Interim Project Report

**Full Unit – Interim Report**

A study in (HCI) human computer interaction

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Introduction

This report provides an overview of the progress that has been made on the project so far, including the aims, objectives, planning, completed work, and next steps. I will explain my progress with respect to my timeline and why I have deviated from it. The report also discusses some of the challenges that have been faced during the project and how I have overcome them. I will also talk about a lot of the theoretical knowledge of HCI I have learned and explain how it relates to my project and provide a survey of all the literature and resources I. I will show how I am applying HCI principles to my user interfaces.

This is a complex project that involves designing, creating, and testing three different user interfaces with different HCI principles. The goal of the project is to create user interfaces that are easy to use, efficient, and enjoyable for users. It is also to gain a comprehensive understanding of HCI principles and their application to the design of interactive systems by creating three user interfaces, A shopping website, a Inventory managements systems interface, and a note taking application.

The project is currently in the implementation phase. So far, I have, created the shopping websites layout, created the database and website interfaces layout for my inventory management system, and begun my notes application. Swing has also been learned and used to create a basic GUI for the note’s application as well as bootstrap to make websites. All the major research has been competed as I used this first term to focus on that then next term, I will focus in the Ui’s.

1. Abstract:

Human-computer interaction (HCI) is a multidisciplinary field that studies the design and evaluation of interactive computer systems for human use. The goal of HCI is to improve the interaction between users and computer systems by improving the methodologies and processes for designing interfaces, teaching techniques for evaluating interfaces, and developing new techniques for creating these interfaces. Human-Computer Interaction (HCI) focuses on three more major concerns; the people, the computers and that tasks that are performed. The most important aspect of HCI is understanding the user. This involves understanding the user's goals, tasks, and needs, as well as their cognitive, and physical abilities to perform their desired task, the book Human-computer interaction by Alan Dix [1] says that an interaction between a computer and user should be “seamless with respect to their everyday work”. For example, what may be simple to understand for a young person who has been accustomed to computers, may not be as usable to older people. This would be an issue of accessibility. By understanding the end-user, We can design and implement systems and processes that are easy to use and efficient and we can help facilitate effective communication between users and technology.

Some other important aspects of HCI are usability and functionality. Usability is a measure of how easy and efficient a system is to use. A usable system is one that can be learned and used quickly and easily, and one that allows users to complete their desired tasks. Functionality is the services the system provides to the user and the paper [3] explains how the value functionality is only visible when the system is efficiently utilized by the user. However, there are trade-offs with usability and functionality, for example in my interface I have had to Simplify the navigation of my website which reduces the number of clicks needed to access essential features and looks more visually appealing. While this may enhance usability, it limits the visibility or accessibility of certain advanced functions which could decrease efficiency for higher level users.

Because of this, system designers should prioritize understanding the end user's intentions and their approach to tasks. Neglecting the end user's needs can lead to many problems, potentially even endangering people’s lives. Alan Dix [1] talks about how aspects such as psychology, computer science, design, and engineering are all intertwined into HCI and how a good designer would have knowledge of the user’s skills and capabilities and can understand the users' needs, preferences, and behaviours.

In this project I will explore how crucial a systems design is and I will create 3 user interfaces using various principles and methods I have gathered from all the resources I have gone through then I will demonstrate these principles in my Ui’s. I will also talk about the hardware aspect of a computer and evaluate how usable it is regarding my project. In my final report at the end of the year I will explain the projects aims, professional issues, an evaluation of all the work I have done and the theory I have learnt about HCI.

The 3 interfaces I am creating are a shopping website using HTML, CSS, and JavaScript (web-based interface), a notepad desktop application using java and Swing (Graphical user interface), and Database Management System (DBMS) Interface using MySQL for the database and a website for a GUI. They will all have user-centred design where the user's needs, goals, and preferences are at the forefront of the design process. [2] helped me decide which interfaces I should create. I will also be conducting user testing on them while I am designing to improve my design and understand my target users needs better.

# 1.1 My UI’s

For the notes desktop application, I am using Swing which a java library that will help me make a graphical user interface. This is a new technology for me, so I have spent a week learing how to use it, I have used the swing Documentation and manual (2) and also a course on youtube (10101010). This is targeted towards students so I will design it with principles targeted towards the 14-21 age group. It will be a simple note taking application with limited functionality but with the options you would find in a normal note’s application would all be there, for example, save, load, delete, change size and change font. It will also have images and icons to help navigate throughout the website and everything will be laid out in a way that is intuitive and suitable for users to learn and use.

The website will be a shopping website catering to users with disabilities such as visual impairment. The website's user experience (UX) design should prioritize simplicity and ease of use as I am designing it to be used in conjunction with a screen reader. This will be designed with a commitment to accessibility encompassing elements such as semantic HTML, clear navigation, high contrast, and keyboard accessibility. I have created a simple interface which is navigated by menus, and this will evolve into a website with descriptive text, alt tags for images, and compatibility with screen readers, facilitating a seamless browsing experience. I am adhering to accessibility guidelines like WCAG, striving for at least AA compliance (1010101010).

The Database interface will be an inventory management system using a MySQL database and html/CSS/js interface, targeted towards business owners who have a warehouse and need to keep inventory of their items. I will start the back end using java and Spring boot to interact with the database and the back end together using java’s servlet library. They will need to use it in different devices such as a phone, tablet, laptop and computer. It will also have a simple navigation design to provide an at-a-glance overview and quick access to key features. This is why im using bootstrap as it is responsive so it will provide better control of the layout of the website and also will make it look more visually appealing. I Have been using [7] to help me design the interfaces. It will also implement an account functionality for security, as well as defining user roles and permissions to control access levels based on the user's responsibilities.

# 1.2 HCI Goals for my Ui’s:

Shopping website:

* Clarity/Usability: The website should be easy to understand, learn and navigate. Users should be able to find what they are looking for quickly and easily.
* Consistency: The website should use consistent design patterns and terminology. This will make it easier for users to learn and use the website.
  + This will be done using mental models: The website should respect the mental models of its users. This means that the website should be designed in a way that is consistent with how users expect websites to work.
* This will also help with recognition: The website should use recognition rather than recall helping users navigate and find information. This could be done by using familiar design patterns and terminology.
* Feedback and Response Time: Provide clear feedback for user actions, such as successful form submissions or errors. Ensure that response times are reasonable to avoid user frustration.
* Error prevention and forgiveness: The website should help to prevent users from making errors. Also allowing users to recover easily from mistakes or explore different options without significant consequences.
* Visibility and Affordance: Ensure that interactive elements are clearly visible and provide visual cues about their functionality. Use design elements that intuitively suggest how they can be interacted with.
  + This will be done using Visual hierarchy: The visual hierarchy of the website should make it easy for users to find the most important information. For example, I will use large, bold fonts for important text, or by using contrasting colours to make important elements stand out.
* Dark mode: The notepad application could have a dark mode to reduce eye strain and to make the application more comfortable to use in low-light conditions.
* Accessibility: Integrate accessibility features, such as keyboard navigation, screen reader compatibility, and alternatives for multimedia content, to ensure the website is usable by individuals with visual impairments.
* Learnability: Design the website in a way that allows users, including those with visual impairments, to quickly understand how to navigate and use its features without a steep learning curve.

Notepad application:

* Focus: The notepad application should provide a distraction-free environment for writing. Users should be able to focus on their writing without being interrupted by other applications or notifications.
* Usability: The notepad application should be easy to learn and use. Users should be able to find the features that they need quickly and easily.
* Flexibility: The notepad application should be flexible enough to meet the needs of different users. Users should be able to customize the application to their liking.
* Power/Efficiency: The notepad application should provide a variety of features to help users be more productive. This is especially true for expert users.
* Satisfaction: The notepad application should be enjoyable to use. Users should have a positive experience when they use the application.
* Efficiency: Users should be able to complete their tasks quickly and easily.
* Internationalization: The application should be designed for international users. This means using a neutral language and design, and avoiding cultural references that may not be understood by all users.

Database management system interface:

* Learnability: The database management system interface should be easy to learn. Users should be able to learn how to use the interface quickly and easily.
* Efficiency and Productivity: Users should be able to complete their tasks quickly and easily. Streamline workflows and interactions to ensure that business owners can efficiently manage their inventory. Minimize the number of steps required to perform common tasks.
* Memorable: Users should be able to remember how to use the interface after not using it for a while.
* Robustness: The interface should be able to handle a variety of tasks and users. It should be able to recover from errors and to provide users with feedback on their actions.
* Satisfaction: Users should have a positive experience when they use the interface. They should feel confident that they can use the interface to complete their tasks.
* Customization/Personalization and Flexibility:
* Feedback/ Status Updates:
* Security and Privacy: Prioritize the security of sensitive inventory data. Implement robust authentication measures.
* Scalability: Design the inventory management system to handle varying scales of inventory, accommodating businesses with different sizes and levels of complexity.

2. Project Specifications:

Project Goal: To design and implement three user interfaces (UIs) for software applications, focusing on the UI itself. The UIs should be usable, efficient, and visually appealing.

Project Requirements:

* The UIs must be designed for different user groups and tasks.
* The UIs must be implemented using modern software engineering principles.
* The UIs must be evaluated using HCI principles such as usability, efficiency, and user satisfaction.

Project Deliverables:

* Three implemented UIs: a shopping website, a notepad application, and a database management system interface.
* A report that describes the design process, the evaluation of the UIs, and the HCI principles that were applied.

Project Resources:

* Software: HTML, CSS, JavaScript, Bootstrap, Java, Swing
* Other: HCI textbooks and articles, usability testing software

Evaluation techniques:

* Cognitive walkthrough
* Heuristic evaluation
* Model-based evaluation

# 2.1 Target Audience

* Shopping website: Younger/older Visually Impaired Users:

|  |  |
| --- | --- |
| Younger | Older |
| Younger visually impaired individuals are often more familiar with technology, including screen readers, magnification software, and other assistive technologies. | Older individuals may have varying levels of proficiency with technology, from those who are comfortable using assistive technologies to those who may need simpler interfaces. |
| Often engage in online shopping for a variety of products, including fashion, electronics, and entertainment. | They may visit the website for essential tasks such as online shopping for daily necessities, accessing health information, and staying informed about news and events. |
| Modern Aesthetics: Consider a modern and visually appealing design to resonate with the preferences of younger users. | Provide clear instructions and assistance throughout the website, especially in areas like form filling and checkout processes. |
| Ensure the website is responsive and compatible with various devices, including smartphones and tablets | Consider users with cognitive impairments by providing clear and simple instructions, avoiding jargon, and helping when needed. |
| Provide support for multiple languages and ensure that the website is culturally sensitive and accessible to users from different regions. | |
| Ensure compatibility with a variety of assistive technologies, including screen readers, magnifiers, voice recognition software, and refreshable braille displays. | |

* Inventory management system: Entrepreneurs and Small Business Owners/ managers
  + encompasses a range of business types, including retail stores, e-commerce ventures, manufacturing companies, and service providers.
  + Business owners may have varying levels of technological expertise. The inventory management system should be designed with an intuitive interface to accommodate users with different comfort levels with technology.
  + Business owners are often pressed for time, juggling multiple responsibilities. The inventory management system should be efficient, allowing users to quickly perform tasks and access essential information.
  + Business owners appreciate systems that offer customization options to tailor the inventory management process to their specific business models.
  + Given the sensitivity of inventory and business data, business owners prioritize systems that ensure the security and privacy of their information.
  + The inventory management system should be scalable to accommodate the evolving needs of businesses as they expand.
* Notes application
  + students are primarily focused on their academic studies. They are likely to take a variety of subjects, including core subjects like math, science, literature, and social studies.
  + students may need features that facilitate revision, such as flashcards, summarization tools, and reminders for important dates.
  + College students typically choose a specific field of study. They might need more advanced features tailored to their coursework and research.
  + generally comfortable with technology, Students may have varying attention spans. Design a UI that is visually engaging and easy to navigate, with clear and concise information.
  + Allow users to customize the interface to some extent, such as choosing themes or adjusting font sizes. Personalization can enhance the user experience.
  + Allow for quick actions to streamline notetaking. Shortcuts, quick editing features, and easy sharing options can save time for busy students.

3. Aims, objectives, and literature survey

The aims of this project are to:

* Design and implement three user interfaces (UIs) for software applications, focusing on the UI itself.
* Evaluate the UIs using HCI principles such as usability, efficiency, and user satisfaction.
* Gain a comprehensive understanding of HCI principles and their application to the design of interactive systems.

The specific objectives of this project are to:

* Research HCI principles and different UI technologies.
* Design three UIs for different user groups and tasks.
* Implement the UIs using modern software engineering principles.
* Conduct usability testing to evaluate the UIs and make necessary changes.
* Write a report that describes the design process, the evaluation of the UIs, and the HCI principles that were applied.

# 3.1 Technologies I have used and why.

**Java Swing:**

Swing is part of the Java Foundation Classes and is included in the Java Development Kit (JDK) since version 1.2. It is a GUI widget toolkit that provides a collection of standard graphical components for creating user interfaces (UIs). (10101010)

Key features of Swing:

* Platform independence: Swing components are written entirely in Java and do not rely on any platform-specific code. This means that Swing applications can be run on any computer that has a Java Runtime Environment (JRE).
* Extensive set of components: Swing provides a rich set of standard graphical components, including buttons, labels, text fields, menus, and dialog boxes.
* I am making the notes application in swing because it will mainly be used on desktop computer and swing is tailored for making desktop applications.

Reason I used Swing for creating the GUI as opposed to JavaFX:

* It is significantly easier and quicker to learn and use.
* With respect to the future of java, sit is more stable whereas JavaFX may be replaced with new technology in the future.
* Already included in the java JDK so it should be easy to run on my supervisors and markers computers without having to install additional software.
* Swing provides built-in support for accessibility features, making it easier for developers to create applications that are accessible to users with disabilities.

**HTML/CSS/JS with Bootstrap:**

Bootstrap is a free and open-source front-end framework developed and is a powerful and popular toolkit for building responsive and mobile-first web applications. Bootstrap simplifies the process of designing and styling web pages by providing a set of pre-built components, CSS styles, and JavaScript plugins that can be easily integrated into web projects.

Why I used bootstrap and key features:

* Bootstrap provides a pre-built collection of CSS classes and JavaScript components that can significantly expedite the development process which facilitates rapid prototyping.
* **Responsive Design:** Bootstrap is built with responsive design principles, ensuring that your website seamlessly adapts to different screen sizes and devices, including desktops, tablets, and smartphones. This is crucial for providing an optimal user experience across various platforms.
* **Grid System:** Bootstrap's grid system provides a structured layout framework for organizing your website's content. This makes it much easier to create consistent and visually appealing layouts without having to manually adjust margins and padding for each element.
  + Grids help to create a consistent visual experience for users.
  + Grids can also be easily adapted to different screen sizes and devices.
  + Accessibility: Grids can also help to make designs more accessible to users with disabilities. For example, users with low vision may find it easier to scan and understand a grid-based layout. Additionally, grids can be used to create designs that are compatible with screen readers and other assistive technologies.
* **Cross-Browser Compatibility:** Bootstrap is extensively tested across various browsers to ensure consistent rendering and behaviour across different platforms.
* **Consistency:** Bootstrap's consistent design language ensures that your website maintains a cohesive look and feel throughout its pages. This enhances the overall user experience and makes the website more visually pleasing.
* **Accessibility:** Bootstrap incorporates accessibility features that make your website more usable for individuals with disabilities.

There are a few reasons why I did not use a framework to create a website UI where I don't need much functionality:

* Simplicity: I only need a simple website with no complex functionality, so using a framework can add unnecessary complexity. Frameworks often come with a lot of code and features that I wouldn’t need and could make my code more difficult to manage and debug. Additionally, frameworks can add additional processing overhead, which can slow down the website.
* Control: I need complete control over the look and feel of the website and using a framework can be restrictive. Frameworks often have their own built-in styles and layouts, which can limit the ability to create a unique and personalized design. Additionally, frameworks can make it more difficult to customize the behaviour of the website.
* Learning curve: Since I am relatively new to web development, learning a new framework can be very time-consuming. This can delay the development process and make it more difficult to get the website up and running. And since only need to create a simple website functionality wise, the time investment may not be worth it.
* Flexibility: Since I need to frequently make changes to my website as I am using a prototyping approach, using a framework can make this a lot more difficult and time consuming.

# 3.2 Motivation

* Why I’m interested:
  + I am interested in designing and implementing user interfaces (UIs). This HCI Project will give me the opportunity to design and implement three UIs for different user groups and tasks. I will also learn about different UI technologies and how to use them to create UIs that are both usable and aesthetically pleasing.
  + I will learn how to conduct usability testing and use the feedback from users to improve my UIs.
  + This Project will also give me the opportunity to learn about a wide range of HCI principles, including cognitive psychology, design principles, and evaluation methods. Then I will learn how to apply these principles to the design of interactive systems that are both user-friendly and effective.
* How this will help me in my future career:
  + I will gain a comprehensive understanding of HCI principles and their application to the design of interactive systems. This knowledge will be essential for designing usable and effective user interfaces for a variety of applications.
  + I will also develop practical skills in UI design, implementation, and evaluation. These skills will be in high demand in the job market as companies increasingly focus on creating user-centred products and services.
  + In addition, completing this project will also help you to develop several important transferable skills:
    - Problem-solving skills. HCI is a problem-solving discipline, and designing effective user interfaces requires the ability to identify and solve problems effectively.
    - Critical thinking skills. HCI is an evidence-based discipline, and it is important to be able to critically evaluate research findings and make informed decisions.
    - Creativity skills. HCI is a creative discipline, and it is important to be able to come up with new and innovative solutions to design problems.
    - Research skills
* What makes this topic significant for UI designers:
  + The reason HCI is important is because it has a direct impact on our lives. We interact with computers and other digital devices daily, and we want those interactions to be as efficient, effective, and enjoyable as possible. HCI principles help designers create user interfaces that are easy to learn and use, and that allow people to complete their tasks quickly and easily.
  + People want to be able to use computers and other digital devices without having to read manuals or learn complicated procedures. HCI principles help designers create user interfaces that are intuitive and easy to understand.
* Uses of HCI and applications/systems where it is vital:
  + Medical devices: HCI can help to ensure that medical devices are safe and easy to use for both patients and healthcare professionals.
  + Educational software: HCI can help to ensure that educational software is engaging and effective for students.
  + Websites and mobile apps: HCI can help to ensure that websites and mobile apps are easy to navigate and use for users.
  + Consumer products: HCI can help to ensure that consumer products, such as smartphones and televisions, are easy to use and enjoyable for users.

# 3.3 Theory

Human-Computer Interaction (HCI) is a multidisciplinary field that explores the design, development, and use of computer systems from the perspective of the user. Some of the most important aspects of HCI are:

* Cognitive psychology: This focuses on how humans think, learn, and remember information. It is important for understanding how users interact with computers and how to design UIs that are easy to learn and use.
* Design principles: These are general principles that can be used to design effective user interfaces.
* Evaluation methods: These are methods that can be used to evaluate the usability of UIs. Some of the most common evaluation methods include user testing and reviews.

HCI theory is important because it helps to ensure that interactive systems are designed to be usable, efficient, and enjoyable to use. This is important for several reasons, including:

* Increased productivity: Usable systems can help users to get their work done more quickly and easily.
* Reduced errors: Usable systems can help to reduce the number of errors that users make.
* Increased satisfaction: Usable systems can help to increase user satisfaction with the system.

HCI theory encompasses a range of principles and models aimed at understanding the interaction between humans and technology. The goal is to create user interfaces and experiences that are not only efficient and functional but also intuitive, enjoyable, and accessible.

**Key Principles of HCI Theory:**

* User-Centred Design (UCD):
  + At the core of HCI theory is the principle of User-Centred Design. This approach places the user's needs, preferences, and abilities at the forefront of the design process. By involving users in the design and evaluation phases, developers can create interfaces that align with users' mental models and expectations.
* Usability:
  + Usability is a fundamental concept in HCI theory, focusing on the effectiveness, efficiency, and satisfaction with which users can accomplish tasks within a system. Usability principles guide the design of interfaces to minimize errors, streamline workflows, and enhance overall user experience.
* Affordances:
  + Affordances refer to properties of an object that suggest how it can be used. Signifiers are cues or indicators that communicate these affordances. In HCI, understanding and appropriately implementing affordances and signifiers help users intuitively grasp how to interact with a system.
* Feedback and Guidance:
  + Providing timely feedback to users about the outcome of their actions is crucial in HCI. Guidance, also called predictive feedback and feedforward, informs users about the potential outcomes before an action is executed. These principles contribute to a sense of control and predictability, enhancing the user's experience.
* Cognitive Load and Mental Models:
  + HCI theory considers the cognitive load imposed on users during interactions. Designers aim to reduce cognitive load by aligning the system's structure and functionality with users' mental models. This reduces the need for extensive learning and enhances user understanding.
* Accessibility and Inclusivity:
  + HCI emphasizes the importance of designing interfaces that are accessible to users with diverse abilities and needs. Inclusive design ensures that all users, regardless of physical or cognitive abilities, can interact with technology easily and efficiently.
* Error Prevention and Recovery:
  + HCI theory addresses the inevitability of user errors. Design strategies focus on preventing errors through clear communication and intuitive design. Additionally, systems should support users in recognizing and recovering from errors.

**Models in HCI:**

Alan Dix talks about “the golden rule of design”: which is understanding your materials.

* understand computers – limitations, capacities, tools, platforms.
* understand people – psychological, social aspects, human error.

1. The Human:

This model conceptualizes the human mind as an information processing system, providing insights into how humans perceive, process, and respond to information. It helps designers understand cognitive factors influencing user interaction.

How do users think? Users appreciate quality and credibility. They don’t read, they scan:



These images depict heat maps revealing the focal points of user attention during online browsing. The most viewed areas, represented as the "hottest" zones, tend to cluster around the middle of sentences, which aligns with the typical scanning behaviour of web users. A user’s impatience and the pursuit of instant gratification drive users to satisfice, opting for the first reasonable choice instead of the optimal one. Optimization is a lot harder and takes a lot more time, so satisficing is generally the more efficient approach. Users rely on their intuition and seek control in their interactions.

A fundamental principle in creating a user-friendly interface is to minimize cognitive effort, following Krug's first law of usability. Webpages should be clear, self-explanatory, and have clear structure, with moderate visual cues and easily recognizable links. By reducing cognitive load, you make it easier for visitors to grasp the idea behind the system. Recognizing users' limited patience, designers should strive to keep user requirements minimal, the less action is required from users to test a service, the more likely a random visitor is to try it out.

Effective management of users' attention is crucial. Web-users can instantly recognize edges, patterns and motions, a webpage should guide attention to specific areas through use of visual elements. This approach can help your visitors to get from point A to point B without thinking of how it is supposed to be done. Guidelines are extremely effective as they lead the visitors through the site content in a very simple and user-friendly way. The less confusion and questions a user have about the page, the better the sense of orientation and provides an overall improved user experience. (11)

Mental Models in HCI:

* Mental models are based on users' beliefs about the system they are interacting with.
* They are crucial for predicting user actions and interactions with the system.
* A key challenge in HCI is aligning the designer’s mental model with that of the users.

The computer:

In Human-Computer Interaction (HCI), the model of the computer refers to the mental framework users construct about how a computer system operates. This conceptual model is a crucial aspect of designing interfaces that are intuitive and user-friendly. Users form mental models based on their interactions with other computers and systems. This system should align with the users’ expectations, and this is achieved through clear affordances, providing visible feedback, maintaining consistency in design, and ensuring effective error handling. The mapping between controls and system functions, along with the visibility of system status and options, contributes to a coherent mental model. Furthermore, a system's learnability and adaptability over time influence the users evolving conceptual model of computer systems.

* Input and output modalities: Computers receive inputs through various means, such as keyboards, touch screens, and voice commands. Outputs can be presented visually, audibly, or through haptic feedback. Interfaces should match input and output modalities to user preferences and task requirements.
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Colour Theory:

* Use complementary colours to create contrast. They create the strongest contrast, which can be used to make important elements stand out.
* Use analogous colours to create harmony They create a sense of harmony and unity, which can be used to create a calm and relaxing atmosphere.
* Use triadic colours to create balance. Triadic colours are colours that are evenly spaced around the colour wheel. They create a sense of balance and stability, which can be used to create a professional and sophisticated look.
* Use tetradic colours to create interest. Tetradic colours are made up of two complementary colours and two analogous colours. They create a sense of interest and excitement, which can be used to grab users' attention.
* Different types of audiences are attracted to different colours.
* Fewer colours are generally more powerful and less overwhelming.

Nielsen's usability heuristics are a set of principles that can be used to design more usable user interfaces (UIs). They are based on the idea that users should be able to easily learn, use, and remember how to use a system. The heuristics are designed to help designers avoid common usability problems. (12)

1. Visibility of system status: The system should always keep users informed about what is going on, through appropriate feedback within a reasonable amount of time.
2. Match between system and the real world: The system’s language, terminology, and concepts should align with what users already know from their real-world experiences.
3. User control and freedom: Users should be able to backtrack or undo actions easily, offering them the freedom to correct mistakes.
4. Consistency and standards: Follow platform conventions and be consistent in your use of terminology and design.
5. Error prevention: Careful design that prevents a problem from occurring. Double-check user input and provide clear instructions to avoid mistakes.
6. Recognition rather than recall: Minimize the amount of information that users must remember by providing appropriate defaults or making information easily retrievable.
7. Efficiency and flexibility: Efficiency features and shortcuts should be available for power users without overwhelming beginners. Accommodate both users by providing clear navigation options and the ability to customize frequent actions.
8. Aesthetic and minimalist design: Clutter-free, aesthetically pleasing designs are more user-friendly.
9. Help users recognize, diagnose, and recover from errors: Error messages should be clear, concise, and constructive. They should tell users what the problem is, and how to fix it.
10. Help and documentation: Provide easy access to help and documentation, and make sure it is clear, concise, and up to date.

# 3.3.1 Literature review

**Human-Computer Interaction (3rd Edition), Alan Dix, Gregory D Abowd, Janet E Finlay and Russell Beale (1)**:

Introduces the core concepts and scope of HCI, defines HCI and its importance in the modern world. It is a foundational text that offers comprehensive insights into HCI principles, design considerations, and user experience. The book's focus on user-centred design, iterative development, and robust evaluation techniques makes it invaluable in the HCI field. Specific chapters and pages, such as Chapter 5 (Pages 3, 4, 8, 10, 14), Chapter 6 (Pages 38, 48), Chapter 8, and Chapter 10, provide detailed insights into these topics, contributing significantly to the understanding and advancement of human-computer interaction.

**Designing the User Interface: Strategies for Effective Human-Computer Interaction (6th Edition) by Ben Shneiderman (5):**

Talks about design principles and strategies for effective HCI. It emphasizes on the usability of interactive systems, guidelines, principles, and theories for designing user interfaces, and the management of design processes. This book presents a broad survey of designing, implementing, managing, maintaining, training, and refining the user interface of interactive systems​​. It emphasizes direct manipulation, menu selection, command languages, interaction devices, and collaboration​​.

**Empirical Research in HCI (Human-Computer Interaction: An Empirical Research Perspective by I. Scott MacKenzie) (6):**

MacKenzie's book discusses the empirical methods in HCI research. It highlights the importance of historical context, the human factor, interaction elements, scientific foundations, designing HCI experiments, hypothesis testing, modelling interaction, and the process of writing and publishing a research paper in the field of HCI​​.

4. My Progress so far

# 4.1 Work completed.

* A literature review on HCI principles and theory has been conducted, this was what I spent the most of my time on this term as there was a lot of theory and design techniques I had to learn, and I could only properly design and begin the interfaces around this:
  + Completing Alan Dix's book was a milestone, this has enriched my understanding of HCI and given me a lot of techniques for designing my user interfaces. It mainly taught me about the theory behind HCI. I focused on the most important chapter for my project. These are in my diary.
  + Watched Scott Klemmer's lectures and made extensive, this offered practical insights into design heuristics and visual design.
  + Read this paper: Sinha, Gaurav, Rahul Shahi, and Mani Shankar. Human computer interaction
  + Read and made notes on <https://www.smashingmagazine.com/2008/01/10-principles-of-effective-web-design/>
  + Read and made notes on Designing for the Web: An Introduction to Human-Computer Interaction by Jakob Nielsen: <https://santhosh-adiga-u.medium.com/jakob-nielsens-heuristics-for-interaction-design-guidelines-for-user-centered-excellence-609b270c7e6a> and <https://www.interaction-design.org/literature/article/user-interface-design-guidelines-10-rules-of-thumb>
  + I have also read and made notes on Designing the User Interface: Strategies for Effective Human-Computer Interaction (6th Edition)
  + Read the main chapters and made some notes on An Introduction to Human-Computer Interaction by Jakob Nielsen, Bansal, H., & Khan, R. (2018).
  + Read the main chapters and made some notes on An Introduction to Human-Computer Interaction by Jakob Nielsen, Bansal, H., & Khan, R. (2018).
  + Read: A review paper on human computer interaction. Int. J. Adv. Res. Comput. Sci. Softw. Eng, 8(4), 53.
* A detailed project plan has been developed.
* Three UIs have been designed for different user groups and tasks.
* My focus shifted to deeper learning and research. However, balancing the extensive reading of HCI literature with development was challenging.
  + Keeping a diary has been crucial in this endeavour because it helps me remember all the mistakes, problems and track my progress.
* I am making all my UIs in grayscale for this first term as per what I have learnt in Scott Kelmers lectures. This is so that I don’t use colour for making visual distinctions between components. Using a greyscale layout has helped me distinguish different elements and components on the page from each other. Then I have used luminance (different shades of grey, black, white) for showing which items are more important on each page.

Shopping website

I have begun this website by first using Canva to make a design for this website including all the HCI principles I had learnt. I previously planned to have this website targeted towards students but after more research and discussion with my supervisor I changed it to be targeted towards any user with visual difficulties. This is because I can use many different HCI principles that would be different from my other UIs whereas the previous version would be too like the other UI’s. I started by creating a navigation bar using bootstrap and adding the essential features of the website on it by taking inspiration from other popular websites like amazon.co.uk. I also added components/widgets like buttons, labels, text fields, and more to the website window. I then added Empty cards where I have put placeholder items that are being sold. Currently I am designing a few different product pages and a cart which will help me demonstrate how an average user could use this website. I then created another page which will act as the homepage of the website and will direct the user to wherever they need to go.

I first had to learn how to use bootstrap. I have made this webpage using bootstraps grid system as it was the most efficient way to have all the elements and components on the page in a symmetrical and centred position. Alignment guides the eye, reducing clutter. I had some issues learning how to use bootstrap and especially how to control and manipulate the columns and rows, but this video really sped up my progress: <https://www.youtube.com/watch?v=-qfEOE4vtxE>. I have had to redesign the website a couple of times a as I kept improving and building on the previous prototype using the knowledge I have acquired during my research.

After developing the shopping websites layout and structure I applied styling using CSS. While Bootstrap accelerated the process, including my CSS files in IntelliJ proved troublesome as they would not connect to the main html file, this prompted a switch to VS Code which seemed to instantly fix the issue. The decision to not use a framework or React for the website was a strategic one, based on the project's specific needs and my comfort with the technologies. I originally began learning and using react, but I did not continue for the reasons I mentioned previously.

Next, I will begin adding functionality like saving items int a basket and being able to buy items. This will include setting up event handlers to respond to user interactions (e.g., button clicks) for website. I will also create many more pages for this website like help pages and a settings page which will have all the options for changing the settings a visually impaired user might need.

**Notes application**

I began by learning Java Swing using this course: https://www.youtube.com/watch?v=Kmgo00avvEw&t=3s. I first made a design of the application using Canva, as well as all the functions and buttons that the application will need. I designed the multiple navigation bars for different functions by taking inspiration from other word processors like Microsoft word. I have created a panel with a navbar and a page where users would write. This is all still in greyscale so I can design the layout properly without using colour as a crutch. I am currently creating the multiple navigation bars, but I have had problems switching between them, so I have just left them as three separate ones for now. After this I added components like buttons, labels, text fields to the window. After all of this I Set up event handlers to respond to user interactions (e.g., button clicks) but now they do not do anything they just output to the console what action has be done.

The development of the Java GUI for the note’s application required meticulous attention to HCI principles, ensuring both functionality and user-friendliness. Even though I will not have much backend functionality, I am designing my user interface to be mainly functional as it will be used by students who are likely to have a lot of technical expertise. I have also redesigned the inventory interface a few times for better visual appeal as I was learning and get more comfortable with swing and learning more about HCI which was very time-consuming.

**Inventory management interface**

I began this user interface by also designing it in Canva. For this one I was going to have an account system and a responsive design as it will be used by professionals and must be very efficient and meet at the requirements they would have. I first created the database where all the account information and users’ inventory would be stored. After a meeting with my supervisor, I was informed that I dint need that much functionality so I am going to uses the MySQL database just to store random information which can be used by the inventory system. I then begun making the UI using html/CSS/js and bootstrap. The was quite say as I already had experience with bootstrap from the first website UI. As with all the other user interfaces I created the frame of the interface and started by created a side navigation bar. I then added columns of inventory stock next to it where I just used placeholder information. I began this UI using colour but after my research I redesigned it to have an upper navigation and a side navigation bar and to be in grayscale. This was all to cater towards my target user which my first design didn’t do as well. I made these changes after doing user testing with university students. I will explain all the aspects of my design below. I also redesigned the interface again moving around components and making it look more modern and visually appealing.

My process of design: This image describes how I have been designing my Ui’s.

A diagram of a process

Description automatically generated

# 

# 4.1.1 Designs and HCI principles

A computer screen with a computer screen

Description automatically generated with medium confidenceNotes application:

6

1.The white empty background in contrast to the beige page provides a contrast that gives easy visibility and makes it easy for the user to focus as there is nothing to draw the users attention away from the page. I will do this by Reducing distractions: The notepad application will have a minimalist design that reduces distractions by removing unnecessary features and by using a simple colour scheme.

The reason the page is beige is to emphasise it being like a real notebook.

2.

3.

4.Having easily recognizable icons facilitates recognition over recall, this means students who are already accustomed to technology should be able to easily use this interface.

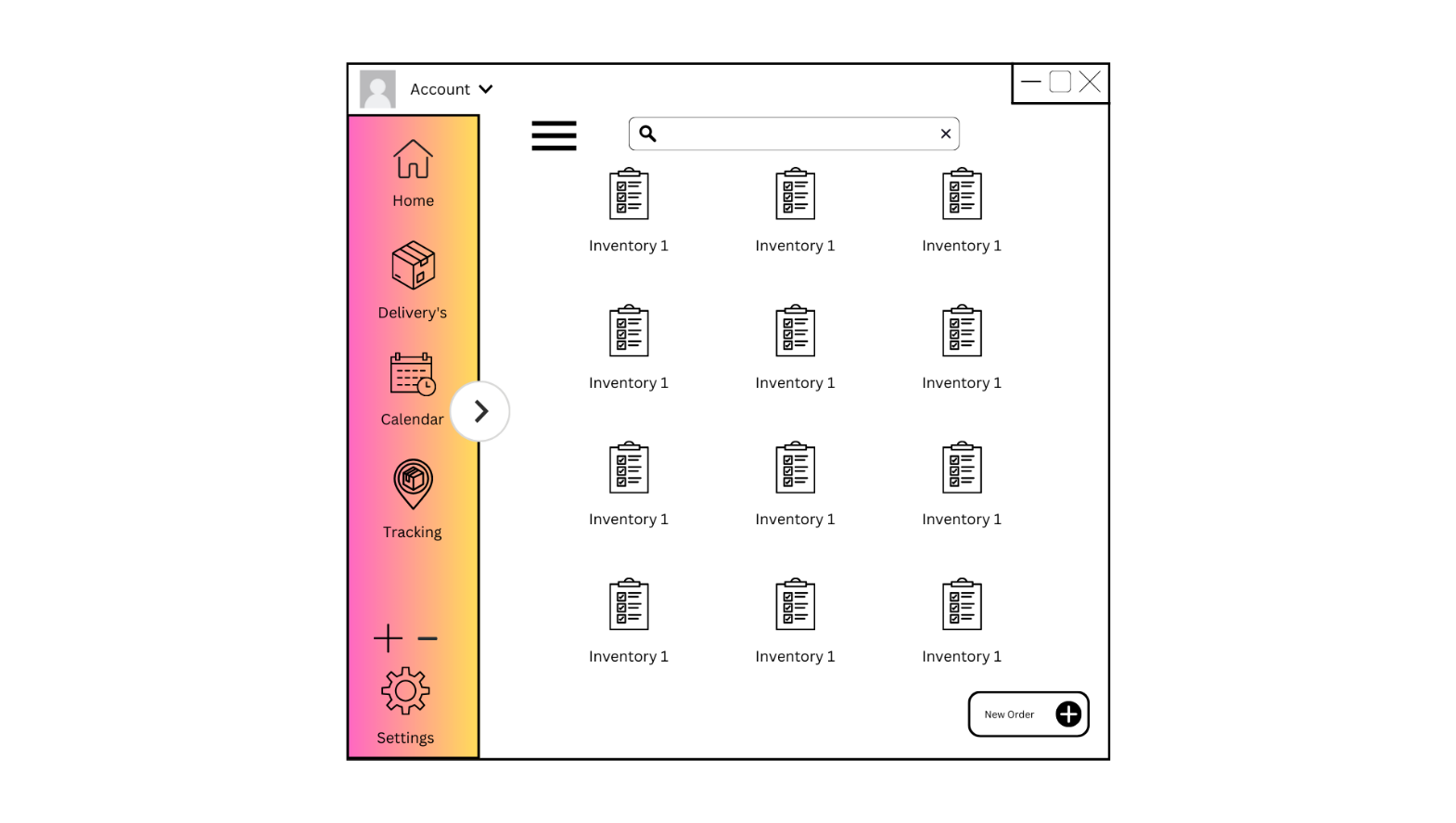
5.

6.

* Show system status by having a loading bar when long operations are performed, each page the user is on e.g., home, will be highlighted to show the user where they are.
* This will also give feedback about the storage of the system and feedback about any changes and actions made e.g., confirmation of change popup.
* The help section adds more usability to the application, The notepad application will have an integrated search feature to help users quickly locate specific notes and any functions they need.
* It will also provide flexibility by being able to customize the user’s navigation bar to and any components they need to use frequently. Then it will have the ability to change font, colour, size etc to provide customization for the user.
* Error correction: One way this will be done is Spell checking: The notepad application will include spell checking to help users catch and correct mistakes.
* It is also robust as it provides many options and functions for the user.
* The icons are solid and black on the navbar whereas the actual navbar is a light gradient colour, this is to make it look more visually appealing to students and they tend so like more bright and flashy colours but not to bright as to where it pulls your attention from the main page where you are writing.
* To facilitate user control and freedom, there will be the options to undo/redo, delete, exit anything they have done.
* All components will have consistent names with other word processors to make them easy to recognize.
* It will also prevent errors, e.g., data loss from the computer closing abruptly, bad input.
* When a user wants to do a function like print, it will show a preview of how the page will print which facilitates error prevention and clearly shows the consequences of the users’ actions.

Inventory management system:

5



3

4

2

1

1. The settings option will provide Customization and flexibility: Allow business owners to customize views, reports, and notifications to align with their specific business needs. Flexibility in system configuration ensures that the inventory management system can adapt to different business models.

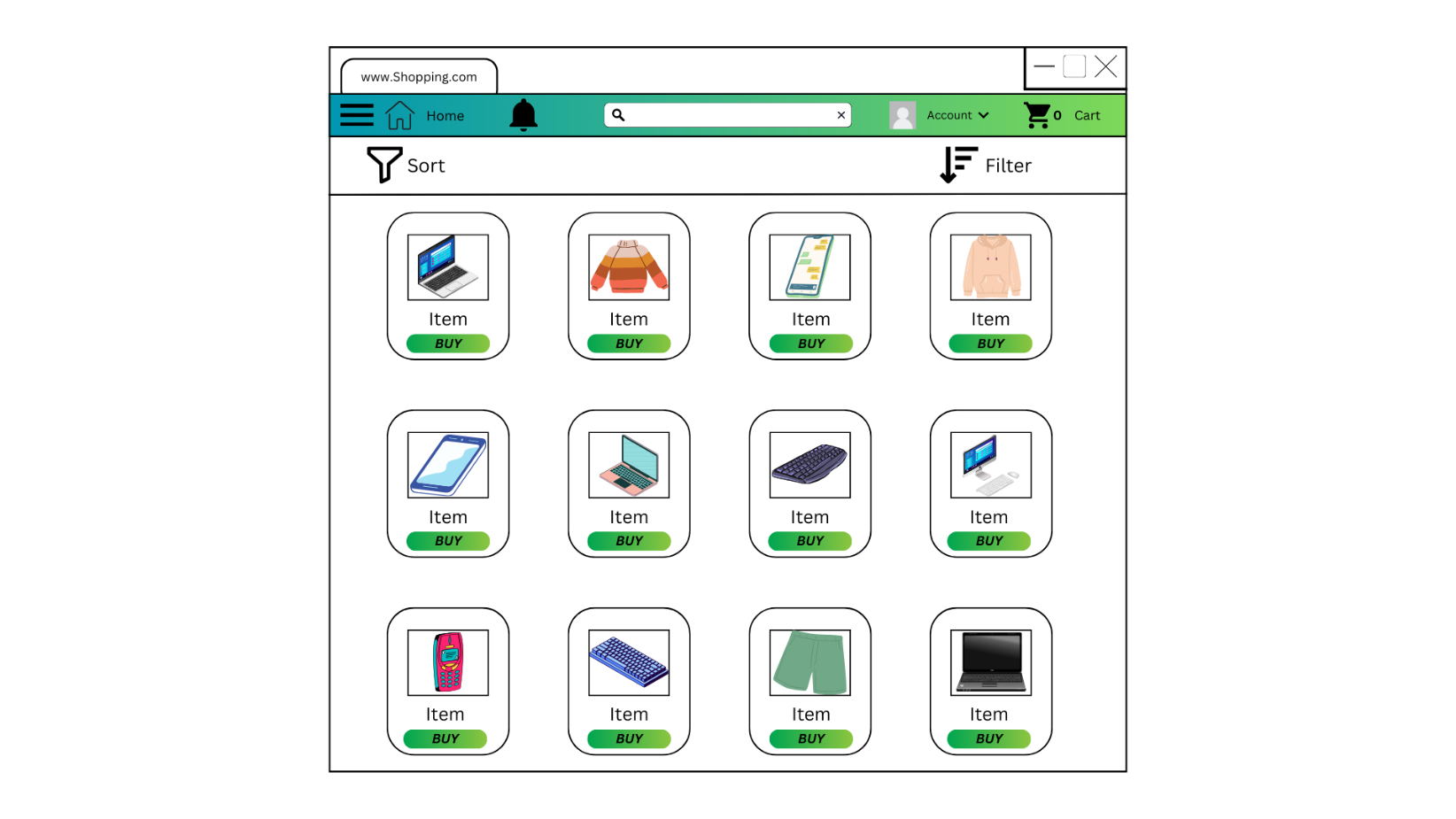
2.The whitespace between items conveys grouping

3.There is also a search bar which helps they user easily find the functions they need. (usability)

4.The arrow button on the sidebar shows that it is collapsible to help with visibility

5.I chose a gradient colour scheme as it looks more visually appealing than a static colour.

* This interface will have learnability integrated into a help system which will come up with tool tips and guidance on how to use the system.
* To promote efficiency, productivity, and flexibility, all the main functions and options are on the home screen and easily accessible. There will also be shortcuts for the most used functions.
* This should also be a memorable interface as it will always have the same layout on every page and on every device, it is used on.
* It is also robust as it provides many options and functions for the user.
* Security and privacy: Provide real-time feedback on inventory changes, updates, and system status. Timely notifications and alerts can help business owners stay informed about critical events affecting their inventory.
* The icons on the screen are recognisable briefly so the user does not need to remember them.
* The account icon also has a drop-down icon showing it can be opened to have access to more options related to account.
* There is a + - icon to increase and decrease the size of the Screen, these will have tooltips or name tags to explain what they do.
* To facilitate user control and freedom, there will be the options to undo/redo, delete, exit anything they have done.
* It has a very minimalist design.

Shopping website

3

1

2

5

4

1.The nav bar provides easy access to functions which helps with usability, it also helps with visibility as green and white contrast significantly

2. Affordance: The interactive elements are clearly visible by being solid black and provide visual cues about their functionality. Icons will have tooltips to help explain what they do.

3. The gradient colour is more visually appealing, and this will be a consistent colour theme for each page

4.All items are separated and arranged in a grid patter to help users see each item individually and scan quickly through the page.

5.

* This website provides clarity as it is simple and easy to understand, it also has a consistent styling for each page all this also helps with recognition rather than recall.
* I will provide clear and concise feedback for every action the user does.
* It will also have audio feedback such as button clicks and error sounds for visually impaired people.
* It will have error prevention by making sure that the option a user is doing is what they want to do, e.g., buying something. It will also have forgiveness protocols such as before a user pays for their items, they will have to check the basket where they can remove items if needed.
* This ill also have an option to change into high contrast mode and a dark mode which helps with visibility.
* I will be providing accessibility by designing the website in a way where it is compatible with devices such as screen readers.
* Learnability is also included as it is very simple to use and therefore quickly learnt.
* These are sorting and filtering icons to help the user find whatever they are looking for.
* There will also be a bar and a section of the page to show how far the user is in their buying process.
* The categories of items will be like items in other shops.
* It has a very minimalist design.
* The size of each element indicates its hierarchy.
* I created this using grid which can help to make designs more accessible to users with disabilities. For example, users with low vision may find it easier to scan and understand a grid-based layout. Additionally, grids are used for designs that are compatible with screen readers and other assistive technologies.

# 4.1.2 Other HCI methodologies I have included in my designs:

* Consistent Names, Clear choices
* Recognitions over recall
* Aesthetic and minimalist design
* Help clearly.
* whitespace in text to convey grouping.
* Use size contrast to indicate hierarchy, vary size and thickness.
* Uses a font that many people are familiar with and have a high X height (height of lower-case letters compared to capital): High x-height easier to read online.
* Mixed typed case is faster to read than all caps because you get greater vertical variation which gives your eye more information as its reading.
* tools like scale and layout as ways of distinguishing elements on the page instead of colour in the beginning
* Grids help to create a consistent visual experience for users.
* Generic Icons: they facilitate repeat recognition, you know what something looks like but not what it called.
* Design for glanceability
* Error popups or important information will be flashing or moving to draw the user’s attention.
* Menus:
  + less demanding of the user, relying on recognition rather than recall
  + still need to be meaningful and logically grouped to aid recognition.
  + naming of menu options then provides the only cue for the user to find the required option.
* Toolbars/navbars:
  + Most users do not want to spend time reading a manual, or even using online help to find out what each button does so I put the icons on the menus in the same way that accelerator keys are written there. So, in the ‘Edit’ menu one might find the option.
  + As the mouse drags down through the menu selections, each highlight in turn.
* Dialog boxes for important information

# 4.2 Software engineering

Throughout the development of this project, I have been applying software engineering principles and methodologies to ensure that all my interfaces are not just user-friendly but also robust, reliable, and easy to understand and maintain.

**Use of Revision Control System**

I have been using a revision control system, specifically Git, to manage all the project's source code for all three user interfaces. This enables me to track changes and maintain a well-organized codebase. Git allows me to create branches for new features or fixes, merge changes, and roll back if necessary. One risk throughout the project is the potential for hardware failure, which could result in significant data loss and disruption to my project. This is not a very high risk but to address this concern, I am using GitLab, this is a version control system which hosts your repository online. This strategy involves regular code commits to ensure that all my project code and data are safely stored on git which I can access from anywhere. This means that even in the event of local hardware failure, no critical data will be lost. Additionally, this aids in managing various program versions which lets me retrieve older versions of my code in case of any issues, thus minimizing potential time and effort wastage. This ensures the integrity and traceability of my codebase.

**Test-Driven Development (TDD)**

I have been using Junit 5 tests to test my java swing classes. For testing the Swing applications actual GUI, I will be using a dedicated GUI testing library. One popular library for Swing GUI testing is AssertJ Swing.

I have adopted Test-Driven Development (TDD) as a key methodology in the software development process of my Java Swing notes taking application. TDD involves writing tests before implementing features. This approach helps me identify and address issues early in the development cycle, leading to a more robust and reliable software product. Another reason I am using TDD is that the test cases serve as executable documentation, and they provide examples of how your code is expected to behave which make it easier for others to understand my code.

**Agile Methodology**

I have used anagile methodology to develop these UIs as they are well-suited for projects with changing or evolving requirements. It also promotes, frequent feedback, and iterative development. This is all needed as this project involves heavily prototyping code and improving the user interface with HCI knowledge.

**User-Centred Design (UCD)**

UCD focuses on understanding the needs and preferences of users. It involves techniques like personas, user stories, and usability testing to create interfaces that align closely with user expectations. This is extremely relevant to my project as HCI is all about how a user interacts with the system and my UIs are designed around how a user would use them.

**Code Quality Tools**

I am using tools like prettier for vs code to keep my code style consistent. Another reason that this is very useful is that manually formatting code can be time-consuming. Prettier automates this process, saving me a lot of time and allowing me to focus on writing and understanding the logic of the code rather than its presentation. It also allows me to easily stick to my code standard for all my separate user interfaces.

Conclusion

This interim report has provided an overview of the progress that has been made on the HCI Project so far. The project is on track to be completed successfully by the deadline.

The research and planning phase has been completed, and the design phase is well underway. A basic website layout has been created, a database has been created for the inventory management system, and a basic shopping website has been created and styled. Swing has also been learned and used to create a basic GUI for the note’s application

The next steps for the project are to:

* Continue advancing all three uis.
* Conduct usability testing on the shopping website and notepad application.
* Make necessary changes to the UIs based on the feedback from usability testing.

I am confident that I am on track to complete the project successfully by the deadline. I am looking forward to continuing to work on the project and to learning more about HCI principles and their application to the design of interactive systems.

Bibliography and citations

Resources that have helped me prepare this plan:

* [1]. [*Human-Computer Interaction (3rd Edition)*](http://www.amazon.com/gp/product/0130461091?ie=UTF8&tag=hci01-20&linkCode=as2&camp=1789&creative=9325&creativeASIN=0130461091)*, Alan Dix, Gregory D Abowd, Janet E Finlay and Russell Beale***,** this book provides a comprehensive overview of the field of HCI.
* [2].[*https://www.techtarget.com/searchapparchitecture/definition/user-interface-UI#:~:text=Types%20of%20user%20interfaces&text=graphical%20user%20interface%20(GUI),touch%20user%20interface*](https://www.techtarget.com/searchapparchitecture/definition/user-interface-UI#:~:text=Types%20of%20user%20interfaces&text=graphical%20user%20interface%20(GUI),touch%20user%20interface). This article helped me decide which Interfaces I was going to make so I could plan how to make them.
* [3]. *Sinha, Gaurav, Rahul Shahi, and Mani Shankar. "Human computer interaction." 2010 3rd International Conference on Emerging Trends in Engineering and Technology. IEEE, 2010*. This paper is a basic introduction to HCI and talks about the history and how the field has evolved, and what the future of HCI could be.

[4]. [*https://youtu.be/WW1g3UT2zww?si=lgXaFbYio-kMyJAt*](https://youtu.be/WW1g3UT2zww?si=lgXaFbYio-kMyJAt)

* This is a playlist of lectures by Scott Klemmer and is a full course on HCI offered by Stanford University

[5]. [*Designing the User Interface: Strategies for Effective Human-Computer Interaction (6th Edition)*](https://www.amazon.com/Designing-User-Interface-Human-Computer-Interaction/dp/013438038X/)*,*

* This is atextbook on user interface (UI) design. create UIs that are easy to use and pleasurable.

[6]. *MacKenzie, I. S. (2012). Human-computer interaction: An empirical research perspective*. This is a book by I. Scott MacKenzie that provides a comprehensive overview of empirical research in human-computer interaction (HCI). The book is divided into two parts:

* Part 1: Foundations: This part covers the basics of HCI research, including the history of HCI, the human factor, interaction elements, and the fundamentals of science and research.
* Part 2: Methods and Applications: This part covers the different methods used to conduct HCI research, as well as how to apply HCI research findings to the design of new computer systems and interfaces.

[7].[*https://www.creativebloq.com/features/ui-design*](https://www.creativebloq.com/features/ui-design)

* This article provides a comprehensive overview of UI design, covering everything from the basics to advanced techniques. I will use this when designing my UI.

8. [*https://www.youtube.com/watch?v=He-1O8Pa4SE&list=PLlGZc17KPrVCGRKtgbdvnGshN8AePlqpd*](https://www.youtube.com/watch?v=He-1O8Pa4SE&list=PLlGZc17KPrVCGRKtgbdvnGshN8AePlqpd)

* This is a playlist that guides you thorough java swing and how to use it to create a good-looking GUI.

9.[*https://docs.oracle.com/javase/tutorial/uiswing/*](https://docs.oracle.com/javase/tutorial/uiswing/)*.*

* This is the Swing manual and documentation.

10. [*https://www.canva.com/*](https://www.canva.com/)

* This is a website which allows you to design anything you need.

11. [*https://www.smashingmagazine.com/2008/01/10-principles-of-effective-web-design/*](https://www.smashingmagazine.com/2008/01/10-principles-of-effective-web-design/)

*12. https://www.interaction-design.org/literature/article/user-interface-design-guidelines-10-rules-of-thumb*