

# Investigation of what influences user design and best practices for protecting sensitive information

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## Abstract

The primary goal of this research study is to investigate the effectiveness and safety of a sophisticated software system that generates labels for food products. A multinational corporation utilizes this software system to label their food items for sale in restaurants and retail stores across the globe. To achieve our research objectives, we will comprehensively analyse the existing literature on this subject, including scholarly articles, research reports, and industry publications. Additionally, we will conduct interviews with regular users of this software to gain a deeper understanding of their experiences and insights.

Based on our preliminary findings, we have observed that the user-friendliness of the software significantly impacts the tasks performed by its users. Specifically, users tend to face challenges with complex interfaces, confusing workflows, and lengthy training sessions, which can lead to reduced productivity and increased error rates. Therefore, we recommend further research to identify additional strategies that can enhance the quality of the software and ensure the security of sensitive information. These strategies may include user-centric design approaches, innovative training and support mechanisms, and robust security features to prevent data breaches and cyber-attacks.

Word Count: 184

# 1 Introduction

The main objective of the research project is to delve into the concept of user-friendliness in software design and information technology while simultaneously exploring various methods that can be employed to safeguard confidential information within the software under examination. The project has been divided into five chapters, each focusing on a distinct research area.

The initial chapter aims to provide an extensive literature review examining the effectiveness of several security measures, including MFA, passwords, and user profiles. Additionally, the chapter delves into current research and literature related to user-friendliness in software design and information technology. The chapter's main objective is to provide a comprehensive understanding of the topic and its significance in the field.

The second chapter of the project is dedicated to defining the research's purpose and research questions.

The third chapter of the project focuses on an in-depth discussion of the various methods used to gather relevant information about the software application. The primary objective of this chapter is to assess the software's level of security and whether it is user-centred, meeting the needs and expectations of its users. The chapter details the methods used to gain insights into the user's feelings and opinions about the software's quality, usability, and overall performance. This section of the report provides valuable insights into the research methodology adopted to measure the software application's effectiveness.

In the final phase of the project, the researcher thoroughly evaluates the practicality of the project by scrutinizing various aspects to ensure its feasibility. The researcher has taken great care to ensure that they have unfettered access to the necessary software and its users. They have been working closely with the users and have dedicated ample time to collaborating with them. Additionally, the researcher has the option to seek guidance from the creators of the software to gain a comprehensive understanding of its design and implementation. This meticulous approach ensures that the project is not only feasible but also executed with the utmost efficiency and effectiveness.

Word Count: 331

## 2 Literature review

### 2.1 Literature surrounding practices in protecting sensitive information

Today, cybercrime has become a major concern for businesses of all sizes and types. With the advancement of technology, cybercriminals have developed sophisticated methods to breach the security of business infrastructure. This has made it extremely challenging for businesses to ensure the safety and security of their data and assets. The need for strong cybersecurity measures has become more critical than ever, as cyber attacks can devastate businesses.

In the paragraphs below, several principles are discussed that can be applied to protect software systems and other related security topics. These principles offer guidance on establishing effective security measures to safeguard digital assets against various types of cyber threats. (Saltzer & Schroeder, 1975)

This paper outlines ten foundational design principles crucial for building secure computer systems. These principles stress the importance of designing inherently secure, user-friendly, and customizing systems to meet security needs. By implementing these principles, organizations can ensure that their computer systems are secure, reliable, and able to withstand the ever-evolving threats posed by cybercrime.

The IEEE Cybersecurity Initiative has recently published a comprehensive paper titled "Avoiding the Top 10 Software Security Design Flaws", which aims to provide software developers with a detailed guide to identify and prevent common design flaws that can lead to security breaches. The paper emphasizes the crucial difference between bugs (implementation-level issues) and flaws (deeper design-level problems). It stresses the importance of secure system design to prevent security breaches and minimize their consequences. To ensure the paper's accuracy and practicality, it is based on contributions from software security experts who shared their real-world data and expertise on significant design flaws. The overall objective of this initiative is to shift the focus from finding bugs to addressing and learning from design flaws, ultimately improving overall software security. By following the guidance provided in this paper, software developers can enhance the security of their systems and protect users from potential security breaches. (Arce et al., 2014)

Microsoft has released a paper on creating and managing passwords. While passwords are a commonly used security measure, they can be vulnerable to various attacks. To increase the security of login credentials, follow best practices such as using a unique and complex password, changing it frequently, and enabling two-factor authentication. It's essential to understand that even strong passwords can be compromised through methods like phishing attacks and brute-force cracking. (Hicock, 2016)

Exploring the literature focusing on software security is an important aspect of software development.

## 2.2 Literature surrounding user-friendly theories

To develop user-friendly software, it's crucial to prioritize the users' needs and focus on an intuitive layout, clear instructions and feedback, and functionality that aligns with their goals. Key factors that determine software usability include design, interface, features, and performance.

Prioritize users for effective software. Consider their perspectives and needs during development and incorporate feedback for a user-friendly product that meets expectations.

Ultimately, the user's influence on software design cannot be overstated. By prioritizing their needs and incorporating their feedback, developers can create software that is both effective and enjoyable to use.

User design psychology is an interdisciplinary field that applies psychological principles to digital interface design, creating user-friendly, efficient, and enjoyable products.

The article "User Psychology: How to Use UX Design Principles to Enhance The User Onboarding Experience" on Userpilot.com offers designers practical guidance on designing effective interfaces that cater to users' needs and preferences.

The article covers key psychological concepts like Endowment Effect, Hick's Law, Goal Gradient Hypothesis, and Zeigarnik Effect. These principles can be applied to UX design for a better understanding of users' decision-making. It also recommends designing visually appealing, user-friendly, and intuitive interfaces. By integrating these principles into the design, designers can develop products that meet users' requirements.(Ali, 2022)

The article gives tips to improve onboarding. Use clear instructions, visuals, and break tasks into smaller steps. This creates a seamless experience for users to engage better with your product or service.

"Translational Behavioral Medicine" journal highlights the significance of user-centred design (UCD) in healthcare settings. UCD enhances evidence-based practice implementation by considering characteristics of individuals. This innovative design approach prioritizes user requirements and creates effective, user-friendly solutions, promoting satisfaction.(Dopp, Parisi, Munson, & Lyon, 2019)

The article explains how User-Centered Design (UCD) draws from various fields such as human-computer interaction, user experience design, service design, and cognitive psychology. It can be applied to different healthcare specialties to improve healthcare services. User design psychology principles can also be applied in other industries. While not providing a direct definition of "User Design Psychology," sources give a good understanding of how psychological principles are applied in UCD and UX. For a more detailed definition, consult specific journals or articles on human-computer interaction, cognitive psychology, and UX design.

We will continue drawing attention to the history of UX and UCD by examining a book authored by Don Norman, a distinguished specialist in design, usability, and cognitive science. He is especially well-known for his influential publications and papers on UX and UCD. One of his most notable works is "The Design of Everyday Things," originally released in 1988 under the title "The Psychology of Everyday Things."

Norman's book explores the essential design and usability concepts and em-

phasizes the significance of creating user-friendly and intuitive products. The principles that he emphasizes include "affordance," which refers to an object's features that suggest how it can be used; "signifiers", which indicate possible actions; and "feedback", which provides information to the user about the action taken and the results achieved.

In 2015, Hoff authored an article that explored the concept of a user-centric approach to software design in great detail. UX design is a specialized field that seeks to enhance user satisfaction by improving the usability, accessibility, and appeal of a product, service, or organization. It does this by considering every aspect of the user's interaction with the entity, including interface design, layout, visual design, text, brand, sound, and interaction.

Usability engineering is pivotal in coordinating these components to ensure the most effective interaction possible. It involves user testing and research to identify pain points and areas for improvement in the user experience. The insights gained from this process are then used to create a design that is intuitive, easy to use, and delightful for the user.

UX design also focuses on creating a consistent and coherent experience across all touch points of the user journey, from initial discovery to purchase and post-purchase support. This involves understanding the user's needs, goals, and motivations at each journey stage and designing accordingly.

The ultimate goal of UX design is to create a positive experience for the user, one that is memorable, engaging, and satisfying. This benefits not only the user but also the product, service, or organization, as it increases user engagement, loyalty, and brand advocacy. (Hoff & Bashir, 2015)

Trust is a significant factor in the interaction between humans and automation. Researchers have conducted various studies to identify the factors that promote or hinder trust in automation. A study by Hoff and Bashir examines 101 papers and 127 studies and identifies three layers of variability in human-automation trust: dispositional trust, situational trust, and learned trust. The paper provides design recommendations for creating trustworthy automation and suggests future research directions to encourage appropriate trust in automation. Overall, the study emphasizes the importance of building trust in automation to enhance the interaction between humans and automated systems. (Brhel, Meth, Maedche, & Werder, 2015a)

The book "Understanding Your Users: A Practical Guide to User Research Methods" by Kathy Baxter, Catherine Courage, and Kelly Caine provides a comprehensive and practical guide to various user research methods. It covers many different user research methods, including considerations before and after conducting these methods. The book aims to help readers understand how to prepare for and conduct user research activities and analyze and present the data practically. (Baxter, Courage, & Caine, 2015)

In the 2020 paper "The Influence of User Interface Design on Task Performance and Situation Awareness in a 3-Player Diner's Dilemma Game", Jiang and Fang explore how UI design affects players' performance in a game setting. The study found that the Level 3 UI design improved task performance and situation awareness scores, unlike the Level 2 UI design.

By linking the two ideas, we can conclude that understanding your users and conducting user research activities is critical to designing user interfaces that improve performance and situation awareness. The findings of Jiang and Fang's study provide valuable insights into designing interactive systems and

user interfaces in various domains. Combining the knowledge from the book with the findings from the study can help designers create user-friendly and efficient interfaces.

"Applying User-centered Techniques to Analyze and Design a Mobile Application" provides a case study on utilizing UCD techniques like personas, scenarios, and interaction models in mobile application development. The team used personas and scenarios in the analysis phase to understand user needs and behaviours. During the design phase, they created interaction models to develop prototypes aligned with user requirements. This approach improved the application's usability and user satisfaction. (Lopes, Valentim, Moraes, Zilse, & Conte, 2018)

The research paper titled "Exploring Principles of User-Centered Agile Software Development: (UCASD) A Literature Review", written (Brhel, Meth, Maedche, & Werder, 2015b), in 2015 is a comprehensive study that delves into integrating UCD and Agile Software Development (ASD) methodologies. The paper presents a systematic literature review that analyses various studies and explores how UCD can be effectively integrated into ASD processes.

The study highlights five generic principles identified for integrating UCD and ASD: continuous stakeholder involvement, balancing the amount of upfront work, and synchronizing between UX designers and software developers. The paper discusses how Agile approaches emphasize direct communication with the customer, but there can be challenges in defining who the customer is in this context.

Furthermore, the review points out that integrating UCD into Agile processes can enhance the usability and UX of the developed systems. This involves understanding and addressing user needs throughout the system life cycle and ensuring active collaboration with users during the development process. The study emphasizes the importance of collaboration and knowledge sharing in Agile methods and how it can be leveraged to improve user experience.

However, the paper also identifies gaps in the existing literature, such as a lack of comprehensive coverage across different UCASD dimensions, like practices, processes, technology, people, and social aspects. It also notes the need for more abstract and generalized results that can be applied across various contexts and a quality assessment of primary studies included in the review.

Overall, the study presents an insightful analysis of the integration of UCD and ASD and highlights the potential benefits of incorporating UCD principles into Agile processes.

The text provides a comprehensive and informative overview of this approach, drawing from a vast range of existing literature on the subject. It underlines the importance of considering the users' perspective at every stage of the software development process. By doing so, developers can create software systems that are custom-tailored to the precise needs of their users. This, in turn, leads to a more rewarding user experience and greater overall user satisfaction.

Hassenzahl defined five key characteristics that shape the UX concept. First, UX is subjective and can vary from person to person. Second, it is a holistic experience encompassing all aspects of the product or service. Third, UX is dynamic and changes over time, influenced by factors like the user's mood, environment, and interactions. Fourth, UX is context-dependent, which means it is shaped by the user's goals, expectations, and needs. Finally, a good UX

is a valuable experience that meets the user's expectations and provides them with benefits. (Hassenzahl, Diefenbach, & Göritz, 2010)

According to the literature mentioned above, when it comes to software development, UCD is not only important for creating an effective and intuitive UX but also for ensuring security. By involving users in the design process, developers can gain valuable insights into potential vulnerabilities and security risks and design software that is more resilient to attacks.

In addition, incorporating security measures into the design process from the outset can help to create a more secure product overall. This means developers should consider security not an afterthought but a core aspect of the design process.

Overall, UCD can help create more secure software by involving users in the design process and incorporating security measures from the outset. By taking a proactive approach to security, developers can help to ensure that their software is more resilient to attacks and better able to protect users' data and privacy. Let us delve deeper into this intriguing theory and examine every aspect with meticulous attention to detail.

Word Count: 2063

### 3 Aim and Research Questions

The main aim of this research is to examine the software used by a food production company thoroughly. The objective is to gain a comprehensive understanding of its features and functionalities. The software, referred to as EMOS in this study, is critical to the food production process as it acts as a repository of essential information related to the labels of various food products.

EMOS contains a wealth of information, including highly accurate product descriptions, precise weights, unique bar codes, and other essential elements. This information is critical to ensuring that high-quality food products are produced and distributed with consistency and accuracy. Our analysis will delve deep into the functionalities of Emos, exploring its effectiveness in facilitating the production and distribution of high-quality food products. In particular, we will focus on the software's usability, examining whether it is user-friendly and how it can be improved to enhance its usability. In addition to usability, we will also pay close attention to the security of the information stored by EMOS. We will explore ways to enhance the security of this information, ensuring that it remains protected from unauthorized access and other potential security threats. Our research aims to provide valuable insights into how EMOS can be optimized better to serve the food production industry and its customers.

Title: Cybersecurity

These questions assess the software's ability to withstand and respond to both known and emerging cybersecurity threats, including the effectiveness of its threat detection and response systems and the overall security culture of the organization.

The study focuses on the following questions:

1. How does the software ensure data security and user privacy?
2. How resilient is the software against current and emerging cyber security threats?

We need to evaluate the ease of use of software specifically created for food labelling.

Evaluate the software interface's intuitiveness and ease of navigation for new users.

We can do this by keeping these few questions in mind :

1. How effectively does the software handle daily tasks to be undertaken by employees?
2. How effective are the user-supports that are available?

The researcher plans to use the literature highlighted in the literature review to create survey questions. The survey will focus on evaluating the software's security and user-friendliness. The appendix will contain the survey.

Word count 357 words.



## 4 Research Methods

Within this chapter, we will delve into the various methods that we employed to obtain answers to the research questions we posed earlier. We will explain why we chose these methods and how we implemented them throughout the research process. We will also offer a comprehensive overview of the materials we used and the specific type of individuals who participated in the study. By examining these factors in detail, we hope to give readers a deeper understanding of our research methodology and the insights we gained from our collected data.

This research aims to assess the quality of user experience and security measures. This will involve a diverse group of individuals who play integral roles in the production process of organizations in the Republic of Ireland. Our sample includes production operatives, infrastructure engineers, food safety employees, and developers, all of whom utilized and contributed to the development of the software system that we analyzed. This software system is a crucial component of the food production process, and the insights that we gained from this study will be valuable in optimizing its performance.

Our objective is to evaluate the security and user-friendliness of the software system. To accomplish this, we will conduct in-depth interviews with participants. These interviews will be conducted in person, in a private meeting room, or over the Microsoft Teams platform for participants who cannot meet in person. During these interviews, participants will be asked a series of questions in an online survey to help us gather the necessary information. Each interview will last around 10- 15 minutes. This hopes to result in either a positive or negative experience with the software system. This will allow us to quantify the data collected. Our study aims to thoroughly evaluate the software system and provide insights into both its usability and the effectiveness of the security system that it utilized.

The researcher utilized Microsoft Forms as a tool to create surveys. The researcher constructed questions in the survey that gauged the level of security and user-friendliness of the software, and the survey was distributed to a group of 10-20 participants. Once the data is collected, the findings will be thoroughly analyzed, and the results will be presented in a poster. The researcher has opted to display the results in charts as Microsoft Forms offers a convenient feature to convert the results to charts. The researcher is going to use quantitative methods of research for the surveys. The researcher researched this method and will discuss a paper found on this method of research below. (Al-Momani, 2000) The research paper delves into the delays experienced by 130 public projects in Jordan, offering managers a quantitative means of evaluating contractors. The findings reveal that delays can stem from multiple factors, including designer issues, user modifications, weather, site conditions, late deliveries, economic conditions, and projects.

Word Count:528

## 5 Feasibility

The researcher has gone to great lengths to ensure the credibility of their study. They have comprehensively analysed existing literature on user design and cyber security best practices. Through this in-depth analysis, the researcher has acquired a wealth of knowledge and insights on the best practices to follow in the design of software that prioritizes security and user experience.

To ensure that the study is comprehensive and conclusive, the researcher has identified many individuals who use the software. By doing so, the researcher can gather a vast amount of data and insights to draw meaningful conclusions that can be used to improve the software design and enhance user experience. If some participants are unable to respond, the researcher has made plans to send out a higher number of surveys to compensate for any shortfall and ensure that the research is conclusive.

The researcher is confident that the study can be completed within the allotted time frame. They have invested significant time and effort to ensure all necessary resources are available and the project is well-planned and executed. The researcher is determined to deliver a comprehensive, reliable, and conclusive study that will serve as a valuable resource for the software development community and enhance the security and user experience of the users of this software.

Word Count: 215

## 6 Ethical Considerations

The proposed research methodology for software users aligns with the highest ethical standards to guarantee responsible and respectful data collection.

Following an in-depth analysis of Todd D. Little's book section on ethical research, which emphasizes the importance of confidentiality protection and informed consent (pg. 38), the researcher has identified the following critical standards:

- The foremost priority is to safeguard the participants' rights and safety throughout the research process.
  - Before conducting the survey, the researcher will inform the participants of the survey's purpose, their role, and data usage.
- Participation is voluntary, and the participants can withdraw at any time, and there will be no pressure placed on the participants. - Privacy and confidentiality will be given top priority, and only necessary personal data will be collected securely stored and anonymity in reporting. The researcher will implement stringent measures to safeguard sensitive information.
- The survey process will be transparent, with participants duly informed of data usage, access, and potential outcomes. The survey aims to avoid any harm, including emotional and psychological impacts, and ensure accessibility and non-discrimination.

This ethical framework will guide the researcher's approach to obtaining valuable, respectful, and responsible data from software users while ensuring integrity and respect for participant rights. No private information will be requested as it is irrelevant to this research, and participants will be above 18 years of age and of sound mind. (Little, 2013) Word Count: 230

## Appendix

Draft Survey.

1. Hello, my name is Bernadette Murphy and I am a postgraduate cyber-security student at Chevron College and the University of Sunderland. I am currently researching a piece of software used in this workplace that labels food. For this study, we will call it EMOS. This survey aims to investigate the security and user-friendliness of this software.

In this survey, you will be asked questions related to the topics of security and user experience. It should take you approximately 10-15 minutes to complete.

Please note that your participation in this questionnaire is completely voluntary. If you choose to withdraw your information at any point during the study, you can contact the researcher at [bernadette.murphy@dawnmeats.ie](mailto:bernadette.murphy@dawnmeats.ie) or [bernadette.murphy@chevroncollege.ie](mailto:bernadette.murphy@chevroncollege.ie). By taking part in this survey, you acknowledge that you are over 18 years of age and that your participation in this study is voluntary.

- (a) I consent
- (b) I do not consent

-Please note that my survey will have branching and clickable options. This is just for visual purposes. Also, the interviewer will be present in instant messages or emails to explain any technology participants may not use.

2. Please pick a department below you to work in. If your department is not listed, please select other and specify the department with one word.
  - (a) Information Technology (I.T.)
  - (b) Sales
  - (c) Retail Production
  - (d) Convenience Production
  - (e) Shop
  - (f) Food Safety
  - (g) Supervisory Role
  - (h) Other(Please see below)
3. If you chose the option other please specify the department you work in below : \_\_\_\_\_
4. Do you find this system(EMOS) to be secure and protect sensitive information?
  - (a) not secure
  - (b) secure
  - (c) very secure

5. Which one of these security methods are you most familiar with:
- (a) MFA-Multi-factor Authentication - using the app with a code and a password.
  - (b) Username and password
  - (c) Biometric-fingerprint
  - (d) Other(Please see below)
6. If you chose the option other please explain below : \_\_\_\_\_
7. Have you encountered times when you can't carry out tasks due to limited access while using this software?
- (a) Yes
  - (b) No
8. Pick the security used in the software (EMOS).
- (a) MFA-Multi-factor Authentication - using the app with a code and a password.
  - (b) Username and password
  - (c) Biometric -fingerprint
  - (d) Other(Please see below)
9. If you chose the option other please explain below: \_\_\_\_\_
10. If there were a time you could not carry out a task due to access privilege, choose a method you would normally use to work around this:
- (a) Raised a ticket so the person who has the privilege could carry out the task on your behalf
  - (b) Sent a team message to IT
  - (c) Other (Please Specify below )
11. If you chose the option other please explain below: \_\_\_\_\_
12. We have rated the security already. Which one of these options would be the easiest option to enhance the security?
- (a) MFA - Multi-Factor Authentication-using the app with a code and a password.
  - (b) Username and password
  - (c) Biometric - Fingerprint
  - (d) Other(Please see below)
13. If you have answered other to above, please specify what you mean by other below: \_\_\_\_\_

14. Is this piece of software designed to keep tasks simple for the user?
- (a) Yes
  - (b) No
15. Is this piece of software sufficient for storing the information necessary?
- (a) Yes
  - (b) No
16. Are you aware of the manual that shows you how to do certain tasks?
- (a) Yes
  - (b) No
17. If you are aware of it, what do you have to do to access this element of the software ( keep the answer brief )
18. Pick only one of these choices to help enhance user-friendliness.
- (a) A little chat bot that answers the user's questions
  - (b) A little section where you can raise a ticket with your issue rather than having to send an email
  - (c) Updating the manual help section
  - (d) Other(see below)
19. If you chose other, please explain what you mean by other briefly ———  
\_\_\_\_\_

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