



# PIC16B HW3 Web Development

CODING

PYTHON

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PUBLISHED

February 25, 2023

This blog post is a tutorial for simple web development using `flask`. The app we're going to build is a simple message bank. It should do two things: 1. Allow the user to **submit** messages to the bank. 2. Allow the user to **view** a sample of the messages currently stored in the bank.

To do this, we create an `app.py` to deploy functions, the `html` files to design templates, and a `style.css` file to format the webpage.

The Github repository link is <https://github.com/skylar0104007/pic16b-hw3-web-development-flask>

## 0. Install Libraries

```
from flask import Flask
from flask import render_template, g, url_for, request
import sqlite3
```

## 1. Enable Submissions

First, create a `submit` template with three user interface elements: 1. A text box for submitting a message. 2. A text box for submitting the name of the user. 3. A “submit” button.

You may find it helpful to put navigation links (the top two links at the top of the screen) inside a template called `base.html`, then have the `submit.html` template extend `base.html`. For example, the `base.html` from `mnist demo` has the navigation links and also specifies where the header and content blocks would go. Then, other templates like `submit.html` just has to write what would go inside `header` and `content` instead of repeating everything that's already in the `base.html` template. There are more examples to extend from `flask` and `jinja`.

### Useful links:

- `base.html` from `mnist demo`: <https://github.com/HarlinLee/pic16b-mnist-demo/blob/main/templates/base.html>

- `submit.html`: <https://github.com/HarlinLee/pic16b-mnist-demo/blob/main/templates/submit.html>
- `flask`: <https://flask.palletsprojects.com/en/2.2.x/tutorial/templates/#register>
- `jinja`: <https://jinja.palletsprojects.com/en/3.1.x/templates/#template-inheritance>

## base.html

This is the main template that establishes a basic format so that `submit.html` and `view.html` can extend from.

```
<!doctype html>
<link rel="stylesheet" href="{{ url_for('static', filename='style.css') }}">
<title>{% block title %}{% endblock %} PIC16B HW3 </title>
<nav>
  <h1>A Simple Message Bank</h1>
  <!-- <b>Navigation:</b> -->
  <ul>
    <li><a href="{{ url_for('submit') }}">Submit a message</a></li>
    <li><a href="{{ url_for('view') }}">View messages</a></li>
  </ul>
</nav>
<section class="content">
  <header>
    {% block header %}{% endblock %}
  </header>
  {% block content %}{% endblock %}
</section>
```

To produce the main page of the website, run the following code:

```
app = Flask(__name__)

@app.route('/')
def main():
    return render_template("base.html")
```

## submit.html

This template allows and reads in 2 entries: `message` and `name`. If the two entries are not empty, it will prompt a `success` message; otherwise, it prompts an `error` message. Conditions for these two messages will be introduced later in an `if` statement of the `insert_message` function. - Remember to specify the input names of the elements to facilitate the use of `request.form['<name>']` in later steps.

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

{% block header %}
  <h1>{% block title %}Submit{% endblock %}</h1>
{% endblock %}

{% block content %}
  <form method="post">
```

```

<label for="message">Your message:</label>
<br>
<input type="text" name="message" id="message">
<br>
<label for="handle">Your name or handle:</label>
<input type="text" name="handle" id="handle">
<br>
<input type="submit" value="Submit message">
</form>

{% if success %}
<br>
  Thanks for submitting a message!
{% endif %}

{% if error %}
<br>
  Please fill in both blanks.
{% endif %}

{% endblock %}

```

See below a screenshot of the webpage layout of `submit.html`.

```

from IPython import display
display.Image("submit.jpg")

```

## A Simple Message Bank

- Submit a message
- View messages

### Submit

Your message:

Your name or handle:

Now, write two Python functions for database management in a new file `app.py` (you can also write them in a separate `.py` file and import them into `app.py`).

- `get_message_db()` should handle creating the database of messages.

1. Check whether there is a database called `message_db` in the `g` attribute of the app. If not, then connect to that database, ensuring that the connection is an attribute of `g`. To do this last step, write a line like do `g.message_db = sqlite3.connect("messages_db.sqlite")`

2. Check whether a table called `messages` exists in `message_db`, and create it if not. For this purpose, the SQL command `CREATE TABLE IF NOT EXISTS` is helpful. Give the table an `id` column (integer), a `handle` column (text), and a `message` column (text).
3. Return the connection `g.message_db`.

```
#function to handle creating the database of messages
def get_message_db():

    #check whether there is a database called `message_db`
    #in the g attribute of the app
    try:
        return g.message_db

    #otherwise connect to that database
    #ensuring that the connection is an attribute of g
    except:
        g.message_db=sqlite3.connect("message_db.sqlite")

        #write the SQL query
        #NOTE: please include the commas and semicolon!!!
        cmd=\
        """
        CREATE TABLE IF NOT EXISTS message (
            id INTEGER PRIMARY KEY,
            handle TEXT NOT NULL,
            message TEXT NOT NULL);
        """

        #execute and return
        cursor=g.message_db.cursor()
        cursor.execute(cmd)

        return g.message_db
```

- `insert_message(request)` should handle inserting a user message into the database of messages.

1. Extract the `message` and the `handle` from `request`. You'll need to ensure that your `submit.html` template creates these fields from user input by appropriately specifying the `name` of the input elements. For example: `<input type="text" name="message" id="message">` is what I used in my template to ensure that `request.form["message"]` contained the `message` input by the user. You should then return the `message` and the `handle`.
2. Using a cursor, insert the message into the `message` database. Remember that you'll need to provide an `ID number`, the `handle`, and the `message` itself. You'll need to write a SQL command to perform the insertion.
  - *Note:* when working directly with SQL commands, it is necessary to run `db.commit()` after inserting a row into db in order to ensure that your row insertion has been saved.

- You should ensure that the ID number of each message is unique. One way to do this is by setting the ID number of a message equal to one plus the current number of rows in `message_db`.
- Don't forget to close the database connection within the function!

```
#function to handle inserting a user message into the database of messages
def insert_message(request):

    #extract values from existing database
    db=get_message_db()
    cursor=db.cursor()

    #use id_num to ensure the ID number of each message is unique
    nrows=cursor.execute("SELECT * FROM message")
    id_num=len(nrows.fetchall())+1

    handle=request.form['handle']
    message=request.form['message']
    #if both message and handle are not empty, insert them to message database
    if message and handle:
        cursor.execute('INSERT INTO message VALUES (?, ?, ?)', (id_num, handle, message))
        db.commit()

    #remember to close connection and save space
    db.close()
```

Finally, write a function to `render_template()` the `submit.html` template.

Since this page will both transmit and receive data, you should ensure that it supports both `POST` and `GET` methods, and give it appropriate behavior in each one.

- In the `GET` case, you can just render the `submit.html` template with no other parameters.
- In the `POST` case, you should call `insert_message()` (and then render the `submit.html` template). Maybe it would be nice to add a small note thanking the user for their submission?

```
@app.route('/submit/', methods=['POST', 'GET']) #support both methods
def submit():

    #if GET, render the submit.html with no other parameters
    if request.method=='GET':
        return render_template('submit.html')

    #if POST, call insert_message and then render the submit.html
    else:

        try: #if successfully insert: id for each message is unique
            insert_message(request)

            #if both name and message are texts, prompt success message
            if request.form['handle'] and request.form['message']:
```

```

        return render_template('submit.html', success=True)

        #if either name or message is not text, prompt error message
    else:
        return render_template('submit.html', error=True)

    except: #if fail to insert, prompt error message too
        return render_template('submit.html', error=True)

```

## 2. Viewing Random Submissions

- Write a function called `random_messages(n)` to return a collection of `n` random messages from the `message_db`, or fewer if necessary.

Don't forget to close the database connection within the function!

```

#function to return n random messages from the message_db, or fewer if necessary
def random_messages(n=5): #set a default n=5
    db=get_message_db()
    cursor=db.cursor()

    #if default n > number of unique messages
    #print all unique messages in database
    #otherwise still print n random messages
    nrows=cursor.execute("SELECT * FROM message")
    total_rows=len(nrows.fetchall())
    if n>total_rows:
        n=total_rows

    #print n random pairs of name and message from message database
    cmd=f"SELECT handle, message FROM message ORDER BY RANDOM() LIMIT {n}"
    cursor.execute(cmd)

    #store name and message and return as tuples
    fetched_messages=cursor.fetchall()
    db.close()

    return fetched_messages

```

### view.html

This template displays the messages extracted from `random_messages()`.

I took advantage of the fact that Jinja tags support looping (so I looped over the messages), and I also used the fact that Jinja tags support indexing of objects (so if `m` is a tuple of user handle and message `m[0]` contains the handle and `m[1]` contains the message).

If `fetched_messages` is not empty, print in the `{message} -{name}` format. Otherwise, print an error message.

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

{% block header %}
<h2>{% block title %}Some Cool Messages{% endblock %}</h2>
{% endblock %}

{% block content %}

{% if fetched_messages %}
    {% for m in fetched_messages %}
        <br>
        {{ m[1] }}
        <br>
        <i>- {{ m[0] }}</i>
        <br>
    {% endfor %}

{% else %} No messages yet!
{% endif %}

{% endblock %}
```

See below a screenshot of the webpage layout of `view.html`.

```
from IPython import display
display.Image("view.jpg")
```

## A Simple Message Bank

- Submit a message
- View messages

### Some Cool Messages

I love PIC16B!  
- *Phil*

I love PIC16B too!  
- *Skylar Lyu*

- Finally, write a function to render your `view.html` template.

This function should first call `random_messages()` to grab some random messages (I chose a cap of 5), and then pass these messages as an argument to `render_template()`.

```
@app.route('/view/')
def view():
```

```
return render_template('view.html', fetched_messages=random_messages())
```

### 3. Customize Your App

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Write some CSS to customize your app! At minimum, you should - Incorporate a non-default font. - Use color in some way.

Feel free to add additional CSS (and modify your templates if necessary) in order to give your app a personal feel.

```
html {  
    font-family: Times New Roman;  
    background-color: Beige;  
    padding: 1rem;  
}  
  
h1 {  
    color: Maroon;  
    margin: 1rem 0;  
    text-align: left;  
}  
  
h2 {  
    margin: 1rem 0;  
    font-size: 23px;  
}  
  
a {  
    color: MidnightBlue;  
    text-decoration: none;  
}
```

Volià!

Run `conda activate PIC16B`, `export FLASK_ENV=development`, `flask run` in Terminal to view the webpage. If port occupied, run `flask run -p 5001` (or any other number than 5000) instead.