()
    new_user['password'] = user_data['password']
    return new_user
```

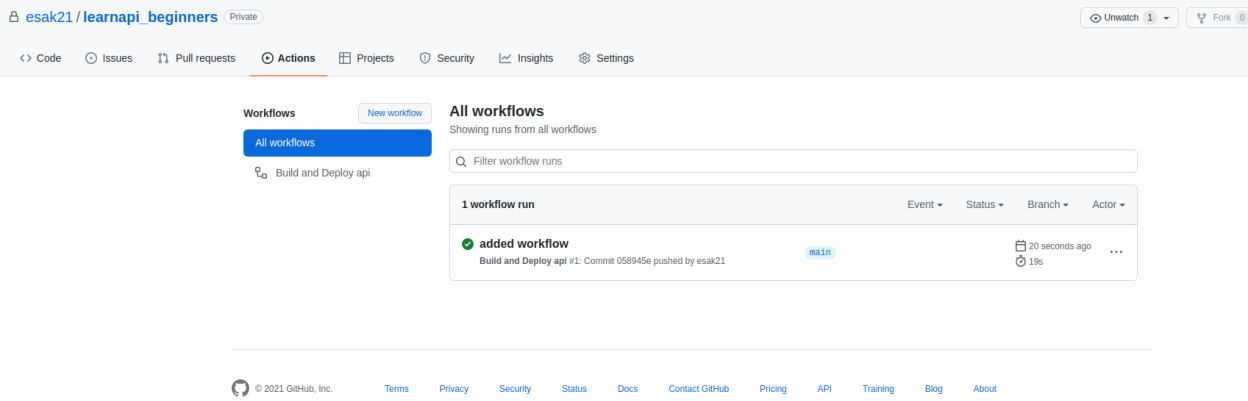
Implement a CICD pipeline

```
name: Build and Deploy api
# Trigger the Branch when we push the Code to Following Branches
on:
    push:
        branches:
            - "main"
            - "anotherbranch"
            - "dev"

# Trigger the Branch when we create PR to Following Branches
    pull_request:
        branches:
            - "main"
            - "test"
```

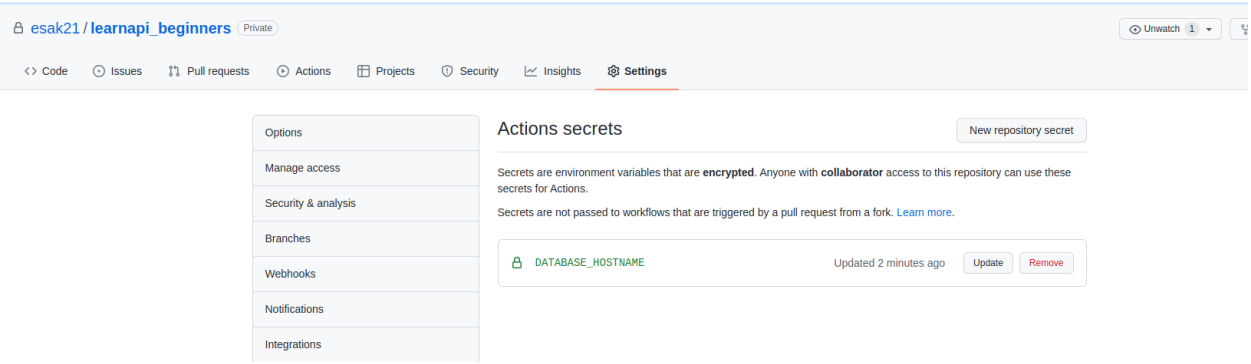
push the code to the Gtihub

```

```

Go to Actions Tab, a Workflow is triggered automatically



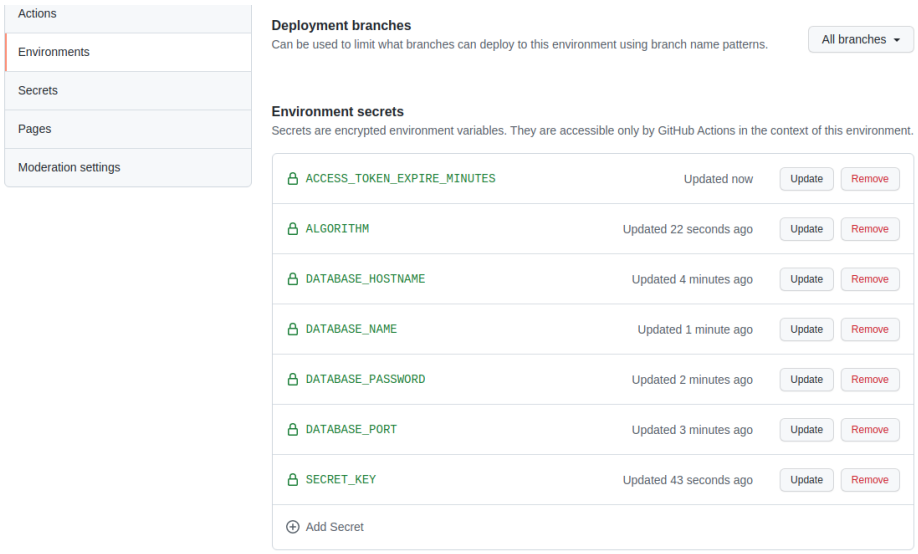
To Store the Environment Variables in Github



To access this in Code

```
jobs:
    job1:
        env:
          DATABASE_HOSTNAME: ${{ secret.DATABASE_HOSTNAME }}
```

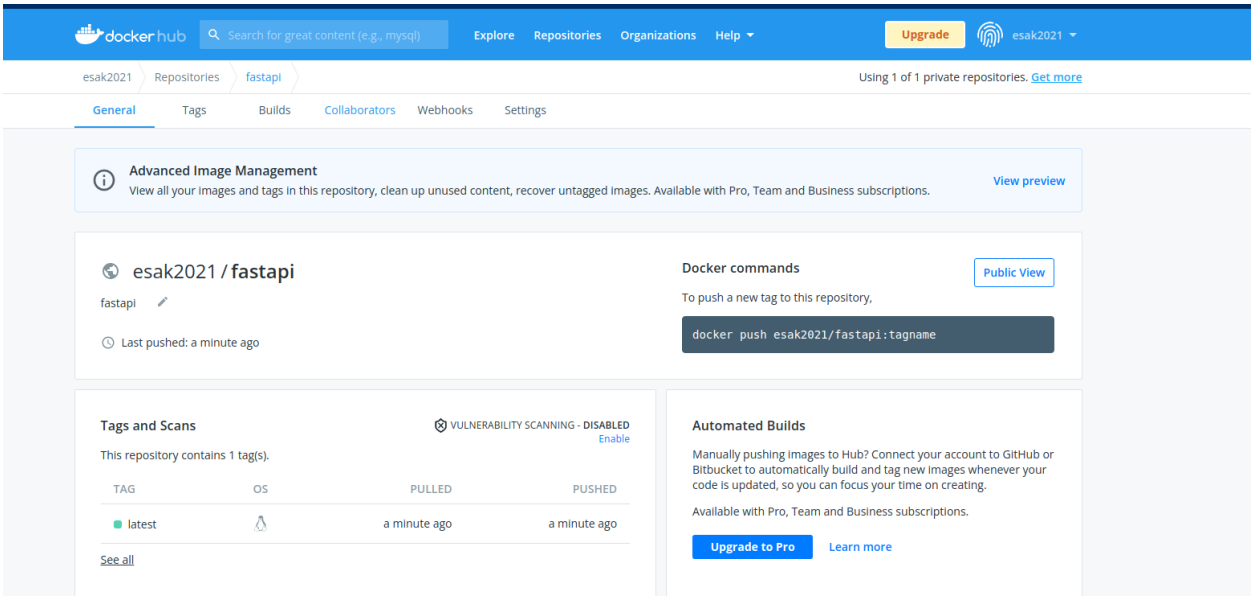
WE can setup secrets in using Environments



Entire Code for CI

```
name: Build and Deploy api

on: [push , pull_request ]

jobs:
    job1:
        environment:
          name: QA
        env:
          DATABASE_HOSTNAME: ${{secrets.DATABASE_HOSTNAME}}
          DATABASE_PORT: ${{secrets.DATABASE_PORT}}
          DATABASE_PASSWORD: ${{secrets.DATABASE_PASSWORD}}
          DATABASE_NAME: ${{secrets.DATABASE_NAME}}
          DATABASE_USERNAME: ${{secrets.DATABASE_USERNAME}}
          SECRET_KEY: ${{secrets.SECRET_KEY}}
          ALGORITHM: ${{secrets.ALGORITHM}}
          ACCESS_TOKEN_EXPIRE_MINUTES: ${{secrets.ACCESS_TOKEN_EXPIRE_MINUTES}}
        services:
          postgres:
            image: postgres
            env:
              POSTGRES_PASSWORD: ${{secrets.DATABASE_PASSWORD}}
              POSTGRES_DB: ${{secrets.DATABASE_NAME}}
            ports:
              - 5432:5432
            options: >-
              --health-cmd pg_isready
              --health-interval 10s
              --health-timeout 5s
              --health-retries 5

        runs-on: ubuntu-latest
        steps:
            - name: Pull Git Repo
              uses: actions/checkout@v2

            - name: Setup Python Version 3.9
              uses: actions/setup-python@v2
              with:
                python-version: '3.9'
            - name: Upgrade Pip
              run: python -m pip install --upgrade pip
            - name: Install dependencies
              run: pip install -r requirements.txt
            - name: Run the Test cases
              run: |
                pip install pytest
                pytest -v -s
```

Lets Setup the Continonus Delivery




```
name: Build and Deploy api

on: [push , pull_request ]

jobs:
    Build:
        environment:
          name: QA
        env:
          DATABASE_HOSTNAME: ${{secrets.DATABASE_HOSTNAME}}
          DATABASE_PORT: ${{secrets.DATABASE_PORT}}
          DATABASE_PASSWORD: ${{secrets.DATABASE_PASSWORD}}
          DATABASE_NAME: ${{secrets.DATABASE_NAME}}
          DATABASE_USERNAME: ${{secrets.DATABASE_USERNAME}}
          SECRET_KEY: ${{secrets.SECRET_KEY}}
          ALGORITHM: ${{secrets.ALGORITHM}}
          ACCESS_TOKEN_EXPIRE_MINUTES: ${{secrets.ACCESS_TOKEN_EXPIRE_MINUTES}}
        services:
          postgres:
            image: postgres
            env:
              POSTGRES_PASSWORD: ${{secrets.DATABASE_PASSWORD}}
              POSTGRES_DB: ${{secrets.DATABASE_NAME}}
            ports:
              - 5432:5432
            options: >-
              --health-cmd pg_isready
              --health-interval 10s
              --health-timeout 5s
              --health-retries 5

        runs-on: ubuntu-latest
        steps:
            - name: Pull Git Repo
              uses: actions/checkout@v2

            - name: Setup Python Version 3.9
              uses: actions/setup-python@v2
              with:
                python-version: '3.9'
            - name: Upgrade Pip
              run: python -m pip install --upgrade pip
```

```
          - name: Install dependencies
            run: pip install -r requirements.txt
          - name: Run the Test cases
            run: |
              pip install pytest
              pytest -v -s
          - name: Login To Docker Hub
            uses: docker/login-action@v1
            with:
              username: ${{ secrets.DOCKER_HUB_USERNAME }}
              password: ${{ secrets.DOCKER_HUB_ACCESS_TOKEN }}

          - name: setup Docker build
            id: builder
            uses: docker/setup-buildx-action@v1

          - name: build and push
            id: docker_build
            uses: docker/build-push-action@v2
            with:
              context: ./
              file: ./Dockerfile
              builder: ${{ steps.buildx.outputs.name}}
              push: true
              tags: ${{ secrets.DOCKER_HUB_USERNAME }}/fastapi:latest
              cache-from: type=local,src=/tmp/.buildx-cache
              cache-to: type=local,dest=/tmp/.buildx-cache
          - name: Image diges
            run: echo ${{ steps.docker_build.outputs.digest}}

    Deploy:
      runs-on: ubuntu-latest
      needs: [Build] # Job run in sequential Order
      steps:
        - name: push changes to production
          run: echo "Deploying to Production Steps"
```