

Final Year Project Report

Full Unit - Final Report

A study in (HCI) human computer interaction

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Declaration

This report has been prepared on the basis of my own work. Where other published and unpublished source materials have been used, these have been acknowledged.

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Abstract

This document serves as the project plan for the A study in (HCI) human computer interaction project. In last year's group assignment, I made an interactive page of a restaurant, creating a beautiful and functional system through different languages (MySQL, Java, HTML etc.). That was my first attempt to create a human-computer interaction system, although web interaction is common in today's environment. I also spend a lot of time on the Internet every day, so I want to do more research on what kind of templates or expressions can convey the layout information more effectively.

Visual + Interaction = Web Design Core

The key to human interaction is that the user understands what the computer can do for us and how to process information, so that we can spend most of our time on "people". Therefore a successful interactive system means that people tell the computer how to work, rather than focus on technological aspect. When performing a given task, it is how to bridge the gap between the computational model and human mental model that really counts. And to achieve the goal above, an intuitive, natural, efficient, robust and customized interface significantly works.

Aims: To compare multiple types of user interfaces and evaluate the design of human computer interaction from a human usability perspective.

Objectives: Make three interactive page with simple and beautiful graphic menu and fully functional operation through HTML, CSS and JavaScript by implementing Bootstrap framework. Attempt to make users can easily meet their needs, execute work efficiently, and give full play to the function of human-computer interaction.

Project Specification

A study in (HCI) human-computer interaction[1]

Aims: To compare various user interfaces and evaluate their design in terms of human usability.

Background: User interfaces are becoming increasingly more important as the world conducts a web-based conversation with itself, along with the continuing computerization of products and facilities. When interfaces are situated in safety-critical contexts, their design and usability can be a matter of life and death: consider the fatalities associated with the Therac-25 radiation therapy machine. The USA Gore-Bush presidential campaign in 2000 was significantly disrupted by voter confusion over the computerized butterfly ballot design. Other classic interface issues include users mistaking their CD-ROM tray for a cupholder, or looking for the "any key". In terms of e-commerce, companies invest in the design of customer web-sites with consideration to visual appeal and usability. Current directions for interface applications include mobile, wearable and ubiquitous computing.

HCI issues include: colour theory; human perception; haptic/tactile technology; gender / age / cultural / special needs issues; speech recognition / generation; graphic design; cognitive issues such as memory, learning and problem solving; design of fonts; navigation; feedback to the user; usability; aesthetics; ethical issues; and interface problems.

For this project the student will design and implement at least 3 different software interfaces (just focusing on the interface) - for instance a web-page/site, a data-base, an interactive sketch tool, a distance learning facility, or a GUI. A more challenging goal is to implement a mobile interface such as for the Android operating system for touchscreen devices.

The report will comprise a comprehensive survey on HCI discussing both software and hardware interfaces. In particular, the software interfaces implemented by the student will be evaluated in the report in terms of HCI principles.

This project is not based on any of your courses, therefore some HCI material will be provided.

Early Deliverables

1. A text-based (non-interactive) monochrome web-page
2. A colourful web-site including images and navigation
3. GUI built with buttons etc.
4. Report: about 15 pages including sketches of designs.

Final Deliverables

1. Design and implement a more advanced interface(s)
2. Complete report
3. The programs must have an object-oriented design, using modern software engineering principles.
4. The report will describe the software engineering processes involved in generating your software.

5. The report will include comparisons of interfaces with a discussion of their meanings.
6. The report will include a User Manual.

Prerequisites: Interaction Design module (PC3001)

Reading

- <http://hci.rwth-aachen.de/HCIBooks>
- <http://www.netmagazine.com/features/top-50-books-web-designers-and-developers>

Chapter 1: Introduction

1.1 Background Analysis

With the development of technology and the improvement and increase of electronic product functions, the complexity of operation will also increase. Because users have to learn how to use and understand the operation of the machine, and the importance of Human-Computer interaction (HCI) is also reflected here. For example, as the content of the web page increases, the information that users need to accept will also become huge, so an intuitive, natural, efficient, and robust interface can interact with users through different functions, such as the visual effects and convenience of the system can significantly narrow the gap between the user and the computer to complete the set of tasks.

The importance of HCI mentioned above is reflected in how the user can quickly and accurately understand the use of the machine, and how the information returns a feedback to the user by the machine is in line with the scope of human understanding. Through the following two classic examples, we can clearly understand the impact of an immature HCI on users.

(1) In the 2000 US presidential election, Florida used the now infamous "butterfly ballot".[2] The ballot papers are divided into left and right columns, and the candidates of each party are arranged on both sides in a "left and right" manner in numerical order. Voters are required to punch holes next to the names of the candidates. But the two columns of candidates are staggered.

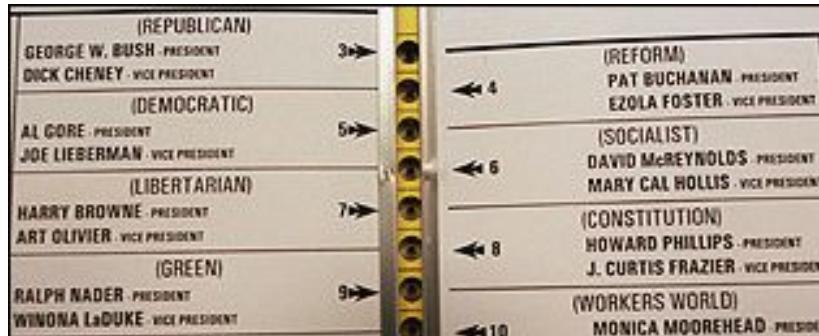


Figure 1.1: The Butterfly Ballot

Such a design makes it easy for people to be confused about who they voted for, causing voters to mistakenly vote for candidates they do not want to vote for. Moreover, it is very inconvenient to use. In many cases, the punching machine cannot completely punch through the paper every time, and it is common to have residue on the paper. Such situations will affect the judgment of the ticket counter.

In addition, after many voters found out that they had voted wrong, they punched an extra hole next to the candidate they wanted to vote for. Such ballots would be considered invalid because of "punching two holes". According to media statistics, the election in Palm Beach County, the total number of such invalid votes exceeded 19,000.

(2) Therac-25, which is a radiation therapy device manufactured in 1985, a device used to treat cancer patients with radiation. Manufactured by Atomic Energy Corporation of Canada (AECL).[3] Its core software program is used to control the radiation dose of radiation therapy. In the short period of 18 months since the machine was put into use, due to major software defects and unreasonable design, patients were exposed to excessive electron rays

during treatment, but the console page showed that the dose was too low, and the operator restarted. The irradiation was repeated, resulting in the death of 4 people and the serious injury of 2 others.

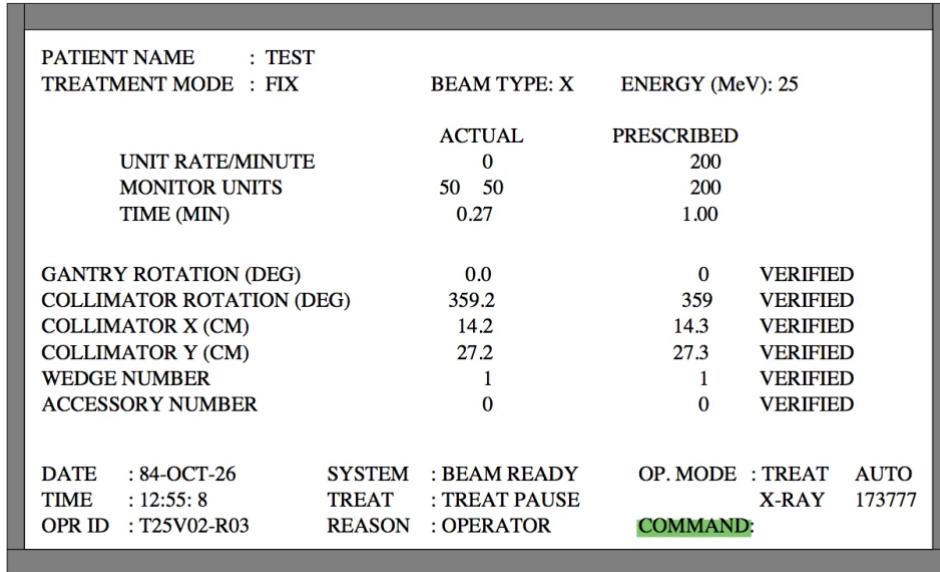


Figure 1.2: The Therac-25 Operation Interface

Through the above examples, it can be concluded that the two-way feedback between man and machine is very important. No matter how good the function is, it is only meaningful to those who can use it. If the user cannot receive information correctly in the process of use, the error of mutual understanding between human and machine will bring quite poor user experience and influence, and even bring danger to the user in extreme circumstances. Moreover, when conducting software engineering, formulating and improving software testing standards is also a topic that needs to be considered and studied.

1.2 Aims and Objectives of The Project

During the half-year development, three deliverables need to be completed in the final stage, two desktop web pages and one mobile web page. It is hoped that the product will have friendly interactive functions, a stable access process and a beautiful visual page when it is finally delivered.

First Deliverable: Create a model display page that allows users to browse model products. The navigation bar is divided into products, events and contact information or whatever. Users can use the navigation bar to go to the information they want to access.

Second Deliverable: Create a CS learning online site that includes knowledge in different fields of computer science. Users can learn and learn about each subject in detail according to the classification of the pages. Comes with videos, code and explanations and more.

Third Deliverable: Create an online shopping page where users can choose what they want to buy, or where they can create a store to buy and sell. With features such as navigation, filtering, sorting, etc., the website will have different pop-up pages to guide users on how to purchase items or web pages, with a shopping cart and payment interface.

For the mobile terminal, since the display page is smaller than that of the computer terminal, sharp transitions and Jarring fonts should be avoided during final delivery. The transition between elements should be smooth, and the fonts should be easily identifiable, otherwise it will affect User's reading and use. So simplification and classification are the main research parts, color contrast is also important, and important information should be presented in the most conspicuous and attractive way.

1.3 Target People and Consideration

For the first two web pages, the people they need to target at are actually more inclined to those people who know a lot about the use of web pages. And the third web-page is a shopping page, so it is more widely oriented to the crowd. Because we expect more people to use the shopping platform we developed for shopping and consumption, whether it is young consumers or elderly consumers . Even though, it does not mean that the design of the first two web pages does not need to consider people of different ages or situations.

(1) Get the right visual elements

User Interface (UI) designers need to carefully consider visual accessibility while building the correct website, because considering the visually impaired or functionally handicapped, especially older individuals. The size of text and buttons should always be kept large, for example, to ensure that the parts of the web-page can provide feedback to the User. Everything that must be read or clicked must be magnified, and the typography must ensure that there is a set spacing between each content or piece so that everyone can see the information clearly.

(2) Focus on usability

As people age, their motor skills and coordination may begin to diminish, making it more difficult for them to interact with complicated user interfaces. Similar to a mouse on a computer and a touchscreen on a tablet or smartphone, it might be a challenge for individuals with poor coordination.

As developers work to improve the user experience, they should consider how the primary and secondary structure of elements can make clicking as easy as possible for users who have difficulty focusing on the target. Examples include making text more descriptive or using large buttons that are easy to understand.

(3) Quickly reach the key point

The integration of technology into every element of existence. Young individuals are also well-versed in the use of technology, whereas elderly consumers employ it in a somewhat different manner. People like to get their questions answered promptly and readily rather than spending an inordinate amount of time navigating the website.

Complicated or difficult-to-access apps are frequently rejected immediately by senior citizens. If the people the developers are aiming to reach don't find the design beneficial, we won't achieve the interactions we desire, and our design will have failed.

Consequently, underline the purpose of the website or application as quickly as feasible to the user. Concern yourself not with GIFs, animations, or gamification. Instead, developers should ensure that the website's layout is practical and straightforward. A user should have immediate access to clear instructions on how to use the app or service and what should be

done next as soon as they arrive at a website design page. This is particularly crucial when developing mobile applications.

1.4 Project Motivation

1.4.1 Stakeholder Motivation

A good website is an external business card. Website home page as the facade of the entire website, design sense is a crucial factor. The home page is the first impression to the user, is the key to attract users to stay in the site to continue browsing, The stakeholders can be beneficial from below aspects:

- The concise performance of the system maximizes the user's experience, and the powerful layout and suitable color matching can improve the clarity of the web page, allowing users to find their goals in the shortest time.
- The use of the navigation bar can classify products, reduce the user's thinking time, and ensure that users can easily go to the page they want no matter what page they browse.
- The provision of a search bar can help users find the target product quickly, especially when the content of the web page increases. Users are already familiar with such search engines that accept questions and keywords, so a search engine is easy to use and natural for users.
- The non-product pages are not the most visible part but are indispensable. The function of a good footer is to allow users to find useful information, including: contact us, website policies and regulations, social media accounts, email subscriptions, and payment methods.
- The content is presented in the form of text in the web page, and the structure of reading follows the form of Z-pattern, the design of the Z-pattern follows the movement of the eye when reading - from left to right, and from top to bottom.
- A good human-computer interaction system should have a mobile nature, because mobile phones are now the device where most people interact with machines, such as browsing the web

These aspects illustrate how the system can be implemented in a more user-friendly way, and guide the user to search for goals and reduce obstacles to tasks.

1.4.2 Personal Motivation

From a developer's point of view, this is an interesting and challenging project. First of all, this is a personal project, which is very important for the time management of the project, the time planning of the project should be perfect in the early stage. Secondly, as the task progresses carry on, you will gradually feel pressure since you have to perfect all the functionality and the design of the interaction system by yourself, especially in the case of immature programming skills. Therefore focus on the technology to be used in this project to learn, and find a sense of accomplishment in learning is really important. Also to motivate

yourself and enjoy each task, which helps developers to have a deeper understanding of the programming technology they are using now. This project focuses on front-end development skill and the implementation of databases. This is a good milestone if the industry in this field is to be involved in the future. Of course, it can also become a transferable skill required for an ideal career in the future, allowing developers to develop more.

1.5 Summary

This chapter verifies the importance of accuracy of information transmission between human and machine by discussing HCI examples in real life, butterfly ballot and the Therac-25. And a good HCI should have good usability and visual effects, which is to consider different groups of people to use the system that we developed. We hope that users can quickly and accurately obtain the information and to reduce the communication barrier between human and machine. Therefore, I had analyzes the motivation of stakeholders when using the system, or what they would like to see.

Therefore, the task of this project is to explore, research, design and develop a new type of human-computer interaction system with strong usability and efficiency. This task can be achieved by learning front-end technologies, tweaking and gathering the requirements of stakeholder, designing web page structures, collocation between color and content, proof-of-concept programs and testing. Finally, an overall evaluation of the whole project is carried out to analyze the professional problems that may occur in the project.

Chapter 2: Survey of Relative Literature

2.1 The first key Literature

The book "Human-Computer Interaction" provides an overview of various theories, concepts, and practices related to designing effective interfaces between humans and computers.

In chapter one has mentioned that there is no doubt that human-computer interaction is a multidisciplinary subject. For example, psychology and cognitive science give developers insight into user perception, cognition, and problem-solving skills.[4]

From this sentence, we can realize that human-computer interaction involves different factors, both behavioral factors and ideological factors, which are relatively more diversified. Because we are facing different groups of people and needs, we need to consider the practicability, convenience and feasibility of interactive pages from different perspectives when designing web pages. Here are some of the main arguments and topics covered in the book:

User-centered design: The authors emphasize the importance of designing interfaces with the user in mind, by involving them in the design process and considering their needs, goals, and mental models.

Usability: The book discusses various techniques for evaluating the usability of interfaces, such as heuristic evaluation, cognitive walk through, and user testing.

Interaction design: The authors provide guidelines for designing effective interactions between users and computers, including principles for designing menus, icons, and other interface elements.

User experience: The book explores the concept of user experience (UX), which encompasses the user's emotions, perceptions, and attitudes towards an interface. The authors discuss methods for measuring and improving UX, such as conducting user surveys and analyzing user feedback.

Accessibility: The book emphasizes the importance of designing interfaces that are accessible to users with disabilities, and provides guidelines for designing interfaces that are usable by everyone.

Overall, the book "Human-Computer Interaction" provides a comprehensive overview of HCI theory and practice, with an emphasis on designing interfaces that are user-centered, usable, and accessible. It draws on a variety of disciplines, including psychology, computer science, and design, to provide a holistic understanding of how people interact with technology.

2.2 The Second key Literature

"Interaction Design: Beyond Human-Computer Interaction" is another influential textbook in the field of Human-Computer Interaction (HCI), written by Yvonne Rogers, Helen Sharp, and Jenny Preece.

It was said in chapter two that web interaction should be simple to learn, efficient to utilise, and deliver a pleasant user experience. By recognising the specific flaws and strengths of

various interaction systems, and then by gaining a grasp of the activities individuals engage in when interacting with things. [5] Following are some of the book's most important arguments and topics:

There should be no barriers to the interaction between the web page and the user. If the usability of the web page is too low, the user experience will be affected, which we try to avoid. You can study multiple web pages and collect and extract those that are intuitive and easy for users to use as references. In later programming, when the web framework is determined, the developer can adopt a similar style or modify it according to the user's needs.

Designing for diversity: The authors emphasize the importance of designing interfaces that are inclusive and accessible to a diverse range of users, including those with disabilities, different cultural backgrounds, and varying levels of technological expertise.

User-centered design: The book advocates for a user-centered design approach, which involves understanding the needs, goals, and behaviors of users and incorporating them into the design process.

Design methods and techniques: The authors provide an overview of various design methods and techniques, such as participatory design, scenario-based design, and prototyping, that can be used to create effective and usable interfaces.

Interaction design: The book explores the concept of interaction design, which involves designing the interactions between users and technology in a way that is intuitive, efficient, and satisfying.

Social and ethical issues: The authors address the social and ethical implications of HCI, such as privacy, security, and the impact of technology on society. They advocate for designers to be aware of these issues and to incorporate them into the design process.

Overall, "Interaction Design: Beyond Human-Computer Interaction" provides a comprehensive and practical guide to designing interfaces that are user-centered, inclusive, and ethical. It draws on a variety of disciplines, including design, psychology, and computer science, to provide a holistic understanding of how people interact with technology. The book is widely used in HCI courses at universities and has been praised for its clear writing style, practical examples, and focus on real-world design challenges.

2.3 The Third key Literature

"Prioritizing Web Usability" is a book written by Jakob Nielsen and Hoa Loranger that focuses specifically on usability issues related to website design. In chapter two which has mentioned experienced users visited the site's home page first, taking an average of 10 seconds less than less experienced users. This difference tells us that as users gain experience, they will judge the site more harshly; They'll browse the page faster and delete things they don't like faster.[6]

At the beginning of the design of the homepage, the main information should be displayed intuitively to avoid overcrowded display of elements on the information performance page, so redundant elements should be avoided as much as possible. We can also confirm that the simplicity of the homepage is very important. When presenting the options required by users on the page, it is necessary to design or modify more according to user needs and the overall framework. For example, a simple and intuitive navigation bar can help users perform tasks more quickly.

Secondly, don't try to be overwhelming. When it comes to innovation, especially when it comes to interaction design, innovation is not always a good thing. It may even have a bad impact on your website. Users crave familiarity, and they will always follow certain ways of doing things. Confusing navigation or a cluttered web layout should be avoided, such as avoid using the same color for multiple block-level elements and proper description while building a navigation bar.

And here are some of the main arguments and topics covered in the book:

Usability: The authors emphasize the importance of website usability and argue that it is essential for creating successful and effective websites. They provide practical guidelines for improving website usability, such as simplifying navigation, making content scannable, and designing forms that are easy to use.

Design principles: The book discusses a set of design principles that can help to improve website usability, such as providing feedback to users, minimizing cognitive load, and using consistent design patterns.

User research: The authors stress the importance of conducting user research to understand the needs, goals, and behaviors of website users. They provide guidance on various user research techniques, such as user testing, card sorting, and surveys.

Accessibility: The book addresses the importance of designing websites that are accessible to users with disabilities, such as providing text alternatives for images and making sure that websites can be navigated using a keyboard.

Web standards: The authors argue that adhering to web standards can help to improve website usability and accessibility, as well as making websites easier to maintain and update.

Overall, "Prioritizing Web Usability" provides practical advice for designing websites that are usable, accessible, and effective. The book is based on extensive research and user testing and has been widely praised for its practicality, clarity, and real-world examples. It is a valuable resource for anyone involved in website design, from web developers and designers to content creators and project managers.

2.4 The Fourth key Literature

the book "Dimensions and Elements of People's Mental Models of an Information-Rich Web Space" written by Yan Zhang. The book is based on a study that investigates people's mental models of an information-rich web space, focusing on the dimensions and elements that people use to organize and understand information on the web.[7]

Here are some of the main arguments and topics covered in the book:

Mental models: The book defines mental models as the internal representations that people have of a system, which guide their interactions with that system. The author argues that understanding people's mental models is crucial for designing effective web interfaces.

Dimensions of mental models: The book identifies several dimensions of mental models, such as structure, hierarchy, and categorization, that people use to organize and understand information on the web.

Elements of mental models: The author discusses the various elements that people use

to create mental models of web spaces, such as navigation, content, and visual design.

Design implications: The book provides design implications for creating web interfaces that are aligned with people's mental models, such as providing clear and consistent navigation, using familiar design patterns, and providing contextual cues to help users understand the structure of the web space.

Overall, "Dimensions and Elements of People's Mental Models of an Information-Rich Web Space" provides a valuable contribution to our understanding of how people organize and understand information on the web. The book highlights the importance of considering users' mental models when designing web interfaces and provides practical recommendations for creating interfaces that are aligned with those mental models. The book is particularly relevant for designers and researchers working in the field of web design and user experience.

Chapter 3: Software Engineering

3.1 Methodology

3.1.1 Agile Methodology

Agile is a time-oriented methodology that emphasises the steady creation of projects over time, with the ability to include adaptation and change directly into the process.

While using agile systems, developers work on projects in "sprints." A sprint is essentially a period of time (typically between one and four weeks) that can be committed to certain tasks and objectives. The benefit is that it can be utilised for longer projects or jobs that may not have a clearly defined end objective and will evolve and improve over time.

Unlike waterfall, which is a fairly linear methodology, all objectives and ideas are outlined at the outset and subsequently performed in a blob-like, organised sequence, facilitating the workflow. Problems emerge if deviations occur or if unanticipated alterations are required. [8] As waterfalls are "one-way," adhere as closely as possible to the design at each stage. It is not ideal for lengthier or ongoing projects, as it is typically employed for smaller, reasonably straightforward projects with low chance of departure.

Agile allows time at the conclusion of each sprint for quality assurance, analysis, and review, allowing for the introduction of new ideas and modifications to deliverables before the next sprint. And while the project is in process, you can return to a previous stage to add or modify, thus the adaptability and flexibility of Agile are better suited to this project. Yet, it is essential to ensure that the process does not continue indefinitely; otherwise, there is a risk that the product will continue to evolve without ever settling.

3.1.2 Project Documentation

As a well-managed project document, in this project a documentation will be used is called the diary which will upload and keep in GitLab. Developers can record all the work or the achievement and follow its trajectory to see the progress of the whole project, and through the grasp of the phase document, the quality of the whole project is well controlled.

It helps the developer understand the progress, problems, and management rationale for the expected goals. Since most software development projects are divided into several tasks, changes can be made based on the documentation (i.e Development steps) when problems arise to avoid developer confusion.

3.1.3 Repository

GitLab is an open-source repository management system project. Git is used as a code management tool for version control, and the web service built on this foundation primarily handles and stores the code and documents generated during software development.

The version control system can ensure the consistency of code and documents, and save all changes and submissions in a remote central repository, so that developers can carry out

project development anytime and anywhere. Moreover, GitLab has detailed time and date records for all additions, deletions and modifications, all information can be obtained through git log which is of great help in project management.

The project might fail or lost, so using the correct place to store the codes is important, always make sure there is a backup in the hardware. On the other hand, storing the program online, such as GitLab can be easily accessed and edit it under version control. In emergency, it can restore all the backup through the recovery code and also there are several security settings that can prevent the account accessed by other person.

In project development, developers can create multiple branches to develop the same project. Usually, no changes will be made in the main branch during development. The branches are independent from each other to ensure the integrity of the source code, and different branches can be merged , Increase development efficiency.

3.1.4 Framework

In this development, the bootstrap framework will be adopted and imported by using this code: <link rel="stylesheet" href="bootstrap.min.css"> in the program. Its advantage is that it has complete documentation and is more convenient to use; it can improve development efficiency; standard name definition is convenient for later maintenance.

In addition, bootstrap is incredibly useful for responsive design. It includes over a dozen reusable components for creating pictures, drop-down menus, navigation, alert boxes, and pop-up boxes, etc., and is a straightforward reference without excessive code settings. It features more than a dozen unique jQuery plug-ins, developers can either include all plug-ins at once or add them individually. You may even change Bootstrap's components, less variables, and jQuery plugins to build your own version.

In terms of framework, bootstrap's pre-processing scripts allow developers to quickly develop using pre-compiled CSS files, or customize the styles they need from source code. E.g. If there are many same effects on the page, you only need to write an effect class to allow the elements used to inherit it. The second is that a framework can be used by multiple devices. With the help of Bootstrap, websites and applications can quickly and effectively configure mobile phones, tablets, and PC devices through the same code.

However developer need to be careful in the choice and use of the framework, since insufficient bootstrap coding skill might lead to time wasting so it is important to have time management on revisiting HTML and CSS at the beginning. Also, developers need to design the overall layout of the web page before starting to write code, a designed layout can build up a web page in a more efficient way, such as designers can draw the distribution, spacing, and form of the web content on a paper or an app.

For the use of the Bootstrap framework, there are risks throughout the development phase. First of all, the learning cost is relatively high. Developers need to understand the entire framework and read the framework documents. The second is the use of the framework, which means over-reliance on the framework. Although the use of the framework will greatly reduce the technical requirements for developers, it will not help the technology to improve, so that it is difficult to eliminate bugs, even including the bugs in the framework itself. This causes developers to spend a lot of time to checking CSS style files and codes, increasing time costs and reducing efficiency. Finally, Compatibility issues occur accordingly. Indeed compatible ways are various with IE, but user experience and development flexibility are still reduced, since the loading speed will be slowed down inevitably by some other files to be imported which may be a bit big.

3.2 Testing

Testing is the most important part in the final progression of the whole project and before delivery to the end user. The following section will cover several testing methods in this project.

3.2.1 User Testing

User testing is the process of executing specified tasks in real-world situations with actual users, such as evaluating the interface and functionality of a website, application, product, or service. The objective of this procedure is to analyse the website's or application's usability and determine whether the product is ready for release to real users. Software testing helps determine where problems, missing requirements, or gaps exist in your product.

According to Jakob Nielsen, one of the field's pioneers, it often takes only five users to identify the majority of usability issues in interfaces,[9] which does not preclude fine-tuning of design and impact at scale research. This enables us to gather user input on our products from our customers, in the form of questionnaires, which will help us improve the product. This is one of the simplest ways to collect information from your clients, as they can complete the survey from any location and provide any feedback. In order to give clients with a flawless user experience, developers will be able to receive sufficient feedback and make necessary adjustments based on post-testing data.

3.2.2 Functional Testing

Functional testing plays an important role in the overall system and requires most of the testing performed. For a web page, it is a complete test of all elements and functions in the web page. Things like testing links, forms for submitting or getting user information, etc.

Link testing includes testing whether all pages can jump to external links of a specific domain, testing all internal links, testing links that jump from the same page, and testing whether there are orphan pages. Test the effect of all pseudo-class selectors acting on elements, such as animation, text color change, etc., to ensure that there will be no surprises in the final delivery.

3.3 Development flow chart

In the first term, the construction of the first human-computer interaction system needs to be built. However, the next phase are difficult to move on without an accurate goal, such as layout, content and how to classify elements (i.e. navigation bar), and the tools provided to users to help them with their tasks (i.e. search bar). Therefore the early design of the web as a whole is an important step that determines what we do next. After that we can learn programming skills to achieve the deliverable we want.

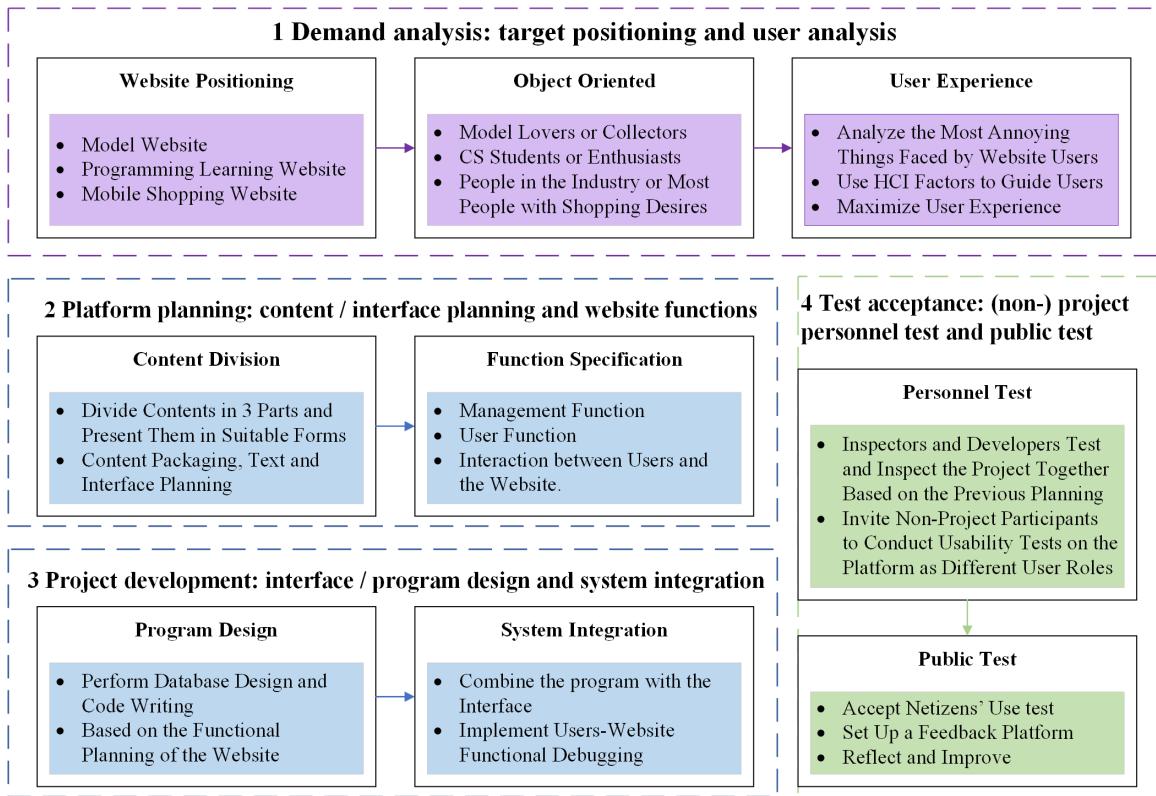


Figure 3.1: development flow chart

First, we need to complete our prototype by successfully creating a proof of concept based on an early deliverable of the specification. To acquire more programming knowledge and improve programming skills through later learning, and then to improve the prototype according to the requirements of stakeholders, so as to build the final deliverable system.

Based on the prototype can give us a clear direction of production. It is an important step for developers to complete and test each function. Understanding the structure of the web page, the implementation of functions, and the import of resources can help developers to build a more advanced final design.

Chapter 4: HCI

4.1 The Background of HCI

Human-computer interaction is a discipline that covers several specialized fields.[4] In the process of user interaction with computer interface, a series of human or machine input and output are carried out. We can define "interaction" as a kind of communication between humans and machines, a friendly two-way information exchange that ignores the barriers between humans and machines.

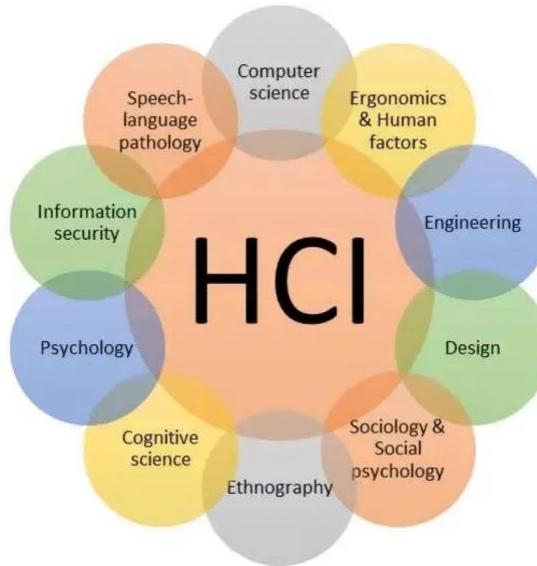


Figure 4.1: HCI and related research fields[10]

Basically, the user inputs information or instructions to the computer, and then the computer can return the information back to the user in a way that humans can understand. This information exchange takes the form of various types, such as keystrokes on the keyboard, mouse movements, symbols and graphics on the display screen, or speech, gestures or body movements.

4.2 The characteristic of HCI

In general, human-computer interaction has two distinguishing features:

(1) Information feedback: People can timely transmit information to objects (machines, websites, etc.), and objects can immediately return the required information to users. Also, users can make judgments based on the information that return by machines to help users to complete tasks.

(2) Human participation and initiative: As a continuous participant in the interaction process, people have the rightful acceptance, judgement, decisions making and operation to machines. At the meanwhile, people are actively receiving feedback from machine, rather than passively receive information.[11]

The realization of human-computer interaction first is about computers. The input and output by the user and the machine, the graphics processing and display of the computer, and the application of algorithms, without these factors, human-computer interaction will not be established. Second, human-computer interaction is about people, it is more concerned with the science and cognition of human behavior, [12]including how to maximize the user's understanding to machine's feedback and studying the influence for how user behavior affects machine design.

4.3 Support for HCI elements

The human-computer interaction process also needs certain elements to support the establishment of a human-computer interaction system. Basically, it can be summarized into the following three elements:

(1) Human Aspect

Human beings are indispensable in the process of human-computer interaction, that is, there is no lack of users. This aspect of human element is mainly the user operation model, and the user's various characteristics, preferences and so on.[13] Tasks integrate the various behaviors of the user and the computer.

(2) Interactive Equipment

Interactive devices are indispensable in the process of human-computer interaction, such as graphics and image input and output devices, sound, posture, tactile devices, three-dimensional interactive devices, etc., and these interactive devices are also constantly improving to achieve the best state and effect in the process of interaction.

(3) Interactive Software

Interactive software is the core of interactive computer. Interactive medium plays a great role in today's society with rapid technological development. It can enliven the relationship between users and machines and maximize the ways users can achieve their goals.

The three elements complement each other and cannot be without one. Only when the requirements of the three elements reach certain standards can a perfect and efficient human-computer interaction be truly formed.

4.4 Design Principles for HCI

4.4.1 User Experience and Behaviour

User experience is a crucial factor in interaction design, as it represents the user's happiness with the product's behaviour and directly influences the product's quality. If people are not satisfied, a product will fail regardless of the innovative technology or high-quality content used in its development.

Consequently, how the user perceives the product is a crucial factor. In common parlance, the behaviour of Internet users is identical to that of customers at conventional establishments.

Visitors scan each new page, scanning some of the information and clicking on the link that most interests them or which they believe will lead them to the desired content.[14] In fact, they do not read the great majority of the pages. Similar to when they are grocery shopping, people do not care what is printed on the back of a product; they just care about the packaging, size, and site of manufacture.

This also shows that the user is not reading, but scanning. When users analyze a web page, they browse a web page in a non-linear manner, looking for some important nodes or anchor points instead of jumping from one site to another in sequence.[15] Internet users are impatient and need instant gratification, they just want these links to direct them to the desired content. It's actually a very simple principle, if a website does not meet the expectations of users which means the designer has failed his job and the company will suffer financial lost. The higher the cognitive load and the less intuitive the navigation, the more users are inclined to leave the site and look for its alternatives.

According to Steve Krug's research, the biggest reason is: users don't care. "If we find something that works, we're hooked. It does not matter to us how it works, as long as we can use it. If your audience likes big bulletin boards, all you have to do is design a bigger bulletin board." [16] How to improve the design of the product to maximize the user experience, I will explain through the following content.

4.4.2 Nielsen's Usability Heuristics

Usability is a quality of a website and a method of design that prioritises the demands of users. It employs a user-centered design process to ensure that websites are efficient and accessible to the actual users, as opposed to the designers. Using heuristic evaluation, most notably Nielsen's Ten Usability Principles, we can determine (and occasionally measure) quality. [9] Dr. Nielsen extracted these ten general principles after examining more than two hundred usability issues. They are an essential reference standard for product design and user experience design, and I will now discuss several of them.

(1) Visibility of system status

In a timely manner, the system should always keep the user apprised of what is occurring through suitable feedback.[17] No matter what the user performs on the system, whether they click, scroll, or push a key, the page should provide immediate feedback. "Instant" indicates that the page response time is shorter than the maximum amount of time that users are willing to wait.

(2) Match between system and the real world

The system should utilise words, phrases, and concepts that are familiar to the user, as opposed to system-specific terminology. Follow the conventions of the real world and make the information conform to the logic of natural thinking.[18] That is, all performances and representations of the system should be as similar to the user's familiar environment as possible.

Metaphors and skeuomorphism mentioned in the "iPhone Human-Computer Interaction Guidelines" are good practices,[22] to display themes or functions with real objects. For example, the microphone or phone icon is a good example, the user can understand the actual use of a function without even thinking about it. Follow real-world conventions, making information appear in a natural and logical order.

(3) User control and freedom

Users frequently select system operations by accident and require a clearly indicated "emergency exit" to quit an unwanted state without a lengthy dialogue.[19] Hence, in terms of interaction design, a response that permits undo and redo is supplied to users

(4) Consistency and standards

Users don't have to wonder if different words, situations, or actions indicate the same thing.[20] Verify that the content corresponds to the real function, lest users become confused.

(5) Flexibility and efficiency of use

By hiding accelerators from inexperienced users, they frequently accelerate the involvement of expert users. In addition, the number of intermediate users is significantly more than that of primary and advanced users.[21] It is built for the majority of users and can sustain stability when the majority of users employ it. Hidden can accommodate both novice and seasoned users while staying adaptable and efficient.

(6) Aesthetic and minimalist design

Discussions should not contain material that is irrelevant or rarely required. As indicated above, the user's browsing action is not reading or viewing, but scanning. Easy to scan involves emphasising vital elements and minimising or removing extraneous material.[29]

Each additional information unit in a conversation competes with and diminishes the visibility of associated information units. Every additional unit of essential information in a paragraph results in a proportional reduction of other information.

4.4.3 Minimalism Design

The minimalist design style, also known as the minimalist design style, as the name suggests, is to use as few components as possible to realize the human-computer interaction of websites and software applications. On the basis of removing redundant components or modules, use the least elements to achieve the best user experience and sales effect. The benefits of the minimalist web design style are as follows:

1. The simple web design is more concise and easy to use, and the user experience is extremely pleasant.
2. The minimalist design is simple and compatible, making it easier for software or web responsive design.
3. The simple and clean interface design is more in line with today's fast-paced user needs.
4. A web page's bounce rate can be decreased with the help of a design that is simple and well-organized, as well as a speedier load time.
5. Straightforward and low-noise interface design, allowing users to concentrate on interface content and product functions with more ease.

Since simple design plays such a huge role in improving user experience pleasure, loading speed and page compatibility, how can we reflect the beauty of simplicity in page design?

(1) Use natural white space to highlight software or product functions/features

Incorporating white space to paintings or designs to heighten the mystery of the work and provide sufficient room for the user's imagination is unique. The usage of white space (also known as negative space[23]) in web page design is more likely to eliminate interface noise and emphasise the presented content. Let users to concentrate more naturally on the exhibited programme or product's capabilities, services, and features, and enhance their perception.

(2) Simplicity

The principle of simplicity refers to omissions in color, space, typography, and content. The simplicity of the website can highlight the association of directions and links, so that new users can use the website and understand the content more quickly.

(3) Optimize the font and typesetting of the interface to reflect the hierarchical structure of the interface

In addition to optimising colour, interface text content, font, and layout, it can make the complete site design more concise and clear, as well as vividly display its page hierarchy. For instance, simplify the wording to make the interface more intuitive and simple to comprehend. By adopting more brief phrases, sentence patterns, or forms (such as subheadings or lists) to simplify the text content of the interface, the page layout is made more straightforward, understandable, practical, and intuitive.

The second is the intelligent use of text characteristics and typography. Excellent minimalist web design typically avoids excessive fonts and typography. Basic one or two, along with attribute settings such as text size, colour, thickness, line spacing, and arrangement position (such as enclosing, juxtaposing, etc.), can also express the page structure and hierarchical relationship in a straightforward and intuitive manner.

(4) Use pictures to explain the interface text

The famous sentence of Wendorrohe (architect designer), "Less is More" is the main principle of minimalist in designing website,[24] when a thousand words can't express clearly, simply adding appropriate pictures can express the designer's wishes more clearly, thus getting twice the result with half the effort.

(5) Use the grid to distinguish interface functions and importance

The simplification of grid design is one of the most commonly used function/module division methods in the minimalist design style. When a consistent grid design is used in software or web design, it can not only divide and display its functional modules concisely and intuitively, but also help users form a certain reading habit in the process of browsing the page, so as to query the required information more quickly and smoothly web content.

(6) Retain menu and navigation design to optimize user experience

The minimalist design style is not an unrestrained reduction of interface components. The web menu and navigation design, as an important factor in optimizing user experience, should not be ignored or deleted even if it is a minimalist web design. Instead, it should be presented in a more intuitive and recognizable way, such as using links, sidebars or hiding the menu bar to present navigation or menu design to optimize user experience.

On the other hand, for minimalist design, this does not mean that the designer can simplify the web page or software interface without restraint, thus losing the original charm and vitality, making the interface difficult to understand and more complicated to use. For example, Some users won't find what they are looking for, the main problem with minimalist design is that users may "get lost", especially for the design of the navigation bar. For users

who have become accustomed to the earlier website model, some may not adapt.

The second is to deprioritizes content, minimalist design will reduce the priority of content. If the most important pages and content in your website design are not intuitive, it won't help users complete their tasks. There is also can get lost in busy designs. If the overall design contains more content or elements, minimalist navigation will bring challenges. Because the developer cannot guarantee whether the proposed element is important to the user, or will help them understand the use of the page.

Consequently, the minimalist design style is a form of design that not only meets the needs of users, but also reflects the creativity and individuality of designers. To avoid influencing the site's usability, element control must be sensitive and exact; otherwise, it would violate the original aim of the human-computer interaction principle.

4.4.4 Colour Theory

Colour theory is a collection of guidelines for highlighting the visual effects of interfaces and improving user attention and communication between users.[25]

Monochromatic: It refers to selecting a colour at the beginning, and then adjusting its transparency and saturation to lighten or deepen the colour to produce a new colour. The visual effect of the page will be uniform in colour but layered.

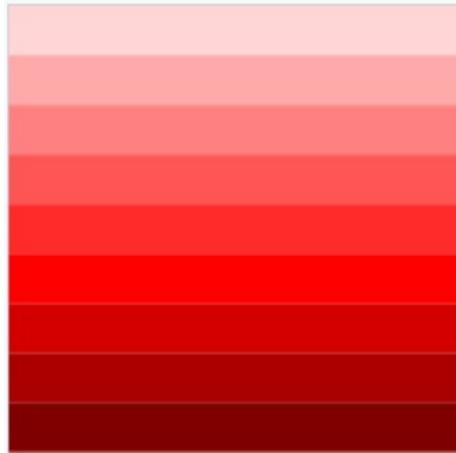


Figure 4.2: Monochromatic colour scheme

Analogous: It refers to colours that are adjacent on the colour wheel, such as green and blue, or red and yellow. The use of neighbouring colour matching can prevent colour chaos on a website, and it is simple to generate a harmonious and cohesive appearance on the website.



Figure 4.3: Analogous colour scheme

Complementary: Generally speaking, the three primary colours (red, yellow, blue) of colours can best reflect the differences between colours, and the strong contrast of colours is visually attractive. Reasonable use of contrasting colours, such as using one colour as the main colour and its contrasting colour as an embellishment, can make the website distinctive, highlight the key points of the interface and produce a strong visual effect.

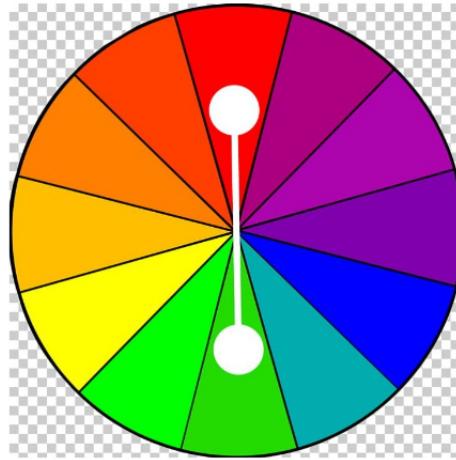


Figure 4.4: Split colour scheme

Warm colour: It refers to the combination of red, orange, yellow and other colours. The use of this tone can create a stable, harmonious and warm atmosphere for the web page.

Cold colour: It refers to the combination of green, blue and purple colours, which can create a quiet, cool and elegant atmosphere for the web page. Cold colours and white colour combination will generally get better visual effects.

4.4.5 Mental Model

If the product designed by us is regarded as a person, the use of the product by the user is equivalent to the dialogue between the user and the product. Interaction design is to design the dialogue between the product and the user, so that the user and the product can better communicate. Its essence is a kind of language, a communication language between the user and the product. In order to achieve effective and good communication, the key to conveying

information is to express your ideas as clearly, succinctly and clearly as possible in language understood by the other party. Similarly, in product design, information needs to be delivered in a way that users can understand. The way that the user can understand is the way that matches the user's mental model.

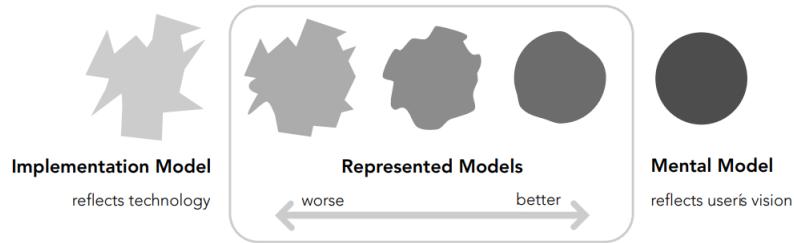


Figure 4.5: Mental Model Graph[26]

In *About Face: The Essence of Interaction Design*, Alan Cooper talks about mental models. Good product design is about trying to match the mental model of the user. The closer the design is to the mental model, the easier it is to understand.[26] Skeuomorphic design is a good example. It introduces familiar objects used by users in the real world as elements of user interface control, which is closer to users' mental model and enables users to easily infer methods of interface control, thus reducing users' sense of fear and obstacles in the face of products. As people become familiar with the interface of intelligent devices, the mental model of users is constantly updated. Users no longer need to explain the meaning of elements in the interface through skeuomorphic design, and flat design comes into being.

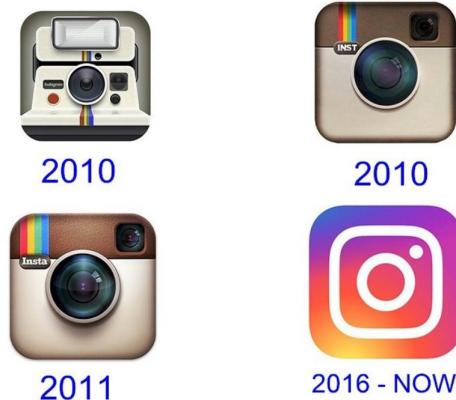


Figure 4.6: Iteration of Instagram's Icon

Let's take Instagram as an example. When Instagram was first established, it was a place where you could easily edit and share photos. Five years later, Instagram is a much more diverse community than ever, and people are using new tools like Layout and Boomerang, and connecting to the world in new ways with Explore.[27] Therefore they created a brand new image to express their needs on behalf of the community, and they expressed the changes and future demands of Instagram through a flatter and simpler design.

People update or form their own mental models through observation, induction, learning and analogy. People are stimulated by external information and get their personal views through personal observation, understanding, action and verification.[28] If they think it is beneficial to them, they will keep and update it into a new mental model; if it is not beneficial, they will give up. For example, recall the first time you were introduced to the process of pull-down refresh. You might have done it by accident or the product intentionally guided you. After you pulled down, you saw the interface change and you thought it was interesting or exactly what you wanted, so you wrote it down; Or you think there's no point and forget

about it soon after. Later, you find that the drop-down can also refresh the interface on other products, and your brain will automatically summarize and integrate these information, so that the mental model of the drop-down corresponding to the refresh interface will gradually emerge. Once this mental model is formed, it will be expressed in the real world, and when you use a new product in the future, when you want to refresh the interface, you will use the drop-down operation.

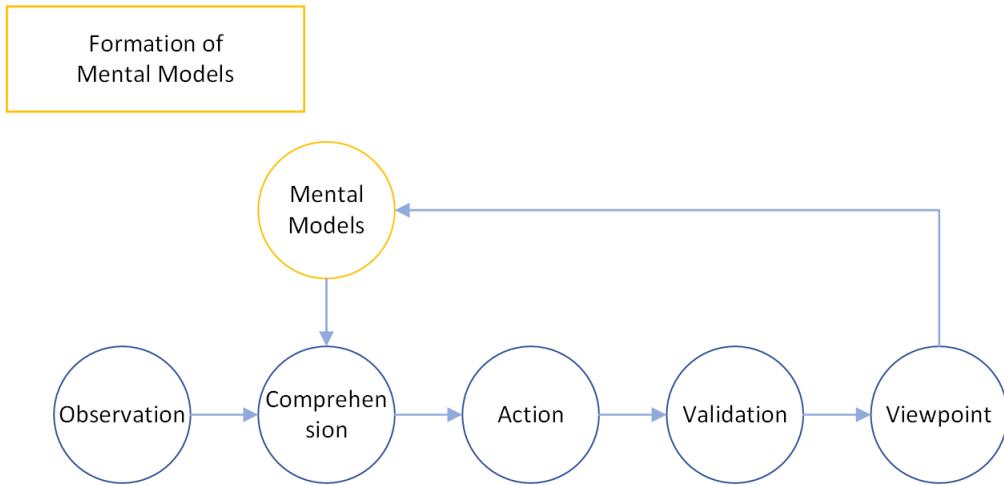


Figure 4.7: Model formation process

Everyone has their own mental model, and that model is constantly updated over time. In the process of product design, interaction design should give priority to matching the existing mental model of users, and then embed the new model by means of guidance and education.

To quote Alan Cooper, "Unless there is a better alternative, conform to standards" [26] that have been proven over time, such as: As IOS design specifications, Google design specifications and various design guidelines are widely used, users have formed corresponding mental models, and it is often difficult to change what users are familiar with. At this time, the widely used design is more in line with users' expectations and easier to use.

Chapter 5: Proof-of-Concepts Program

5.1 Structure Layout

Typography is essential since it is the artistic aspect that unifies a website. Web sites with poor typography are flowery, unsightly, and diminish the perceived value of the site and its information. Poor web typography contributes neither to nor detracts from the online material. Excellent online typography can not only increase the overall value of a website, but also increase the reader's perception of that value.

5.1.1 float, margin, ul..li

In this section I will discuss some CSS style and HTML tag that will be used in lately development, and here is a demonstration shown below that how the float, margin and ul list corporate with each other to give out a good layout in a web page design.

```
/* CSS Style */
<style>
    li {
        list-style: none;
        background-color: yellowgreen;
        width: 260px;
        height: 250px;
        float: left;
        margin-right: 5px;
        margin-top: 5px;
    }

    div {
        width: 800px;
        height: 600px;
        background-color: gray;
    }
</style>

/* HTML ul list */
<div>
    <ul>
        <li>1</li>
        <li>2</li>
        <li>3</li>
        <li>4</li>
        <li>5</li>
        <li>6</li>
    </ul>
</div>
```

In this example, the float property is used for positioning and formatting content or the container element. I set the height and width for each li tag in each ul list, so that each li

tag is a box in which we place the text, picture or content we want. Then I use margin to set the distance between each box. Here I use margin-top and margin-right to ensure that there is a distance around each box. This will make the layout clearer and won't overcrowd the whole structure.

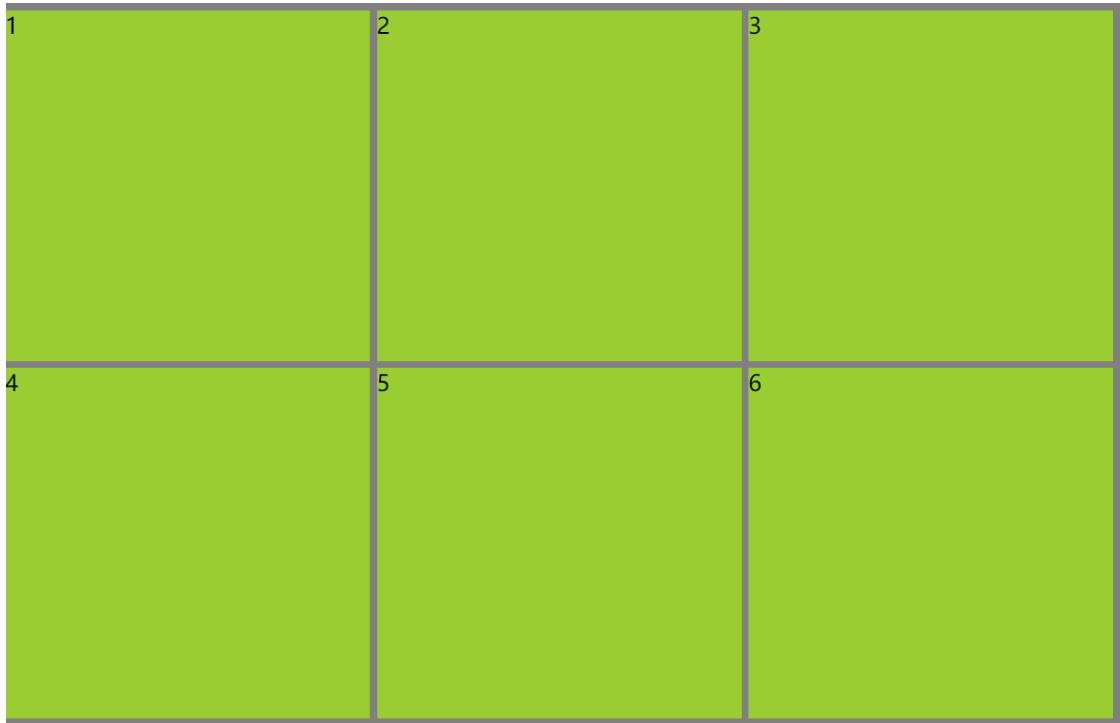


Figure 5.1: Structured layout

5.2 Animation

The advantages of animation can add interest to a website and captivate the majority of users' attention. Here are some instances of animation that I've studied. @keyframe is the most crucial component, and the animation cannot function without it. When I set CSS styles within the @keyframes rule, the animation will transition smoothly from the current style to the new style at specified timings.

To make an animation function, you must connect it to an element. This example associates the "example" animation with the `div` element. The animation will last four seconds, during which the background colour of the `div` element will transition from "red" to "yellow":

```
<style>
div {
  width: 100px;
  height: 100px;
  background-color: red;
  position: relative;
  animation-name: example;
  animation-duration: 4s;
  animation-direction: reverse;
}
```

```
@keyframes example {
 0% {background-color:red; left:0px; top:0px;}
 25% {background-color:yellow; left:200px; top:0px;}
 50% {background-color:blue; left:200px; top:200px;}
 75% {background-color:green; left:0px; top:200px;}
 100% {background-color:red; left:0px; top:0px;}
}
</style>
```

And there is considerable liveliness. CSS styles can have several functions, for as the animation-delay property which determines the wait before an animation begins. In addition, we may specify the number of times an animation should run by implementing the animation-iteration-count property, which provides the number of times an animation can run.

5.3 Responsive Implementation

Responsive Web Design is the process of using HTML and CSS to automatically resize, conceal, shrink, or enlarge a website to make it seem beautiful on all platforms (desktops, tablets, and phones). This means that a responsive web design will automatically adjust for varied screen sizes and viewports.

Typically, to develop a responsive website, you must include the following <meta> tag on each page: <meta name="viewport" content="width=device-width, initial-scale=1.0"> will specify the viewport of the web page, instructing the browser on how to control the dimensions and scaling of the page.

Here is a web page with and without the viewport meta tag:

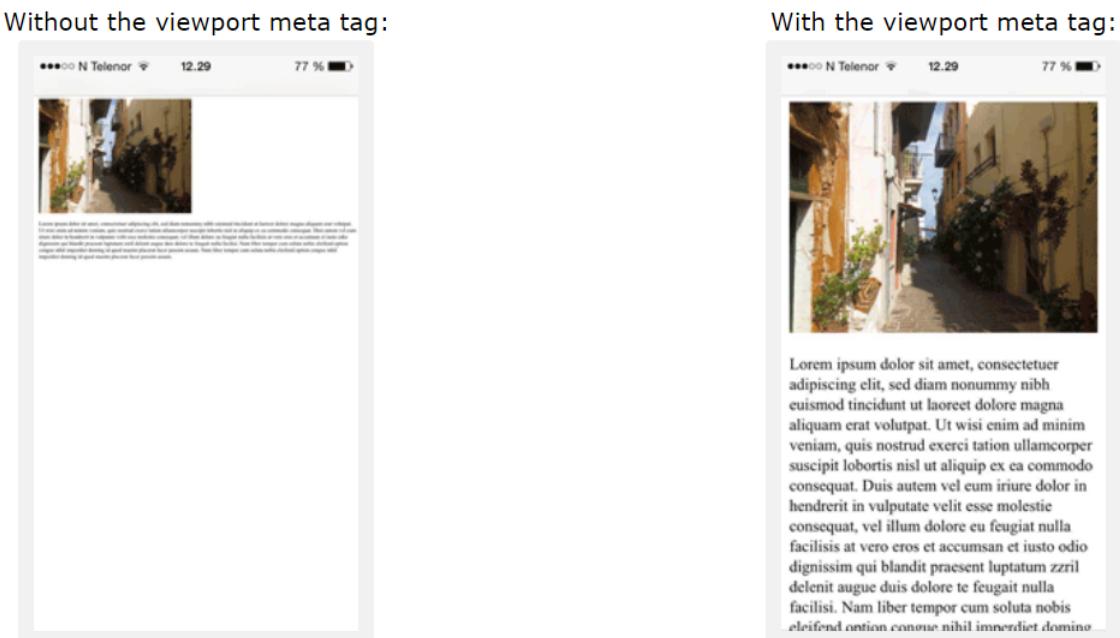


Figure 5.2: Responsive page comparison

Also, it is usual for responsive web pages to employ media queries; with media queries, I can create completely alternative designs for various browser widths.

```
<style>
.left, .right {
    float: left;
    width: 20%; /* The width is 20%, by default */
}

.main {
    float: left;
    width: 60%; /* The width is 60%, by default */
}

/* Use a media query to add a breakpoint at 800px: */
@media screen and (max-width: 800px) {
    .left, .main, .right {
        width: 100%; /* The width is 100%, when the viewport is 800px or smaller */
    }
}
</style>
```

Chapter 6: Model Website Design

6.1 Topic background

The choice of model pages is based on my hobby of collecting models, and secondly, I am more familiar with this type of website than other types of websites. Nowadays, electronic commodity websites are more common with the progress of science and technology, which also makes more various commodities more quickly and effectively enter the public's vision. Therefore, for the lovers or collectors of certain products, the application of electronic websites allows them to check or search for the products they want at any time and anywhere. Model websites can be roughly divided into two types. One is to display and sell products in the form of electronic shopping websites, such as BANDAI and its subsidiaries, while the other is to display but not offer online shopping, such as KOTOBUKIYA and HOTTOYS. But no matter what kind of form, the product and the corresponding information in the most intuitive way to present in front of the user, the second is to increase the fun of product display to enhance the attraction of the website to users.

6.1.1 Requirement Gathering

The establishment of a product is based on the requirements provided by stakeholders for the premise of subsequent planning and development, so the collection of requirements is a very important part of the early development. The objective of a deliverable is to maximize stakeholder requirements and provide a comfortable, efficiency and useful webpage for our users.

As the first deliverable, the plan is to create a model presentation page that allows users to browse a wide variety of model products. The navigation bar is divided into products, store information, events, contact information, and so on. Users can use the navigation bar and access the information they need without any difficulty. The positioning of the first website is not an E-commerce platform, but more of a local, regional product display site. Let the user know the situation of the model product, if the user has the desire to buy, any product transaction activity will be carried out by the offline physical store.

User Stories
As a model collector, I'd like a clean, concise page without too much complicated and redundant information.
As a model collector, I'd like a product category page, so that I can search for products more effectively.
As a model collector, I'd like a product presentation page.
As a model collector, I'd like a page where I can find the address or contact information of the business.
As a model collector, I'd like a section that will inform me of new product launches.

6.1.2 Technical Decision Making

Once the requirements have been collected and analyzed, it's time to start combining the requirements with the implementation idea. According to the above requirements, it is clear that the navigation bar must exist, and there are five elements in the navigation bar, product categories, shops, events, contact information and a search bar.

First of all, the first consideration is to avoid too much unnecessary information presented in the webpage, so that the webpage will be over complicated, which affects the user's reading of the webpage content. The presentation of the content is mainly based on the information of the model, and the rest of the part is in the form of white space. In UI typography, large white space between elements guides the way the visitor's eye scans, making it easy for the visitor to notice prominent elements.[29] Large white space allows time and space for interaction, enhancing the user experience. Therefore, a little implementation with the white space and over compact elements will make it difficult for visitors to click, resulting in a feeling of anxiety.[30]

Product classification and search bar are designed to enable users to search products more quickly and accurately, and product classification is intended to be based on the alphabet classification of product themes. Because the names of products are various, if the product name is used to classify, the same type or the same theme of products will be disrupted, and finally it is likely to cause users to switch pages differently and continuously when using the website. The focus of classification is to let users judge and classify webpage elements and information from the perspective of their own experience. The aim is to make the real world more organized and make the user feel more in control of the site[9], which fits in with Nielsen's usability principal.

Generally speaking, the user experience is very unique, and each user's experience is not exactly the same. How to determine the user's "pain point", and provide corresponding products or services are important. If developer can perfectly solve the pain point, then we can establish a classification standard in the hearts of users. For model pages, the "pain point" of classification is actually their corresponding theme, no matter the movie series, or anime, each product has its own series, just like Superman is DC series. Only by providing classified information that users can perceive, such as product features, then these information can be effectively pushed to users to help them conduct accurate search.

6.2 Initial Designs and Ideas

Navigation bar and Homepage design

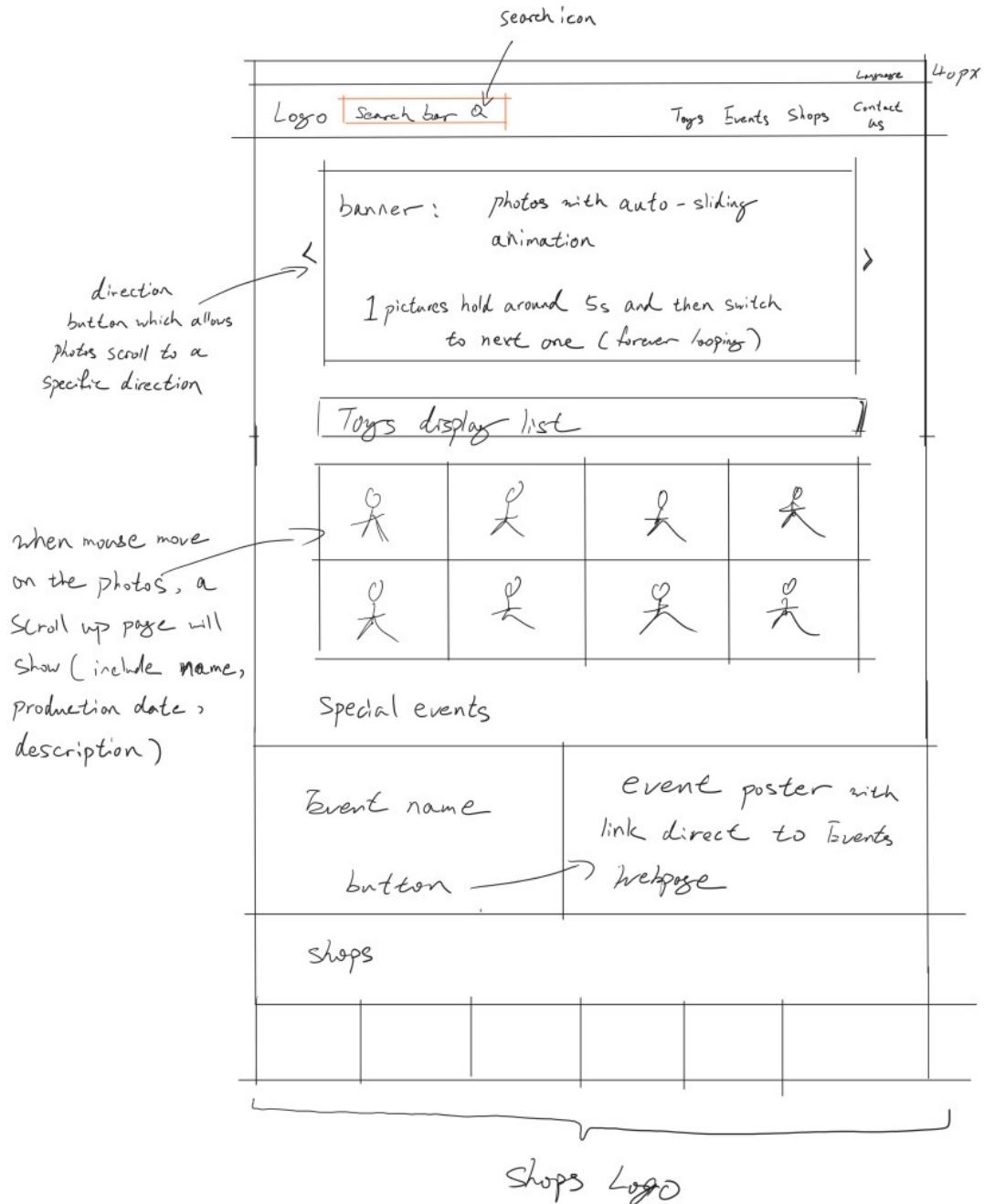


Figure 6.1: Home page draft design

Footer Design

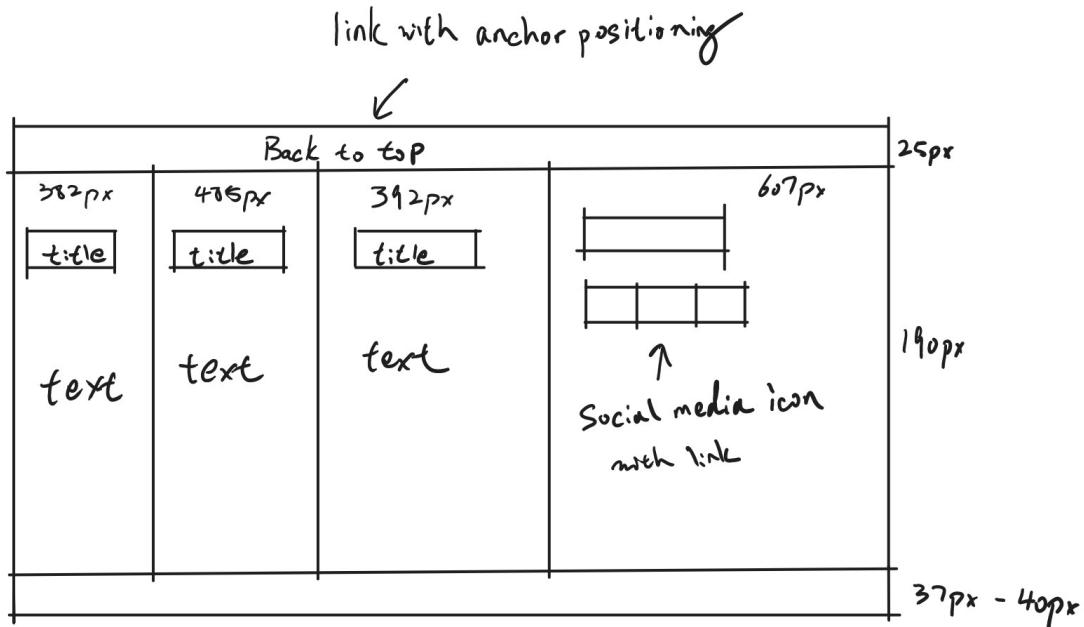


Figure 6.2: Footer draft design

Collectibles List Design

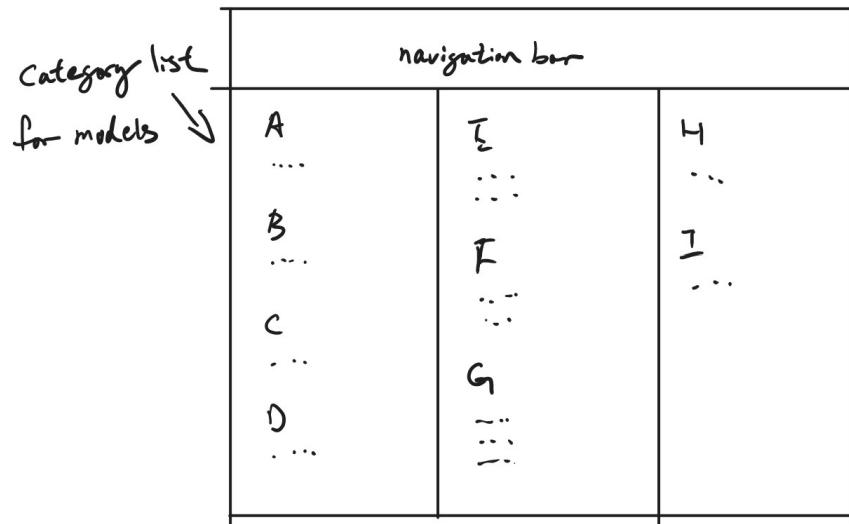


Figure 6.3: collectibles draft design

Contact Us Design

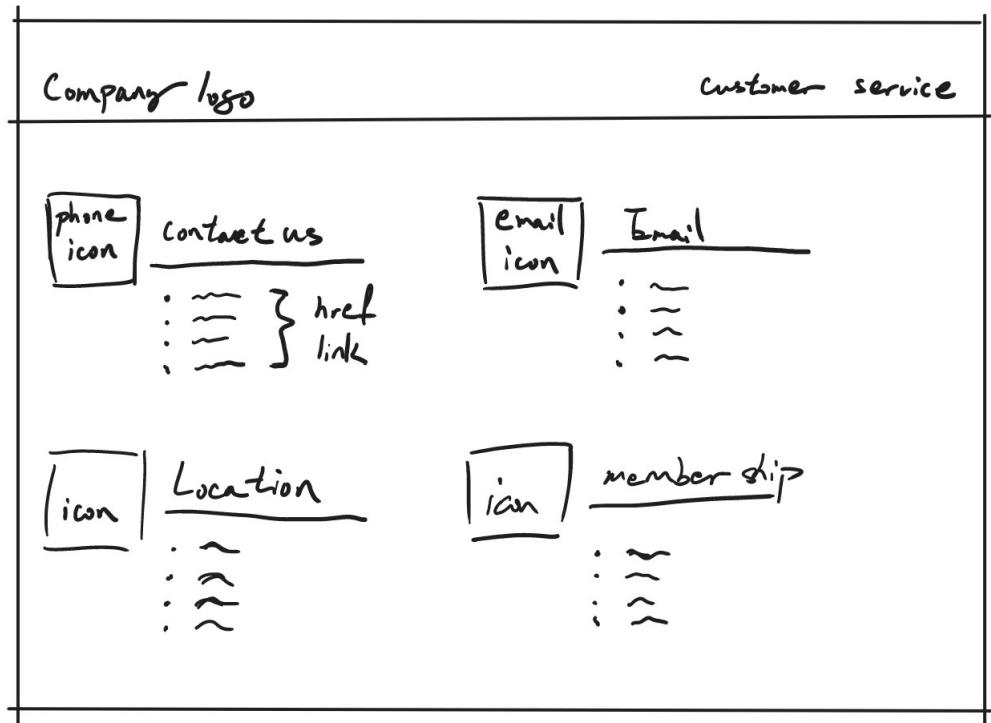


Figure 6.4: Contact us page draft design

6.3 Application Procedure for First Site

This section will represent the code of several web design parts with HCI characteristics to understand the process of web implementation from the programming level. Observe how to style web page text through CSS style sheet to accomplish and fulfill stakeholder's requirements.

Language Switching Bar:

HTML Part

```
<div class="dropdown">
  <button class="dropbtn">USA / English
    <i class="fa fa-caret-down"></i>
  </button>

  <div class="dropdown-content">
    <a href="#">Any other language</a>
    <a href="#">Any other language</a>
    <a href="#">Any other language</a>
  </div>
</div>
```

Use the `<button>` element to open the dropdown menu, then use the `<div>` container element to build the dropdown menu and put the dropdown links within it. Put a `<div>` around the button and `<div>` to correctly place the dropdown menu using CSS.

CSS Part

```
/* dropdown content (hidden in default) */
.dropdown-content {
    display: none;
    position: absolute;
    background-color: #f9f9f9;
    min-width: 500px;
    box-shadow: 0px 8px 16px 0px rgba(0,0,0,0.2);
    z-index: 1;
    margin-top: 1px;
}

/* show the dropdown menu on hover */
.dropdown:hover .dropdown-content {
    display: block;
}
```

The top bar and drop-down button have been customised with a background colour, padding, etc.

`.dropdown-content` is contained by the `.dropdown` class. Due to the fact that this is a `<div>` element and not an `<a>` element, I must float it to ensure that it remains adjacent to the links.

Instead of a border, we have used the `box-shadow` property to create a "card" appearance for the drop-down menu (see figure 4.5). Furthermore use `z-index` to specify the stack order of an element, allowing me to position the drop-down ahead of other items.

The `.dropdown-content` class contains the drop-down menu itself. It is hidden by default and will appear when hovered over. The `:hover` selector is used to display the drop-down menu when the mouse is hovered over a drop-down button.

Banner (Animation):

HTML Part

```
<!-- banner -->
<div class="banner">
    <div>
        
    </div>
</div>
```

Use a container element `<div>` to create an animation box that use to keep several images containers. Wrap a `<div>` element around each `` for uniform animation through CSS.

CSS Part

```

/* banner */
.banner > div{
    position: absolute;
    animation: move_slide2 16s infinite;
    opacity:0;
    /* background-color: pink; */
}

.banner > div:nth-child(1){ animation-delay: 0; }
.banner > div:nth-child(2){ animation-delay: 5s; }
.banner > div:nth-child(3){ animation-delay: 10s; }
.banner > div:nth-child(4){ animation-delay: 15s; }
.banner > div:nth-child(5){ animation-delay: 20s; }

@keyframes move_slide2{
    25%{opacity:1;}
    40%{opacity:0;}
}

```

The .banner > div class is used to set the required parameters for each slide (image) and bind the animation to every image in order to get the animation to work. 16 second duration and infinite interaction so the slide will keep changing during a 16s interval forever.

The parameter for animation: move_slide2 is more like a class that needs to be called, the opacity level will switch between 1 when the animation is 25% completed and switch to 0 when the animation is 40% completed.

The :nth-child(n) selector matches every images that is the nth child of its parent and set a 5 seconds delay for every slide to switch by animation-delay.

Enlarge Effect for Model Display:

HTML Part

```

<div class="newlist">
    <ul>
        <li class="first-row-1">
            <a href="#toy1"><div></div></a>
            <div class="desc">RG 1/144 Gundam finished Benefits Recolor MG Cherry Blossom Po
        </li>
    </ul>
</div>

```

Use unordered list () as containers to store the images of the new arrivals model. And use to specify the URL of the page the link goes to, which helps user quickly direct to the page they want to look at.

CSS Part

```
.newlist .first-row-1 div img {
    width: 220px;
    height: 220px;
    cursor: pointer;
    transition: all 0.5s; /* all attributes transition completed in 0.5s */
}

.newlist .first-row-1 div img:hover {
    transform: scale(1.1); /* enlarge in size 1.1 when mouse move on the picture */
}
```

It indicates a 220px * 220px element which named .newlist. The element has also specified a transition effect for the all property, which is extend around when transform: scale(1.1) is used. It enlarge in size 1.1 when move on the elements by :hover and with a duration of 0.5 seconds.

6.4 Application of HCI and Achievement

Multi-language Switching Bar



Figure 6.5: Drop down language switch bar

Multilingual websites can enhance communication, and while English may continue to dominate the Internet, not everyone desires to visit English websites. The design of multilingual websites can reach a larger audience and take their needs into account. Consumers will believe that you truly care about them if you tailor a product or service to match their demands or address their issues, which will inevitably lead to greater customer satisfaction. This results in improved ratings, repeat business, an increase in clients, and an overall win-win situation.

Navigation bar for Homepage Brand

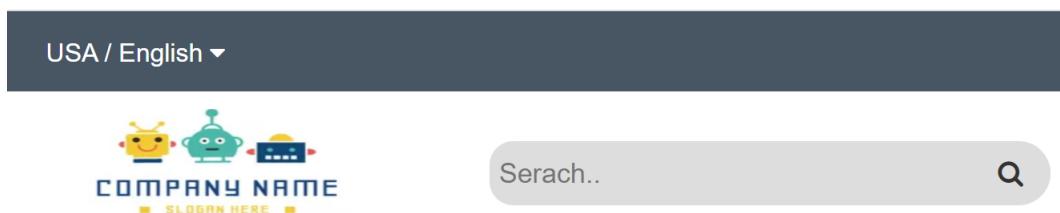


Figure 6.6: Brand and search bar

The main purpose of creating a brand is to cultivate users' loyalty to the brand, which can be distinguished by positioning one's own products from those of competitors. In the commercial field, it is also called differentiation.

Create a fixed but familiar psychological map in the minds of customers.[9] When referring to the same type of products, users will subconsciously associate them with their favorite brands, and this is also the difference between branded products and similar products without brands. Branded products are easier to shape and dominate in the minds of users.

Banner and New Arrivals for Homepage

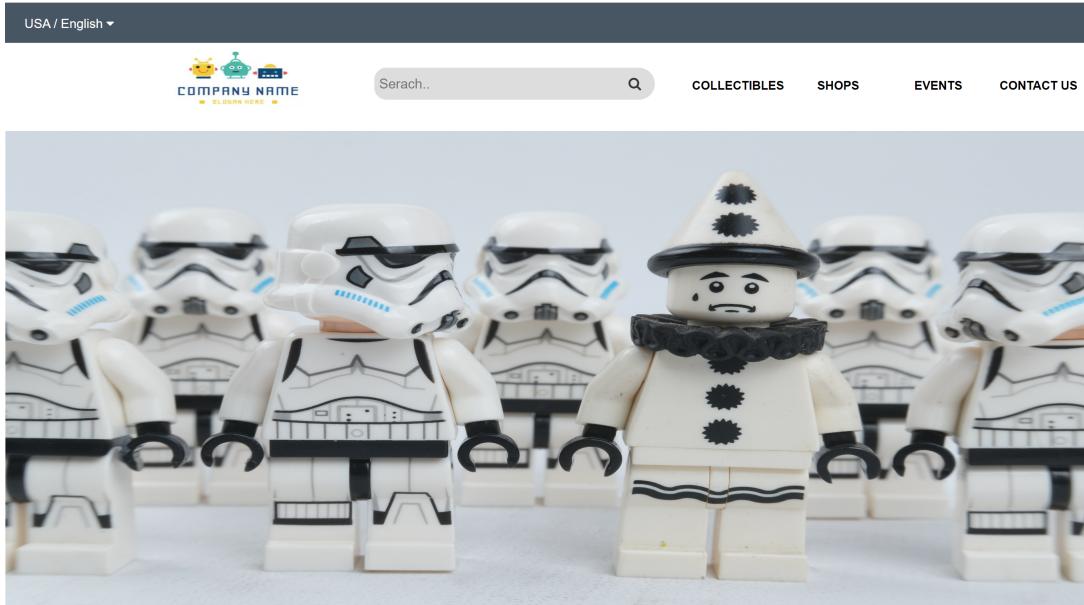


Figure 6.7: Slide Switching

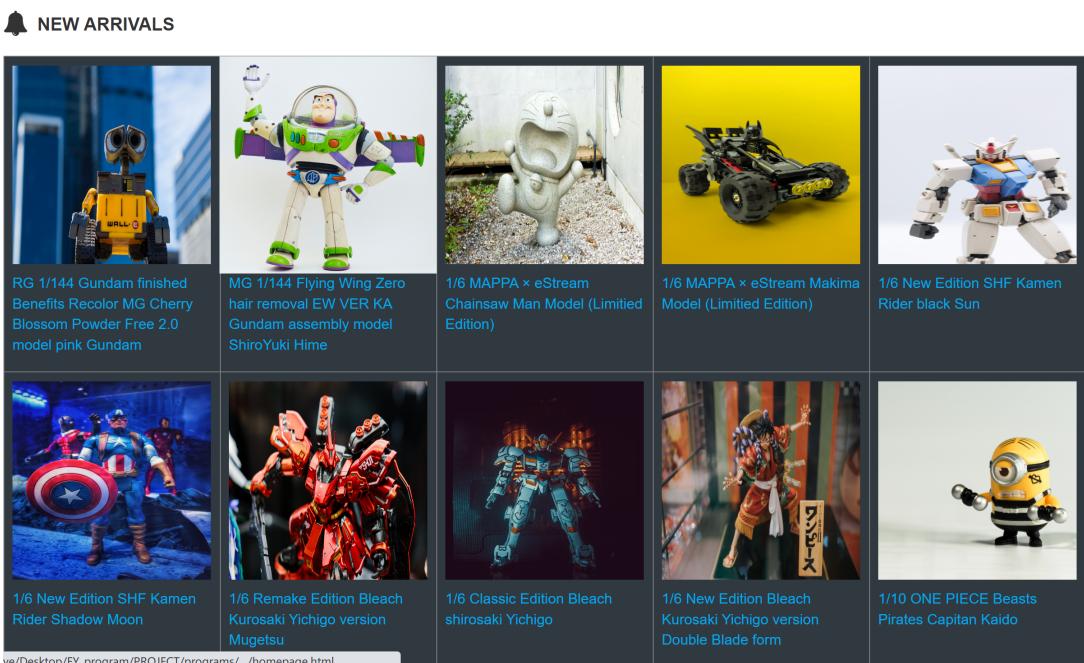


Figure 6.8: Enlarge Effect when mouse move over

Animation

The main purpose of animation is to improve usability. In web design, animations can actually be very useful if they are used in a functional decorative way. A simple animation can actually be a great instructional tool that can provide valuable feedback to the user. Help people understand which button they should click, or create a direction where they can be next to in a web-page since it can draw users attention.[31]

The second use of animation is aesthetics, animation can be a good decoration. The goals of animation are usually purely visual goals, which are acceptable to a certain extent. Decorative animations can help create an emotional connection between the user and the interface.[32] Animations can also inspire visual appeal, making things more interesting and engaging, and ensuring that your users stay engaged with your site for longer periods of time.

Another reason to use animation is to convey a message or function.[33] Animations can be a great tool to show users how a particular piece of content works in an intuitive way or to guide users and provide them with background information.

Special event for Homepage

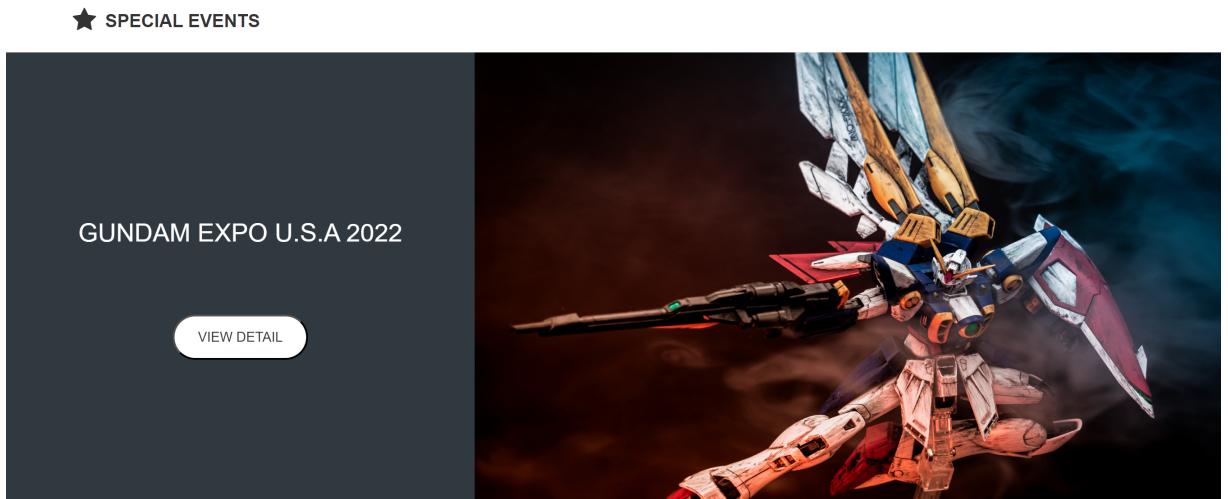


Figure 6.9: Asymmetry Horizontal Structure

For this part, the horizontal balance principle in web page layout design is applied in the overall framework, because most people have the habit of reading from left to right, so the format of the layout is also distributed from left to right. The content is asymmetrically balanced, the purpose is to highlight the more eye-catching title. The content is distributed in a ratio of 4:6. Since the theme is "event", the larger part will be displayed as a poster.

Footer for Homepage

There is an anchor positioning function at the footer part (BACK TO TOP), so that users can return to the top of the home page immediately without sliding the page. This function is mainly to allow users to have a higher degree of control and freedom over the webpage, and also to allow users to be more involved in the webpage, also called human participation which is one of characteristic of HCI.

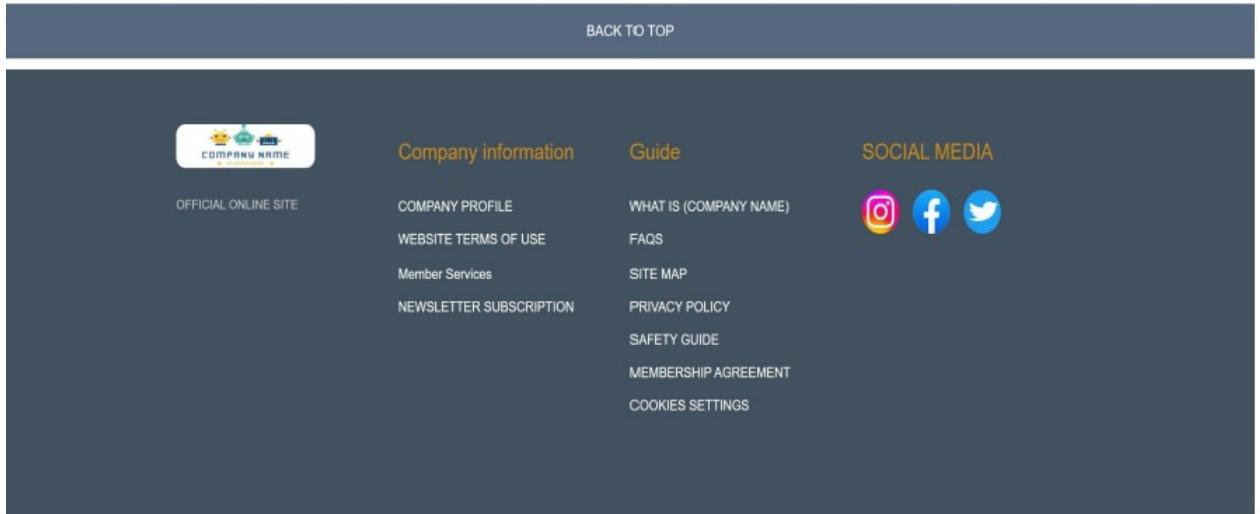


Figure 6.10: Anchor Positioning Function

Collectibles Webpage

The screenshot shows a webpage titled 'COLLECTIBLES LIST' under a 'HOME > COLLECTIBLES LIST' header. The page lists various collectible items categorized by the first letter of their name. The categories are:

- A**: Aura Battler, Demon Slayer: Kimetsu no Yaiba
- B**: Birdie Wing, Bustercall
- D**: GARO, Ghost in the Shell, Digimon, Dragon Ball
- G**: Godzilla, Gundam
- I**: Idolish 7
- J**: JoJo's Bizarre Adventure, Jujutsu Kaisen
- K**: Kamen Rider, King Kong, Kirby
- L**: Love Live!
- M**: Marvel, Mazinger Z, Monster Girl Doctor, My Hero Academia
- N**: Naruto, Neon Genesis Evangelion, NinjaJa
- O**: Obey Mel, One Piece, One-Punch Man
- P**: PAC-Man, Pretty Guardian Sailor Moon, Princess Principal
- R**: RWBY: Ice Queendom
- S**: Saint Seiya, SD Gundam, Star Wars
- T**: That Time I Got Reincarnated as a Slime, The IDOLM@STER, TinyTAN, Tokyo Revengers
- U**: Ultraman

Figure 6.11: Alphabet Classification

Classification can make elements more common, organized and efficient. First of all, this page is responsible for the classification of models, in order to make the classification more organized.[34] Therefore, the models are arranged with the first letter of the subject, which allows users to locate and search more quickly.

And when the mouse moves over the element that the user is searching for, the text will change from black to blue. Because the background color is white, the cold color of the font is used to highlight the function of the font itself as a pseudo-link and guide users to click.

Path



Figure 6.12: Paths have navigational effects

The role of the path is to display the status of the web page, first of all is to let the user know where he is at any time. The second is to improve the user's control and freedom, so that the path is not only displayed, but also increases the flexibility and efficiency of the webpage. Although new users may not realize that the path also has the function of jumping pages, but for advance users, this can make them to access where they want to go more quickly.

Shops and Events Webpage

Shop Name	Shop Name	Shop Name
Welcome to (shop name) Web? Checkout some new exclusive new figure line, and build up your collection!	Description...	Description...
KAMIKAZE MODELS	SUNDON MODEL SHOP	KAMIKAZE
Description...	Description...	Description...

Figure 6.13: Shops page with negative space implementation

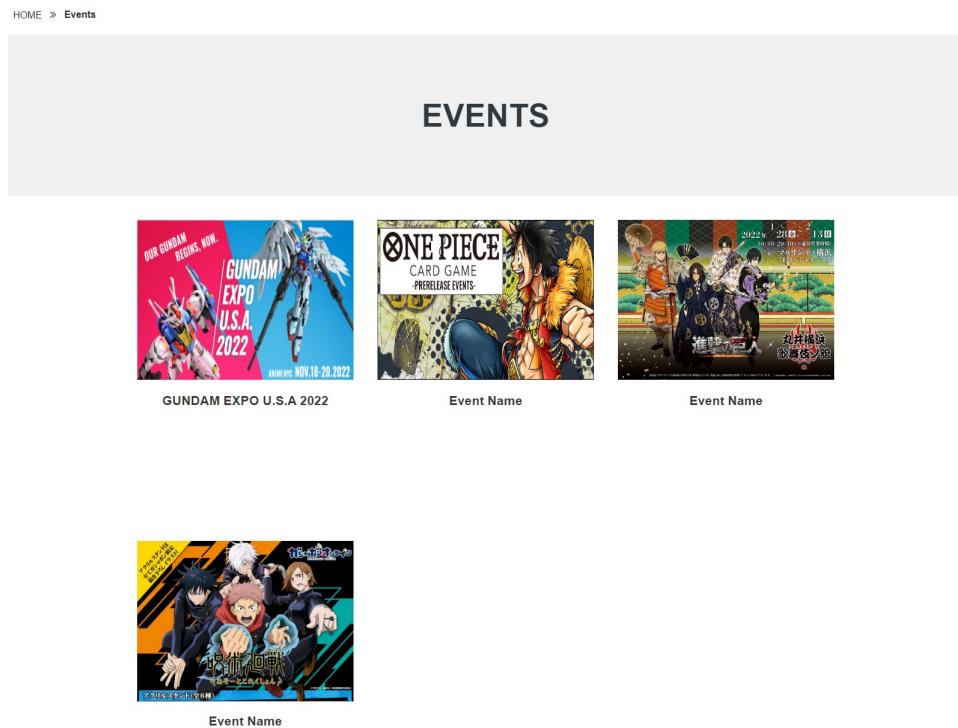


Figure 6.14: Events page with negative space implementation

The above web design follows the minimalist style, and each page uses a lot of negative space design. The layout of the content is based on the central axis, and a lot of blank space is used on both sides, so that there are not too many elements on the page to distract the user's attention and guide the user to focus more on the content.

Contact Us Webpage

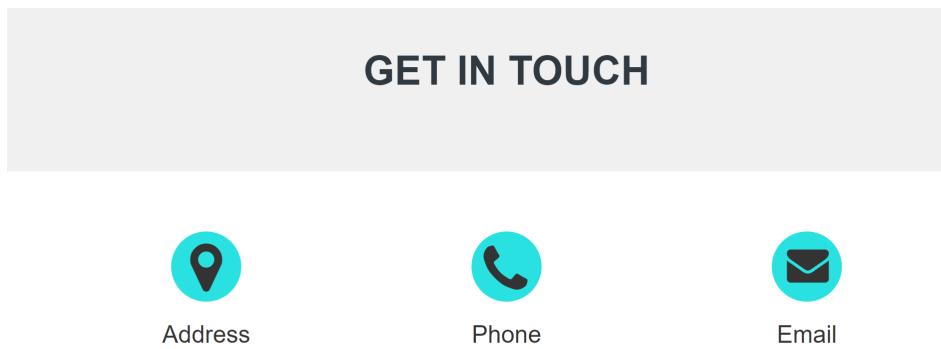


Figure 6.15: Icon Implementation

Added the use of icon in this contact us page, according to Nielsen principle, he mentioned match the system with the real world. Skeuomorphizing the content allows users to understand it without reading or understanding, which also ensures the consistency between the content and the actual function.

Chapter 7: Programming Website Design

7.1 Topic background

In the past, learning code can only be learned through the book, all the programming process and results are directly displayed in the book. Programming, on the other hand, is a very practical process, requiring users to do hands-on operations to get results from the computer. With the development of computers, many different types of learning websites began to appear, and almost the most famous CS learning websites basically contain a wide variety of languages, from front end to back end, database, python, and so on. As a result, most novices do not know how to choose which language to start learning. Each language has different syntax and achievement, some of them are simple to learn and some of them are difficult. Therefore, I plan to make a website purely in one language, then explain and demonstrate each knowledge point in a more specify way, and provide different examples for each knowledge point to demonstrate.

7.1.1 Requirement Gathering

As a second deliverable, the plan is to create a language-specific CS online learning site and apply a responsive design so that the site can be used on either a computer or mobile device without affecting the layout of the page. While the main page tells the user what type of language it is and what it can accomplish, the navigation bar contains four elements, tutorials, forums, resources, and a user login button. After users log in to the system, they can access their favorites list, which is used to save the knowledge points that users want to review later. Then the forum platform is for users to communicate online. Resources are related textbooks for users who prefer to get their knowledge from books.

User Stories
As a CS learner, I want to know the types of programming languages
As a CS learner, I want to know the content of a programming language is about
As a CS learner, I want to know the syntax of the code and the result of a program
As a CS learner, I want a personal account
As a CS learner, I want to access this website on my phone

7.1.2 Technical Decision Making

According to the above requirements, developers need to create a registration page and a login page, and the existence of a navigation bar is essential. Then the main page design must be simple and intuitive so that allows users for the first time enter the website to know what page they are looking at. Second, the layout of the instructional page of the code should also be carefully considered. All programming languages have their own syntax, so it is important to ensure that java's own syntax is displayed in the web page without any impact.

First of all, because the positioning of the website is the development of a single programming language (Java), the design of the home page is more condensed than the design of the first website, due to the reduction of negative space. Macro and micro design in minimalism must be more rigorous to ensure that how to highlight the focus of the page's content does not compromise its aesthetics. As described in the section on Human-Computer Interaction, negative space (or white space) refers to any unused space on the page.[23] Negative space is anything on the page that does not attract the user's attention. However, this does not imply that the background must be white; it can be any colour, image, or other background. Negative space has both micro and macro dimensions. Micro negative space refers to the space between small elements like lines and characters, whereas macro negative space refers to the space between larger modules or elements.[29] The right allocation of space and elements is essential to the overall efficacy of a website's design, making it a crucial aspect of web development.

The second idea is to add JavaScript to the registration page and login page, which not only allow users to enter their personal information, but also ensure authenticity and accuracy. When the information entered by the user does not meet the standard, the system should prompt in time. On this, we can add some buttons to prompt the user, such as the length of the phone. In addition, JavaScript can be applied to the process of code output results, so that users can experience the procedure of editing results output. This can not only increase the interestingness of the website, but also increase the controllability of the website, so that users feel that they can control the site as much as possible, rather than just reading it.

According to user stories, people desire cross-platform access to our website, so a responsive website design will be used in this development. Responsive web design is a sort of web page design layout, the concept of which is to centrally create the page image layout size, and intelligently adapt the layout to the user's behaviour and device environment. Responsive web design is founded on the fluid grid technique, which overcomes the problem of cross-platform viewing sizes that would otherwise impair the usability and readability of the site. This technology enables the site's usability to be presented to its fullest extent.

7.2 Initial Designs and Ideas

Homepage

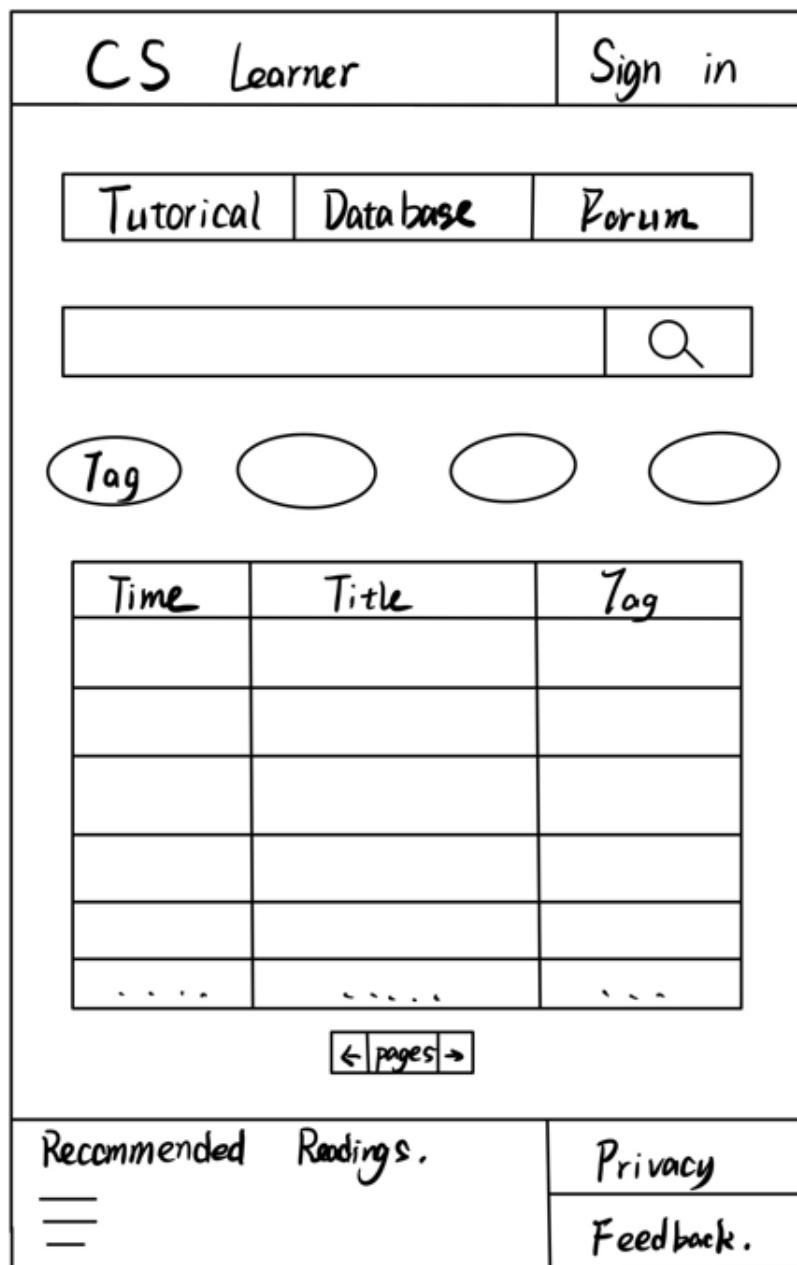


Figure 7.1: initial version of the CS homepage

Tutorial page

CS Learner		Sign in
Title		Tags
<input type="radio"/>	Content	Time
<input type="radio"/>
<input type="radio"/>
<input type="radio"/>
<input type="radio"/>

← pages →

Figure 7.2: initial version of the tutorials page

7.3 Application Procedure for Second Site

Overlay Curtains

HTML

```
<!-- Button to close the overlay navigation -->
<a href="javascript:void(0)" class="closebtn" onclick="closeNav()">&times;</a>

<!-- Use any element to open/show the overlay navigation menu -->
<li class="tutorials" onclick="openNav()>Tutorials
<i class="fa fa-caret-right fa-1x" aria-hidden="true"></i></li>
```

The major thing to do with a overlay and hidden curtain is to implement the open and close function, and before you do that, you need to create two web elements that are responsible for both functions. I created a cross button to serve as the close button for the curtain and selected the element "tutorials" to make the open button ("tutorials" is one of the navigation elements, as shown in figure 7.3). After the element is selected we can use JavaScript to add the effect of the open and close function.

CSS

```
.overlay {
    transition: 0.5s;
}
```

A transition implements a 0.5 second sliding effect, allowing users to visually and clearly observe the curtain covering process.

JavaScript

```
/* Open when someone clicks on the span element */
function openNav() {
    document.getElementById("myNav").style.width = "100%";
}

/* Close when someone clicks on the "x" symbol inside the overlay */
function closeNav() {
    document.getElementById("myNav").style.width = "0%";
}
```

In the HTML section, give the class names of two selected elements: cross button is closeNav, and tutorials are openNav. A sliding effect from left to right can be achieved by setting `.style.width` to 0 and 100 for both functions, respectively.

Sign up Page

JavaScript

```
//password
var passwordInput = document.getElementById("password");
passwordInput.onblur = checkPassword;

function checkPassword() {
    var password = passwordInput.value.trim();

    var reg = /^w{8,12}$/;
    var flag = reg.test(password);

    //var flag = password.length >= 8 && password.length <= 12;
    if(flag){
        // if correct
        document.getElementById("password_err").style.display = 'none';
    }
}
```

```

} else{
    // if not correct
    document.getElementById("password_err").style.display = '';
}

return flag;
}

```

This JavaScript code defines a function checkPassword() which is called when the input field with ID "password" loses focus (i.e., the user clicks away from the input field). The function first retrieves the input value and trims any leading or trailing white-space.

Then it uses a regular expression to check if the length of the password is between 8 and 12 characters (inclusive) and whether it consists of word characters (letters, numbers, and underscores) only. The regular expression `\w{8,12}`, followed by 8 to 12 word characters (`\w{8,12}`), and then the end of the string `$`.

If the password meets the length and character requirements, the function hides an error message element (`<div id="password_err"></div>`) by setting its `style.display` property to 'none'. Otherwise, it shows the error message element by setting its `style.display` property to the empty string "".

Finally, the function returns the value of the `flag` variable, which indicates whether the password meets the requirements or not. This return value could be used, for example, to prevent a form from submitting if the password is invalid.

Responsive Application

CSS

```

@media screen and (max-width: 768px) {
    .overlay .overlay-content .first-col,
    .overlay .overlay-content .sec-col,
    .overlay .overlay-content .third-col,
    .overlay .overlay-content .fourth-col {
        float: none;
        width: 100%;
        height: auto;
        margin-left: 0;
    }
}

@media screen and (max-width: 768px) {
    .overlay .title {
        font-size: 24px;
        width: 100%;
        margin-left: 20px;
        text-align: left;
    }

    .overlay .closebtn {
        font-size: 40px;
        top: 15px;
        right: 15px;
    }
}

```

```

    }
}

```

This code contains two separate blocks of CSS code that are both enclosed within @media queries with a max-width of 768 pixels. This means that the CSS rules within these blocks will only be applied when the screen size is 768 pixels or less.

The first block of code targets several elements with classes inside an element with the class "overlay" and adjusts their styling when the screen size is 768 pixels or less. It sets the float property to "none", which means the elements will no longer float to the left or right of the container, and sets the width to 100%, which makes the elements take up the full width of their container. It also sets the height to "auto", which means the height of the elements will adjust automatically based on their content, and sets the left margin to 0 to remove any left margin that might be present.

The second block of code targets two elements with classes inside an element with the class "overlay" and adjusts their styling when the screen size is 768 pixels or less. It sets the font size of the element with class "title" to 24 pixels, which is smaller than the original font size, and sets the width to 100% to make sure it takes up the full width of the container. It also sets the left margin to 20 pixels and the text alignment to left, which left-aligns the text within the container. For the element with class "closebtn", it sets the font size to 40 pixels, which is larger than the original font size, and adjusts the top and right position of the element to 15 pixels each, which moves the close button towards the top right corner of the container.

7.4 Application of HCI and Achievement

Homepage

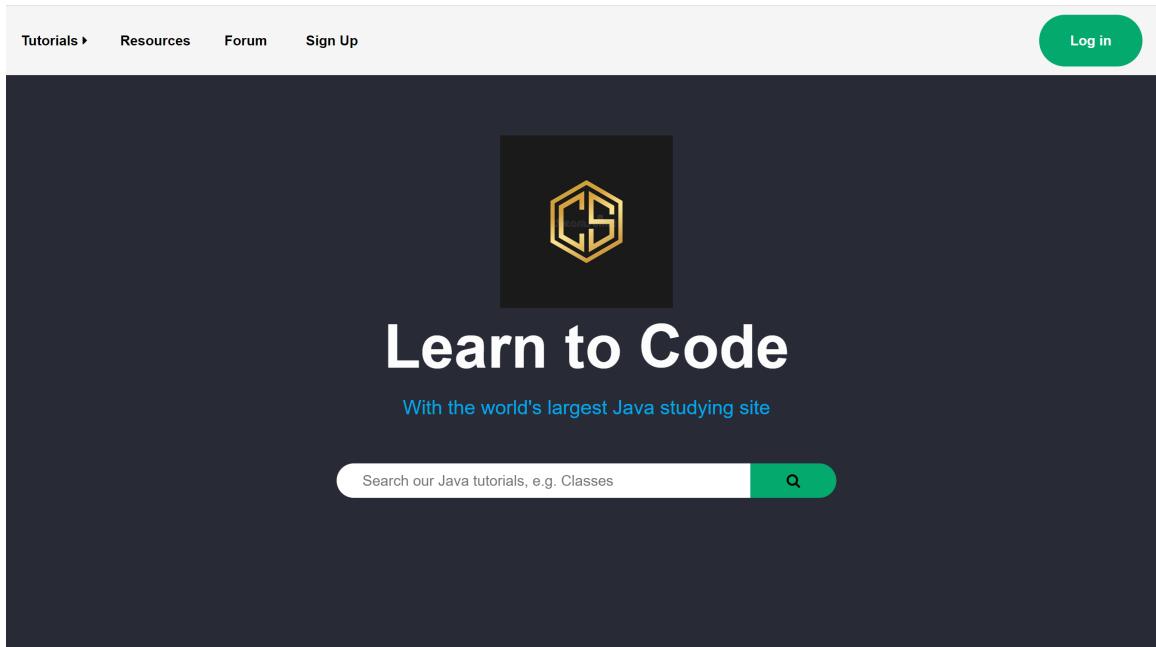


Figure 7.3: Macro and micro level implementation for negative space

In the design of the main page, the overall design adopts the macro-level negative space design. For the background I used dark colour and there are no elements around except the

main body. A wide range of dark colours can provide the user with a feeling of stability and reliability.[37] The font I used a cold colour(blue) and white which is opposite to the background colour, and this is in order to highlight the content and theme and create a strong contrast.

In terms of content, negative space design is adopted at micro-level. The spacing between each line of text is a blue word-sized space. This gives the space a sense of hierarchy and makes the connections between elements visible and natural,[38] focusing the user's attention on the core elements. It also provides enough micro-space for the main body centered in the middle, making the layout concise and not cluttered, but also enhancing the visual hierarchy and scannability of the page.

Classification Tutorials Page



Figure 7.4: Overlay curtains

The biggest benefit of overlay curtains is to increase the usage of a single page and reduce the conversion rate of web pages, allowing users to maximize the tasks they can accomplish on a single page. In addition, it can increase the interest and mystery of the web page. When users find overlay curtains when exploring the web page, it can not only satisfy their curiosity but also impress them, and improve the probability that users will reuse the website.

Java Tutorials Page and Resources Page

These two pages are designed according to the proximity in Gestalt principles. The principle of proximity refers to the tendency of elements close to each other in space to be seen as one. Generally speaking, elements are considered to belong to the same group if they are placed together at intervals.[29] The design of the two pages is separated from the content by a ratio of 2:8, which can help users quickly classify the elements of the web page and analyze the content.

The screenshot shows a Java tutorial page titled "Java Syntax". On the left, there's a sidebar with a navigation menu. The "Java Syntax" option is highlighted with a green background. Below it, other options like "Java Home", "Java Output", "Java Comments", etc., are listed. At the top right, there's a search bar with the placeholder "Search our Java tutorials, e.g. Classes" and a magnifying glass icon. To the far right is a logo consisting of a stylized letter "H" inside a hexagon. The main content area has a light green header with the title "Java Syntax". Below it, a paragraph of text is followed by a code block labeled "Main.java". A "Output" button is located below the code. The overall layout follows the 2:8 rule, with the sidebar on the left and the main content on the right.

Figure 7.5: Proximity in Gestalt principles

The screenshot shows a section titled "Access to the Books". It features two book entries. The first entry is for "Head First Java by Kathy Sierra & Bert Bates", which is marked as "available". It includes a small thumbnail image of the book cover, a brief description, and pros/cons. The second entry is for the same book, but it is marked as "not-available". It also includes a thumbnail image, a brief description, and pros/cons. The layout uses the 2:8 rule, with the book details on the right side of the page.

Figure 7.6: Proximity in Gestalt principles

By harmoniously breaking a large number of text or web elements into paragraphs and blocks. This layout is easier for users to digest and enjoy, because it is also more in line with the user's mental model, most of the current web design is placed compressed information on the left of the page, and detailed content is displayed through more space on the right, so the 2:8 ratio design will make users more familiar.

Login and Sign-Up Page

The figure shows a registration form titled "Welcome to register". It includes fields for "Username" (containing "sc", with a validation message "at least 3 letter"), "Password" (containing ".....", with a validation message "8-12 letter"), and "Phone No." (containing "1234323", with a validation message "length is 11"). A green "Sign Up" button is at the bottom.

```

1 // Promise from setTimeout
2 const afterSomeTime = (time) => new Promise(resolve => {
3   setTimeout(() => {
4     resolve(true);
5   }, time);
6 });
7 const callAfterSomeTime = (callback, time) => afterSomeTime(time).then(callback);
8 callAfterSomeTime(() => console.log('Hello after 1500ms'), 1500);
9
10 const getData = async (url) => fetch(url);
11
12 document
13   .querySelector('#submit')
14   .addEventListener('click', function() {
15     const name = document.querySelector('#name').value;
16
17     // send to backend
18     const user = await fetch('/users?name=${name}');
19     const posts = await fetch('/posts?userId=${user.id}');
20     const comments = await fetch('/comments?post=${posts[0].id}');
21   });
22
23 
```

Figure 7.7: JS Implementation - user input Validation

The registration page verifies user input on the web form with the application of JavaScript, ensuring that required fields are filled in correctly and that the format the user enters (such as email address, phone number) is correct. This can help prevent errors and make the user experience more seamless.

The second is to enhance website interactivity. JavaScript allows developers to create dynamic interactive websites that respond to user actions in real time.[39] For example, JavaScript can be used to display additional content when user input is formatted incorrectly, prompting the user for input without refreshing the entire page.

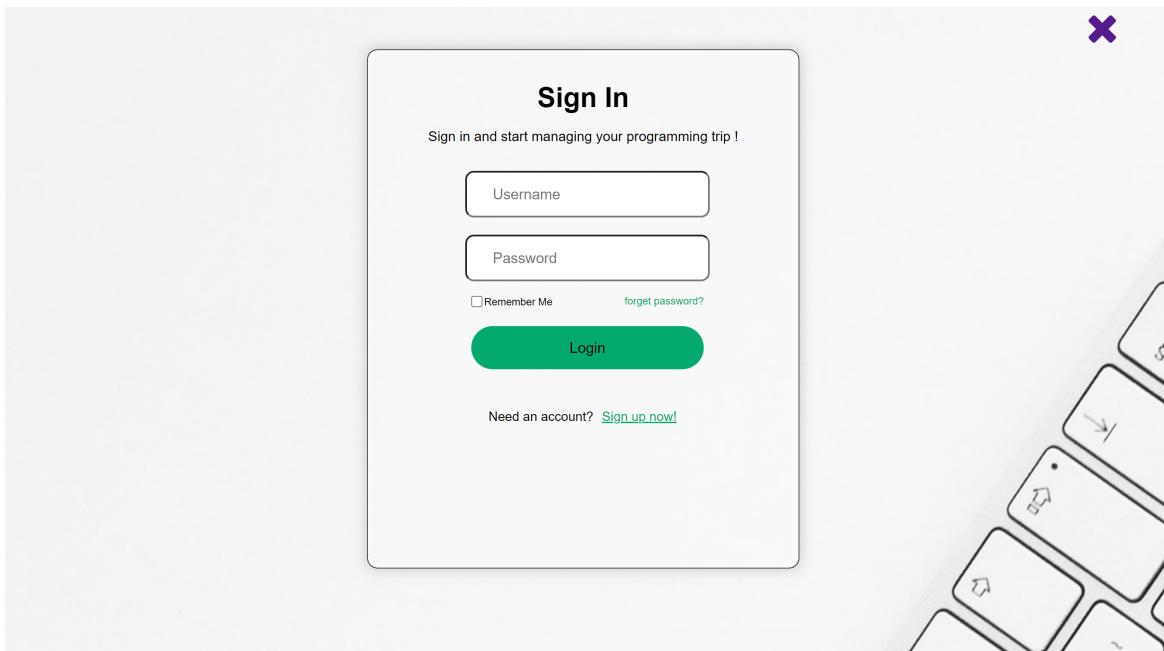


Figure 7.8:

The user login page uses a flat design, a two-dimensional minimalist design style, to build the overall frame. Through simplified, abstract and symbolic design elements, the design object is presented with a fresh, beautiful and easy-to-capture visual effect.[40] The overall design of elements on the page is to keep a simple shape, without excessive shadow and texture decoration, in order to maintain a 2D design. The surrounding white space is also used to remove superfluous elements, highlight the main content, and make the design object more readable.[40] ICONS are also used to capture the characteristics of the object that need to be expressed, like the cross button, and we do not need additional text to understand its function. The implementation of flat style expression ICONS which can make the picture more beautiful and durable.

The design of the user login form in the center part of the page uses the card design in the UI design mode. The login form is surrounded by rounded corners, and the margins around the form are used to leave white space on the page to improve the overall sense of hierarchy.[41] Then the black border around the form is designed to achieve the visual effect of suspended cards, so as to improve the sense of hierarchy of the page space and create a visual sense of space between the content and the background.

Considering that the use of negative space on the overall page is over simplify, it may cause the page to lose its own "weight ", so in the lower right corner of the page has use asymmetric design. Asymmetrical design is all about "weight" because we are attracted to "heavier" elements first. What we do know is that the image itself carries a certain visual weight.[42] Therefore I added the keyboard as the background image. Firstly, the object itself fits in with the theme of the site, and secondly, it doesn't make the page look over monotonous, because excessive white colour tends to cause a certain degree of visual fatigue.

Responsive Application

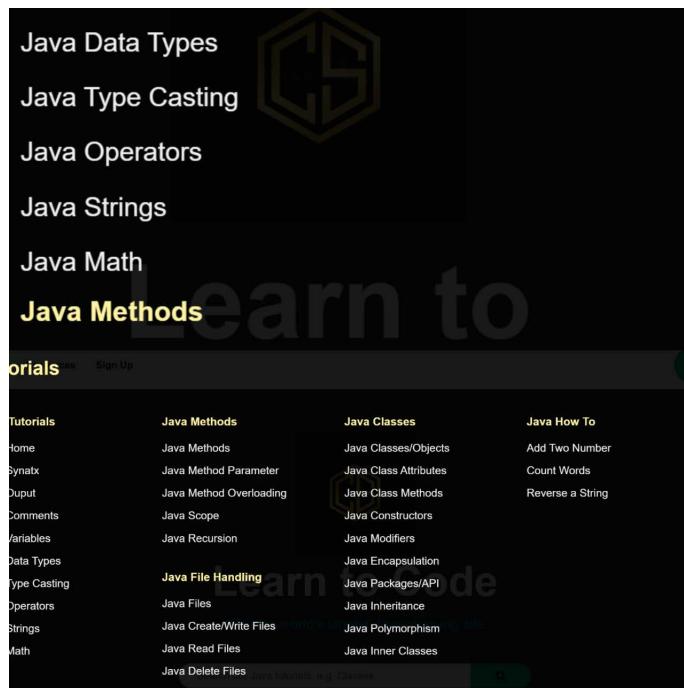


Figure 7.9: Responsive implementation in website

Responsive applications can increase user engagement by providing a better user experience. By designing an application that is easy to use and accessible on different devices, users are more likely to engage with the application and complete their tasks. It also ensures a consistent experience for users,[43] who can access the same application on different devices

and screen sizes and still navigate and interact with the application seamlessly.

Second to give programs faster load times, responsive apps are designed to be optimized for different devices and screen sizes, which means they load faster and provide a more seamless experience for users. It can also improve accessibility for users with disabilities or impairments, such as visual or motor impairments. By designing an application that responds to different screen sizes and input methods, users can interact with the application using the input method that works best for them.

Chapter 8: Professional Issues

In this section, some of the professional issues related to the project will be discussed. Because much of the development in this project is based on stakeholder needs and human-computer interaction, there are many potential professional problems in the project. This section will discuss usability and plagiarism in detail, as these two issues have the biggest impact on this project.

8.1 Usability

Usability plays an important role in web development, which largely determines the success of a website. If when people try to visit a website and the website does not give users the experience or results they want, then there is no doubt that the website is worthless. Usability is a measure of users and an important part of realizing human-computer interaction, because it most directly reflects that the information feedback between human and computer is correct and accurate.

Therefore, at the beginning of the design of the website, we should understand the positioning of the website and what the website can do for users, and make corresponding plans based on the needs of stakeholders. And then when we plan it, we have to figure out how to design the website so that the information that we want the user to see is presented to them in the most intuitive way. According to krug's three usability principles [36], users don't want to think because they are always on the go, so when they come to a web page they don't read it or scan it, they are very good at scanning, users know they don't have to read everything, Instead, it judges the web page through certain parts, such as its brand or slogan. Users will only choose to read what they are interested in or visit what is clearly identifiable, and this is why I choose to design my project in a minimalist style, because I can remove unnecessary elements, simplify the overall structure of the web page, and highlight what I want to show. From a usability and UX perspective, focusing on what is important prevents distracting users, which makes it more likely that they will visit the site's information as we intend.

I use magnification, animation, and categorization to improve the usability of the site. These methods highlight the location of the content.[33]It is also possible to customize the shape of the mouse through the :hover selector, such as replacing the default triangle mouse arrow with a finger shaped arrow to remind the user that the part you selected is accessible. krug's principles also refer to removing half of the text on a page and then removing half of the remaining text. At the time this book was published, web pages were contained excessive text-based content, which generally too long, a bit like Wikipedia. In the design of extremely simplified style, the use of words can be greatly reduced. In the project development, a large number of pictures are also used as the theme, and then text as an aid to improve the website's ornamental and intuitive. Also, the implementation of ICONS to directly replace the meaning of some functions or themes, and these ICONS are often presented in the appearance of real life objects[9], which can reduce the user's reading time on text content and reduce the user's impatience.

8.2 Plagiarism

According to the official definition, plagiarism is presenting work or ideas from another source as your own, with or without consent of the original author, by incorporating it into your work without full acknowledgement.[35] Plagiarism is sensitive in any industry or field because it involves taking credit for the work of others, which undermines originality.

Web development actually belongs to the design industry. In this era of developed networks, there are all kinds of websites on the Internet, but we sometimes find that many websites have similarities. This is especially true when developers are more or less looking at other people's great websites in the early stages of design. Developers unconsciously learn or refer to the idea of those excellent websites, because we need to learn their design from different websites, analyze their advantages and disadvantages, and then establish a personal design style, which requires a lot of practice and time accumulation. I think a designer who doesn't appreciate good web work may never understand the true meaning of borrowing, and a designer who can't integrate the essence of good work into existing needs may never find true inspiration. Even those seemingly unique designs are often inspired by the cumulative experience of the designer over a long period of time from borrowed.

In our era where originality is highly valued, we strive to avoid copying others' words and consider borrowing to be a form of plagiarism. Yet, the boundary between the two is actually somewhat hazy, therefore measuring the ratio between the two is a crucial aspect of this project's progress. If the layout and content of the entire web design are identical to those of other websites, this is without a doubt plagiarism. Yet, how can we assess whether there are similarities within the same sort of web page? The main scene or main elements are essentially identical; you only change one or a few details, such as copy-writing, products, or colour matching, etc., but the final effect and feeling are so similar to the original that others can recognise them as nearly identical works; therefore, we can identify it as plagiarism.

In the development of this project, I also encountered a troublesome behavior of "plagiarism". The first website I designed was a model website, which inevitably involved a lot of model pictures, and most of these pictures were downloaded from the Internet and used in the website development. Because almost all of the images on the Internet are copyrighted, it is obviously illegal for me to use them as part of my project development. So through many meetings with the project manager, we came up with a plan that we would replace all the images by using "unsplash.com", which provides images without copyright, which guarantees any infringement.

Chapter 9: Planning and Time-Scale

9.1 First term

Time Scale	Milestone	Motivation
26/9/2022 —2/10/2022	Start my project plan Make research on HCI Have briefly idea of interfaces	Have a briefly view for what I have to do in the future
3/10/2022 —9/10/2022	Finish and submit project plan Study bootstrap Learing GitLab	Prepare all the environment that I need to set up and ready to code
10/10/2022 —16/10/2022	Design the layout of my first home page Code the home page (Model display webpage) Write the specification and introduction of my report	Start the text-based page, set up the content and the navigation bar Carry on the progress of the report
17/10/2022 —23/10/2022	Add images in it Add CSS style Record the technical concept in the report	Enrich the webpage and carry on the progress of the report
24/10/2022 —30/10/2022	Finish the home page Start the second page Write the technical concept in the report	Try to build an “Abstract”, which helps user knows better what this site are and the (corporate) history
31/10/2022 —6/11/2022	Finish the second page Start the third page Write the technical concept in the report	Try to build up a “shop” web page for user to consume toys
7/11/2022	Finish the third page	Try to build up a “Contact”

—13/11/2022	Start the fourth page Write the technical concept in the report	webpage, which contains the address and number etc.
14/11/2022 —20/11/2022	Finish the fourth page Write the technical concept in the report	Carry on the progress of the report and try to finish the first interface
21/11/2022 —27/11/2022	Go through all the code and test for it	Make sure all the functionality is added and the style is correct
28/11/2022 —4/12/2022	Finish interim report Submit presentation file Overview the code	Ready to meet the deadline and make sure the code is working properly
5/12/2022 —9/12/2022	Prepare my presentation file	Ready for presentation

Figure 9.1: Term one planning

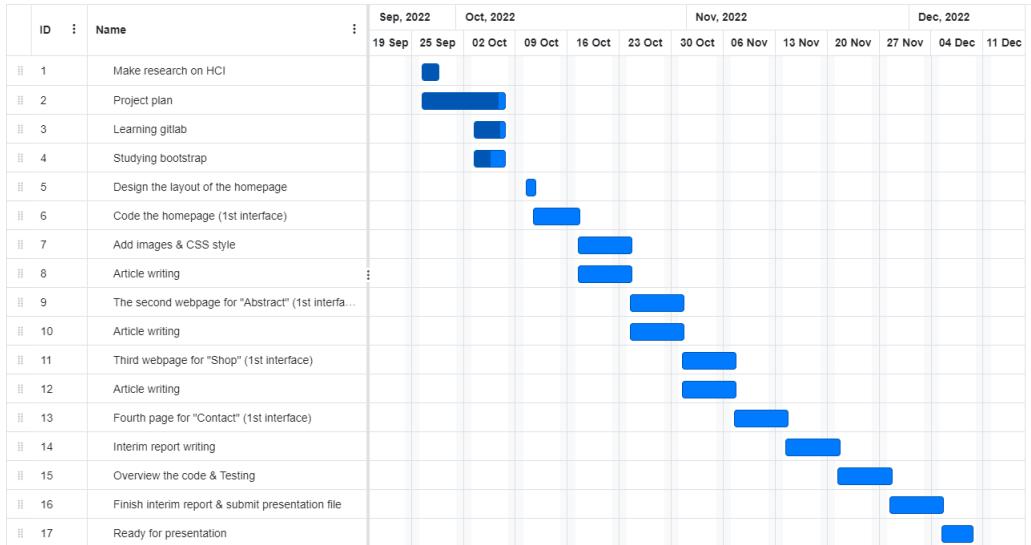


Figure 9.2: Gantt chart for term one

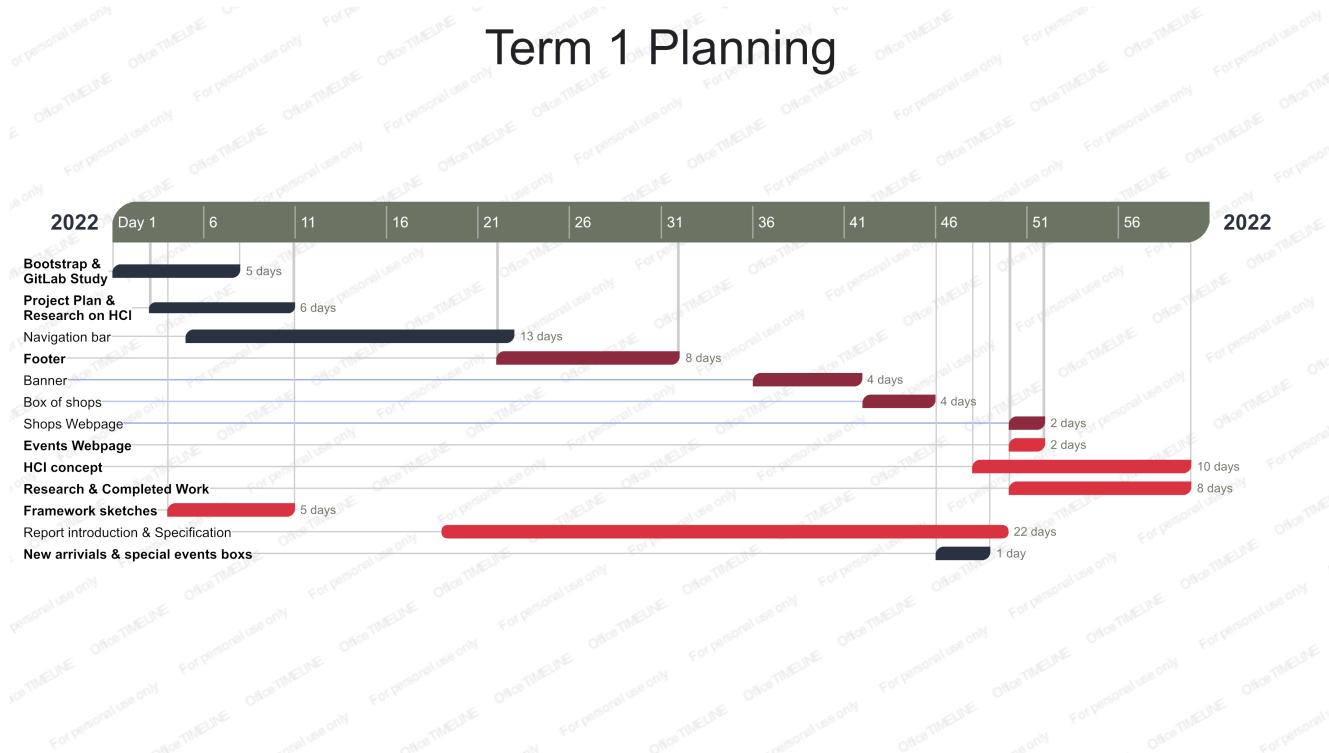
Actual Milestone for term 1:

Figure 9.3: Actual Gantt chart for term one

The picture above shows the actual progress in development. It can be seen that obstacles may be encountered in actual development, which leads to delays in the deliverable of each stage. And this also shows that the advantage of agile development in practice is flexibility. During development, planned changes can be made according to the actual situation of the developer.

9.2 Second Term

Time Scale (dd/MM/YYYY)	Milestone	Motivation
9/1/2023 - 15/1/2023	<ul style="list-style-type: none"> - Design the layout of the homepage (CS online learning site) - Start the homepage - write the technical part in report 	design the layout build up the navigation bar
16/1/2023 - 22/1/2023	<ul style="list-style-type: none"> - Finish the homepage - Start the second page - write the technical part in report 	build up the navigation bar and settle down the css style
23/1/2023 - 29/1/2023	<ul style="list-style-type: none"> - Finish the home page - Start the third page - write the technical part in report 	“classification” page has to be build up
30/1/2023 - 5/2/2023	<ul style="list-style-type: none"> - Finish the third page - Start the fourth page - write the technical part in report 	“event or news” page need to be build up
6/2/2023 - 12/2/2023	<ul style="list-style-type: none"> - report writing 	finish the second interface writing part
13/2/2023 - 19/2/2023	<ul style="list-style-type: none"> - overview & testing the code 	Make sure functionality is added & the style is correct
20/2/2023 - 26/2/2023	<ul style="list-style-type: none"> - design the content layout - start the homepage of shopping site - write the technical part in report 	build up the navigation bar and settle down the css style
27/2/2023 - 5/3/2023	<ul style="list-style-type: none"> - finish the homepage - start the second page - write the technical part in report 	product page need to be build up
6/3/2023 - 12/3/2023	<ul style="list-style-type: none"> - finish the hompage - start the third page - write the technical part in report 	shopping cart page need to be build up

13/3/2023 - 19/3/2023	<ul style="list-style-type: none"> - finish the third page - start the fourth page - write the technical part in report 	payment page has to be build up
20/3/2023 - 24/3/2023	<ul style="list-style-type: none"> - report writing 	Meet the last stage of the report
25/3/2023 - 31/3/2023	<ul style="list-style-type: none"> - overview & testing code 	Make sure functionality is added & the style is correct
1/4/2023 - 7/4/2023	<ul style="list-style-type: none"> - Last stage of the program - Review all the interface 	Overcheck the work that I have done, make sure nothing go wrong
8/4/2023 - 14/4/2023	<ul style="list-style-type: none"> - Have the final report draft ready 	Get the feedback and make some changes by sending the draft to my supervisor
15/4/2023 - 21/4/2023	<ul style="list-style-type: none"> - Finish the final report - Overview the final program 	Ready to hand in my final report
22/4/2023 - 28/4/2023	<ul style="list-style-type: none"> - Get ready the project demo 	To discuss with my supervisor to have a nice demo

Figure 9.4: Term two planning

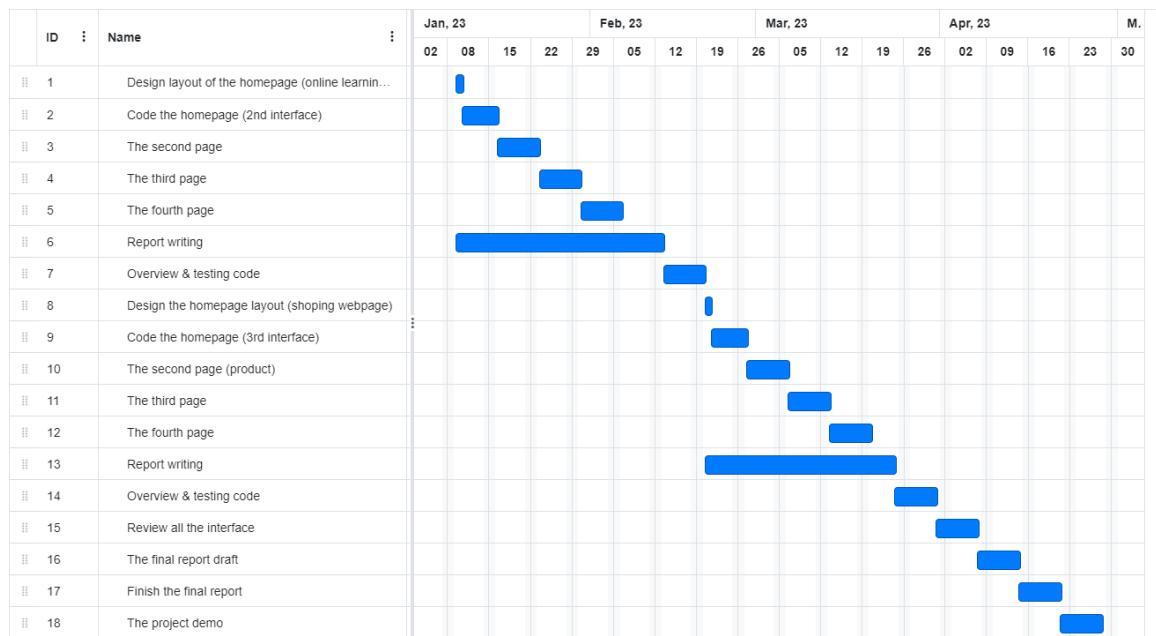


Figure 9.5: Gantt chart for term two

Chapter 10: Critical analysis and Discussion

10.1 Potential Future Enhancements

In the development process of this project, many designs and functions were not applied in time in the project due to the time limit and priority arrangement of tasks. In this section, we will discuss and outline some ideas and functionality that might be applied to the later project.

10.1.1 Major Enhancements

Over Minimalism

In this project, a large number of negative space design is used, so excessive white space leads to over simplify, which is easy to make users visual fatigue and may be not so friendly to colour blindness people. In addition, there will be a lack of boundary between the background and elements, because the colours are too similar, resulting in a high sense of integration, such as the Shops page and Events page of the model website (see figure 6.13 and 6.14). If we can use different colours more skillfully to emphasize the sense of boundary between elements or modules, and increase the application of contrast colors, such as the combination of black and white. We can make the page more diversified without losing the minimalist style.

Insufficient Hyperlink

In this development, a lot of important text content has been classified, and the contents of the classification are with hyperlinks, there is insufficient corresponding website to the hyperlink in the model website, which also led to the decline of web usability. Therefore in the online learning site I created corresponding sites for certain Hyperlinks and then used cursor:not-allowed for those Hyperlinks that were not available. When user moves the mouse over the inaccessible content, the inaccessible flag will be displayed.

Font Size

Font size considerations are also an important part of the usability of the site. When the site is running on different devices, the font size will appear smaller on devices with larger screens, and the opposite on devices with smaller screens. So this is a factor to consider when developing a responsive font, and sometimes it can affect the readability of the font depending on the resolution of the device. Therefore, the size of the font should be carefully considered to avoid the disharmony between the page elements and the font caused by the text is too large, or the text is too small to affect the reading of the content.

10.1.2 Minor Enhancements

Language Switch System

A multilingual Switching system may result in changes to the original layout, as some languages, such as Russian, are relatively long. The length of the text may exceed the capacity

of the container If the text on the web page is changed to another language, which creating the risk of text overflow. Although it is possible to hide spillover text, but it can also affect the overall appearance and readability of the page. Therefore, for multi-language websites, should carefully consider the size of the text container, and conduct typesetting experiments for each language if possible.

Scrollable Text

In the first model site, the enlarge effect was applied to the presentation of the product (see figure 6.8), with a lot of compression of the text description since the picture was the highlight. Due to time constraints, I did not create a separate demonstration page for each product, so adding a scrollable content to display under the image would greatly increase the usability of the page.

Hyperlink for Banner

On the main page of the model site, I designed an auto-sliding image animation for the banner (see figure 6.7), but the decorative animation only enhanced the visual effects of the page. If set the corresponding hyperlink for each image in the banner, which can improve the usability of the banner.

10.2 Self-evaluation

10.2.1 Term One

In the term one, I made a series of plans and goals for myself in order to complete the interim report in December. Firstly, planning is based on the realization of the first deliverable, ensuring that the development results meet the requirements of the stakeholders involved. This provides a good milestone for the first term to ensure that the development of the project can proceed smoothly at term two.

In first term development, the following events took relatively large amounts of time and effort:

- Research and gather development requirements for the first deliverable
- Learn the technique for the Web framework (Bootstrap) and start practicing it
- Eliminate requirements and learned technologies and start to build proof-of-concept to prove the possibility of later development

Personally, I think the collection of requirements is not too much of an obstacle. By studying a lot of knowledge about HCI and conferences, I can precisely locate the presentation of requirements in the deliverable. This can be done by using user stories to analyze the needs of stakeholders, and then organize and construct my idea of the product in the form of sketches. In order to realize my idea, I learned Bootstrap in depth and successfully applied this technology into the development. Since I have some understanding of front-end development, I have a more solid foundation to adjust and build my web development. Although in the middle of the development, I encountered a conflict between my own CSS style and bootstrap CSS style sheet, resulting in the layout of the web page may be different from the setting of

parameters. However, with the accumulation of knowledge and practice, I can cope with and improve any unexpected situation more easily.

Overall, I think the results of the first term are good. Obstacles were encountered but difficulties were solved smoothly. Since the goal is to develop three pages, some of the code from the first deliverable can be reused in the second phase, such as the navigation bar. This also gives me more confidence in term two development.

10.2.2 Term Two

Before the second term began, I did an evaluation of the mid-term program, and based on that, I made a series of decisions about the development in the near future. One of the decisions I made was not to use the bootstrap framework for the rest of the website development because of the CSS style conflicts I experienced during the first term. Sometimes a style conflict can lead to a series of faults, especially when developers need to re-customize their CSS styles. It took quite a lot of time for me to correct the layout faults, which was one of the factors that affected my development progress. In the second term, the development progress was relatively good when I stopped using the framework and I had more control over the layout of the web page.

However, in the later stage of development, I met a difficulty which is how to apply different HCI knowledge aspects to different websites. I think it is immature website development to only apply a single HCI to a website. Although the HCI application of the second website can be similar to the previous one, we need to add a new HCI aspect to it and that is why the development of my third website is kept delayed. After a deep discussion with the project manager, we decided to stop the development of the third website and focus on the improvement of the first and second websites, so as to improve the HCI of each website.

Therefore, in the development of the second website, I improved the implementation of the negative space by introducing both macro and micro design. In addition, it involves the knowledge of Gestalt psychology in typesetting and the page layout, thus influencing the subconscious judgment of users. In the first website, I used more in the design to improve the development of visual effects. In the second website, I added the implementation of JavaScript to make users more involved in the use of the website and further increase the interactivity.

10.2.3 Use of Tools

In the introduction of this report, I have mentioned some methodologies that I will use in this project development, and which also include the use of tools. I've used most of them in term one, so let's recap how these tools have been used:

Visual Studio Code (VSC): VScode is a free and open source code editor, and my project uses this code editor for most of its work because it involves front-end development. Now it supports many mainstream development languages such as HTML, CSS, react, Vue, JS and other front-end codes, as well as python, java and other back-end codes. It has a lot of plugins, through the installation of plugins will bring users a lot of convenience, such as the HTML and other language formatting plugin, browser plugin (which enable developers to quickly open the code file, in the form of web page), such plugins are more practical when doing projects. Speaking of projects, VScode can also use git to manage project code well. In addition to the rich add-ons, VScode also has a number of shortcut keys to make web layout development faster, all of which will help

front-end developers write code more efficiently.

Bootstrap: For this project, I only used bootstrap for the first web design. Since bootstrap contained various web components, I could build a beautiful and fully functional website more quickly. Such as drop-down menus, navigation bars, typography, etc. But some of the styles didn't meet the web develop requirement, so I had to re-customize the CSS style-sheet. But this created compatibility issues, resulting in CSS style conflicts, which I spent a lot of time trying to resolve it. Therefore, although Bootstrap is a very convenient framework, but if you can't keep consistent with some parts of the web design and bootstrap, and then do a lot of CSS rewrite, it will lose the meaning of using the framework.

TortoiseSVN/GitLab: As I said at the beginning, I use Gitlab to store all the work on the project. Although I was not very skilled at using it at the beginning, I made a lot of technical mistakes and spent a lot of time correcting them. However, after a long time of use, I gradually become familiar with branch, merge, and other SVN functions. This also allows me to store and organize my code more efficiently, making the development process formed a good cycle.

Photoshop: Web design inevitably involves a lot of images and the use of color. Photoshop allows me to cut pictures more quickly and extract colors. The use of appropriate colors is an important part of the layout of a web page, and sometimes the Web is used to find the right colors. Photoshop allows me to take a color image and then use a tool to extract the color parameters, which I can then use in web development.

10.2.4 Conclusion

During the half-year project development, I learned the software and technology in the early stage, so that I could continue the development relatively smoothly. I also spend a lot of time in learning HCI knowledge. Just as mentioned above, HCI is a subject involving knowledge in many professional fields. Therefore, in the study of some specific knowledge aspects, I need to refer to and in-depth study of relevant literature, which is also the main focus of this project. Also, I have learned a lot and successfully applied these knowledge into my development project through a number of development tools. These development tools play a very important part in my web development and help me reduce the difficulties in development.

However, in spite of this, there were still many difficulties in the way of development, which led to the delay of the development schedule or the cancellation of one of the projects. I evaluated the pros and cons of the Bootstrap framework in front end development, and I also experienced the conflicts of using Bootstrap with custom CSS styles. So I think if you're going to develop with a framework, it's important to learn the framework up front and try to avoid custom CSS style sheets. However, the development using framework is to use other people's customized interactive way to develop our own development, I don't think it is a good situation, using other people's typesetting or methods to develop our own projects, although very convenient, but not in line with the principle of independent development.

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Appendix A: **Demonstration of the Website**

Video link: <https://www.youtube.com/watch?v=kFK5bYJQY6M>