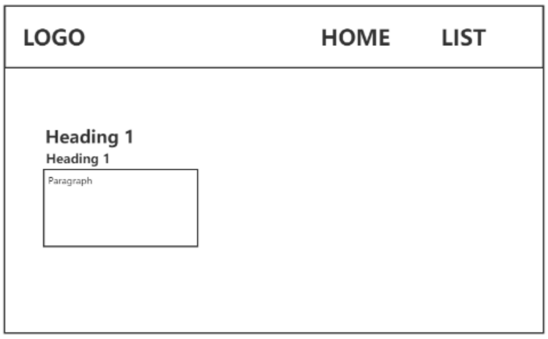
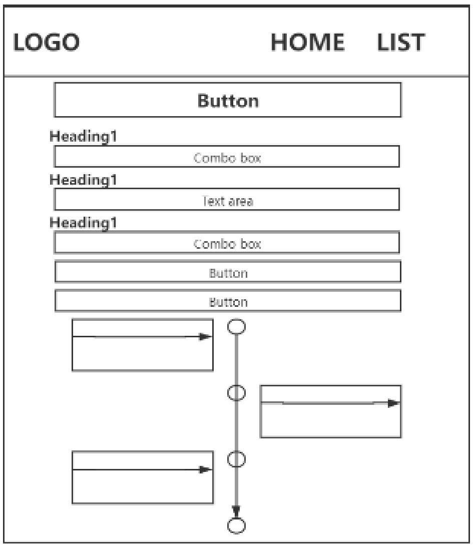
Content

1. Wireframe Model





2. Layout

There is a navigation bar on all pages on the website, convenient for users to jump to diverse pages. On the left side of it is the logo of the web page, whose name can well reflect the functions of the website. Two links to webpage locate on the right of it.

On the home page, the large heading on the left captures the user's attention and provides them with a simple instruction for the utilization of the web. In the list page, the area just below the navigation bar is a button for adding and assessment, which is placed in the most conspicuous position due to its significant role of web application functionality. The following are three filter criteria boxes for search, where users can select or enter the requested condition to filter assessment. Another button for showing all assessments appears below it. Down at the bottom is the presentation of assessments, which is set up in a timeline with a central line in the middle, presented in the order of creation, alternating left and right.

3. Design

The first thing greets the user is a sailboat sailing on the ocean, and the whole page is organized with roughly blue background and a white font, which can activate people's mood. The logo on the left top and the link item on the top right all indicates that it is a website focusing on the efficiency. The following heading and text bring about the guidance for using the website, and the home page plays the role of attracting users and introducing the website.

The background of the List page is similar to that of the Home page, which is a turquoise beach. All input fields, buttons and pictures are matched with candy colour, which is harmonious with the background. The button with the most important function, adding new assessments, is placed in the middle of the navigation bar, highlighted by a circle of light blue shadows. After clicking on it, a form will pop up instead of jumping to a new page, which saves the time of loading. The user provides the task information in it, and all the places that need to be input have prompt information, including the input content, the word limit. Even if the user input exceeds the limit, the maximum length of the HTML file is also specified to increase the vulnerability of the web page.

In the search function, all conditions are optional. Module code and state are selected directly from the combo box without the need to input. Clicking the Search button displays all tasks that meet the criteria.

All tasks are displayed through the timeline, module, title, deadline, state and description are differentiated in different formats. There are three buttons in the card for updating status, deleting tasks and editing tasks, and there is no need to jump to another page when editing tasks with the existence of a new pop-up form. There is also an up-arrow button at the bottom of the page, which can be clicked to jump to the top of the page to enable users to utilize other functions

4. Three-tier Architecture

The application is divided into three parts: Presentation Tier, Application Tier, and Data Tier.

The ***Presentation Tier*** is namely the user interface, which is written by ***HTML***, ***CSS***, and ***Javascript*** and allow users to interact with the web application. Its main function is to present information to users and collect information from users, for instance, showing all assessments, assembling the entered property of one assessment.

The ***Application Tier*** is the core of an application. It is used for data processing, such as adding, deleting, modifying and querying data in the database through specific coding language. In this case, ***db.model*** () Model stored in ***SQLAlchemey*** is utilized in ***app.py***, which creates three tables, todo, code and title for storing the property of assessments. Code in ***views.py*** is used to process properties of one assessment in the database, using information collected on the previous tier. The ***primary key*** in all models is the ***integer*** type. In the model of ***Todo***, ***code***, ***title***, ***description*** use the data type of ***string***, which is entered by the user in the web page. However, ***DateTime*** is used for the ***deadline*** date, which is chosen by the user in a date selection box, ***complete*** of ***Boolean*** type is adopted to indicate whether this assessment is completed or not. Similarly, ***code*** in the model of code, ***title*** in the model of Title is all ***string***, which is consistent with that of Todo.

The ***Data Tier*** is sometimes referred to as the Database Tier, where information from the previous tier is stored, such as Relational Database Management System. The database used this time is a light DBMS called SQLite, all the data are stored in ***db.sqlite***. In particular, ***Python*** scripts are employed to control the ***migration***, ***upgrade*** and **roll** ***back*** of the database.

In this type of architecture, the three tiers do not affect each other. The biggest advantage of the three-tier architecture is the separation of logic and physics, with each architecture running on a different operating system or service platform. Each tier can be customized and optimized as required, and changes made at this time do not affect other tiers

5. Request Handling

Two categories of protocols are utilized in the request handling process. HTTP and TCP/IP. HTTP, an acronym for Hypertext Transfer Protocol, is a protocol for computers to communicate through the network, which is a stateless application layer protocol based on request and response, and usually transmits data based on TCP/IP protocol. The communication between server and client is accomplished by ***request and response***, the client sends a request, the server sends a response. What's more, HTTP does not possess the memory for the transaction, that is to say, a series of safety certification matching need to be done when the client sends the request and establishes the connection with the server for the first time, thus increase waiting time; After the server response, both are disconnected and don't save the connection state as well. The next time a client sends a request to the same server, the connection needs to be re-established. Additionally, HTTP is an application-layer protocol, which needs to be cooperated with TCP/IP, a data transmission protocol. The HTTP client initiates a TCP connection to the server, and once the connection is established, the browser (client) and the server process can access TCP over the socket interface.

When a client (usually a web browser) needs to set up a connection, the first TCP connection is established. After it is completed, the client sends a request to the server, which usually contains a method such as GET or POST to denote specific action that has to be performed on a given resource, Uniform Resource Identifier to indicate the resource, and a HTTP version. The GET method gets information from the server through the URI, such as JS files and images in static folders, and the main function of POST method is to send information in the form to the server, such as properties of added assessments. A server can handle multiple requests at the same time, but each request is handled independently. When it receives a request, this request is processed by the server. The response is sent to the client when it's completed, containing the status information of the request, and the TCP connection is disconnected meanwhile. HTTP works as an intermediary between client and server.

Evaluation

a) Test

The main purpose of website testing is to ensure users' experience, and carry out effective communication and information exchange with users. Complete, high-quality testing enables the site to meet the required quality and functionality. Web testing can resolve most of the issues before the website is published, including functionality, usability, security, accessibility, compatibility, integration, environment, etc., which is essential for the successful completion of a website. Fixing the bugs detected in the testing process in a timely manner can greatly reduce the losses of business operations, for example, huge human cost and material cost of maintaining, declined sales owing to worse reputation, postponement of iteration because of the bugs in old version and so on.

- Default value, prompt input information, warning message of each field in the *form* is correct

Add Assessment Form/ Edit Assessment Form

Input	Expected	Output	Result
Code: string less than 20	Normal	Normal	PASS
Code: string more than 20	Character more than 20 cannot be input	Normal	PASS
Code: NULL	Warning message	Normal	PASS
Title: string less than 100	Normal	Normal	PASS
Title: string more than 100	Character more than 20 cannot be input	Normal	PASS
Title: NULL	Warning message	Normal	PASS
Description: string less than 500	Normal	Normal	PASS
Description: string more than 500	Character more than 20 cannot be input	Normal	PASS
Description: NULL	Warning message	Normal	PASS

Search form

Input	Expected	Output	Result
Code: No requirements	All assessments	Normal	PASS
Code: option in combo box	Satisfied assessments	Normal	PASS
Title: NULL	All assessments	Normal	PASS
Title: string less than 100	Satisfied assessments	Normal	PASS
Title: string more than 100	Character more than 20 cannot be input	Normal	PASS
State: No requirements	All assessments	Normal	PASS
State: option in combo box	Satisfied assessments	Normal	PASS

- The *functionality* is checked by adding, deleting, editing and searching assessments

Operation	Expected	Output	Result
Add an assessment	Assessment added	Normal	PASS
Edit an assessment	Assessment edited	Normal	PASS
Update an assessment	Assessment status updated	Normal	PASS

Delete an assessment	Assessment deleted	Normal	PASS

- Database ***migration***, ***upgrade***, ***roll back*** are tested by changing the database manually

Operation	Expected	Output	Result
Delete description in database, migrate, update	Database changed, migrated, updated	Normal	PASS
Add two assessments with the same id	Database roll back	Normal	PASS

- Web developer tools are adopted to resize the page, in order to check it's ***responsive***, and all information is complete and nicely displayed

Page	Small	Middle	Large
Home	Normal	Normal	Normal
List	Normal	Normal	Normal

- The **port server** is running correctly, without error messages, and can give warnings in special cases
- **Compatibility** testing, most major browsers in the market, and operating systems like Windows and Mac OS platforms have been tested, as well as the display of web pages during printing

Page	Chrome	Firefox	Edge	Safari	Print
Home	Normal	Normal	Normal	Normal	Normal
List	Normal	Normal	Normal	Normal	Normal

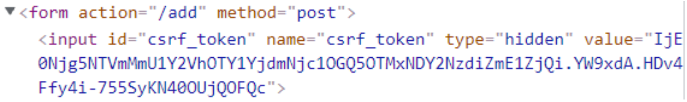
b) Debug

The purpose of debugging is to detect and eliminate potential bugs in the web application, which may lead to abnormal functions and affect the user experience. In order to prevent the wrong operation of the website, debugging must be carried very carefully. In some conditions, the files are closely interrelated with each other, consequently debugging becomes very difficult, so it is very significant to separate the file that need to be debugged and keep other files unchanged.

- *Javascript* debugging is done in the ***developer tools*** in the browser by setting breakpoints and detecting variables
- *HTML* and *CSS* debugging is done through the ***Preview*** plug-in in Pycharm to check the condition of the web page in real time
- *Flask* backend debugging is done by checking the contents of the ***database*** and ***printing*** the data of variables

c) Security

Flask contains the *SECRET_KEY* variable, which is used as an encryption key to produce signatures or tokens. Flask-WTF supports *CSRF* (Cross Site Request Forgery) protection by default, and uses this key to generate an encrypted token that verifies the authenticity of the data in the form to prevent CSFR attacks when users submit assessment.



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▼<form action="/add" method="post">
   <input id="csrf_token" name="csrf_token" type="hidden" value="IjE
   0Njg5NTVmMmU1Y2VhOTY1YjdmNjc1OGQ5OTMxNDY2NzdiZmE1ZjQi.YW9xdA.HDv4
   Ffy4i-755SyKN40OUjQOFQc">
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d) Accessibility

- The title of the page is concise, accurate, and distinguished from other pages
- All pictures have suitable alternative text
- Each page has a different heading with a different level of style differentiation
- Colour contrast is friendly to colourless people
- All text and images appear normal when the page is zoomed in and out
- Different buttons can be accessed only through the keyboard

e) Challenges, Solutions, Learning

The biggest challenge in the development process was the learning of Flask framework, which is completely new to me, and I have no way to start. But I got a good idea of Flask by reading the dog book, watching video tutorials, and studying code from open-source projects. This not only exercised my self-learning ability, but also improved my capacity to adapt to new things.

During the development of the Flask backend, a number of problems were difficult to find because the breakpoints cannot be added. In this case, if checking the code for syntax and semantic errors is not working, I will then print the values of key variables at the terminal to locate the bug. Concerning complicated error messages, others' solutions on the Internet are always helpful. These approaches also apply to other coding languages and other modules.

This project involves considerable files. For the purpose of being neat, beautiful and easy to manage and maintain, file organization methods of open-source project on the Internet and Sample Code provided by Minerva are referred. Files with different functions and types are placed in different folders with concise and accurate names. Despite this small-scale project, we may be responsible for complex and large projects in the future. The standardized management and naming of files will have a positive impact on the team cooperation between the developer team and the white box testing between testing team.

There is a new search function for filtering the assessments satisfying the conditions. For the convenience of users, module code is designed as a combo box instead of an input field. In the process of obtaining all module codes through the back end, it is very difficult using model Todo only. Therefore, a new model code is added to store all the module codes of assessments. The same method applies to title. In addition, in the search process, in order to expand the search scope, the three conditions are not mandatory. Module code and state are not required by default, and title can also be empty. Users are free to whether enter search conditions for filtering or not. Although we are in the role of developers, the functions and interfaces should be considered from the perspective of users.

f) Difference

In general, only some basic functions of Todo List are specified in the requirements. In expectation of better facilitating users, some new functions are added in the process of design and implementation. More exactly, users can remove assessments that have been added, for which have been added incorrectly or completed for a long time; Users can change the status of assessment multiple times between completed and uncomplete; Users can modify any attribute of a task; Users can query assessments by module code, title and state in all tasks.

With the intention of separating assessment of different users, registration and login interfaces are planned to be added in the design process, but this function requires a new database and a new interface, increasing the workload to a large extent. In addition, different users have different assessment, which involves the relationship between models in database. Because of the unfamiliarity and complexity of this content, this function is not added, but the second coursework will possess this functionality to make up for the regret left behind this time.

So as to collect users' feedback, a new Contact Us page is intended to be appended to collect users' opinions on this website. However, due to the single function of this website and few pages, the information collected may not be valuable enough, so this function is not implemented this time. In future large websites with complex functions, it will definitely be designed, and people in the team will be assigned in charge of managing the user feedback to help upgrade and iteration of the website.

6. Reference

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