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Design and Development of Remote PC: An IoT App for Wear Lock Application

Fatin Nursyazwani Rosli[1] and Mohd Nizam Omar[2*]

[1, 2]School of Computing, Universiti Utara Malaysia, UUM Sintok, 06010, Kedah, Malaysia
*Corresponding Author: niezam@uum.edu.my

Abstract: Remote control Personal Computer (PC) refers to a remote network connection that allows a device to access remotely to any device. Nowadays, many users own a combination device of PC and smartphones - for example, the combination of Windows 10 and Android-based smartphones. Although most users know about the importance of locking the PC, users still use manual ways to lock the PC screen and manually enter the id and password to open the screen. On the other hand, it will allow cybercriminals to take advantage of manual entering user IDs and passwords. Therefore, an application that can lock the PC from just a smartphone is developed to prevent user information from being exploited by outsiders. This project aims to develop an application called Wear Lock Application (WLA) as an alternative option for users to lock their PCs via smartphone (Android). The throw-away prototype is taken as a methodology to guide this project, starting from the primary approaches phase, planning, analysis, design, and implementation. The usability assessments that have been conducted agree that WLA is easy to use and valuable enough. The novelty of this application is to provide a more effortless application in terms of how to use it and has a specific function only for Windows and Android users. Hopefully, the development of the application can help Windows and Android users lock their PC effortlessly.

Keywords: *Remote, Computer, Android, Windows, IoT*

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1. Introduction

IoT (Internet of Things) is a network that connects all the sensors of the physical world, sensor networks, and other perception technologies, as well as communication networks, the internet, and other transmission technologies, intelligence operations, and intelligent processing [1]. IoT - based information is separated into two applications, but the purpose is to communicate with each other so that data from one device can be sent to another device remotely. For example, administrators can connect and control remote desktops on LANs and WANs using the Desktop Central remote desktop manager [2]. The project is developed through information-based IoT, an application that connects two devices to operate remotely. Many IoT applications have been developed based on current technological developments and user demands. The project was developed to focus on locking a computer automatically through another device using the concept of a computer server or remote-control computer.

The statement above shows many users who use computers in their daily affairs, including in connection with personal affairs anywhere. There, there is a problem that has been identified is the development of technology causing the security of consumer information to be vulnerable and

Corresponding Author: Mohd Nizam Omar, School of Computing, Universiti Utara Malaysia, 06010, UUM Sintok, Kedah, Malaysia, E-mail: niezam@uum.edu.my

misused by cybercriminals for their benefit. Therefore, if users are still using manual means to lock the computer, the likelihood of users being vulnerable to information theft by cyber criminals is high due to the relatively weak level of security of the device. In addition, locking the computer manually takes time compared to using an application that can control the computer lock remotely.

This paper is divided into seven sections. Section 1 contains an introduction, while Section 2 discusses the background and related studies. Section 3 is about the methodology used for this study, and Sections 4 and 5 are about the design and development and prototype development for the study. Section 6 discusses the evaluation of existing studies, and the final section will conclude the review of this paper and the work for the future.

2. Background And Related Studies

This section will describe the background and related studies to the investigation in more depth of what a lock system is, remote control, and the importance of remote-control. This section will also discuss current applications related to personal computer remote control applications.

2.1 Lock System

Now smartphones are used not only to send and receive phone calls, send text messages, and perform mobile banking operations but also to control various other devices in our everyday lives [3]. In fact, mobile operating systems are now not limited to several functions but can be used as internal applications to operate various external devices such as televisions, computers, cars and more [4].

Furthermore, using a smartphone can be managed easily without using a password manually. Thus, this system is a diverse application as the system is used in various types of applications for various types of keys, applications, and systems such as computers, lockers and more [5].

2.2 Remote control in General

The remote control for a piece of electrical equipment such as a television is the device users use to control the equipment from a distance by pressing the buttons on it [6]. In general, remote control is a system that controls a machine, application, or vehicle via a radio, electronics, or smartphone signal. In fact, remote controls had existed for a long time before they were widely used. For example, during World Wars I and II, radio frequency devices began to be used to operate ships and explosives remotely [7]. Currently, people use a lot of remote controls, regardless of using applications via smartphones or electronics in our daily lives.

2.3 The importance of Remote-Control

A remote control is a special type of software that allows a device to control other devices through a network connection. Typically, remote controls use the TCP/IP protocol to connect between devices and allow users to share their computer desktops with others [8]. In addition, another importance that can be used is the remote control also allows communication of different types of devices or different types of operating systems (OS); remote control can also support operating systems other than Windows, such as Linux and more. It shows many benefits of remote control that can be obtained if it is applied in an application or system [9].

3. Methodology of The Study

The study was conducted following the Throw-away Prototyping methodology proposed by Sami [10]. Throw-away prototyping methodology is also known as close-ended prototyping. This method includes the development of prototypes but uses the prototypes primarily to explore design alternatives rather than the actual new system [11] and use these technical mechanisms to reduce risk in the project. The throw-away prototype employs several basic approaches: planning, analysis, design, and implementation. Some phases mentioned previously will be repeated two times in this method.

It is divided into four main stages: requirements planning, initial analysis, dummy prototype, and implementation. The flow of the phases is illustrated in Figure 1.

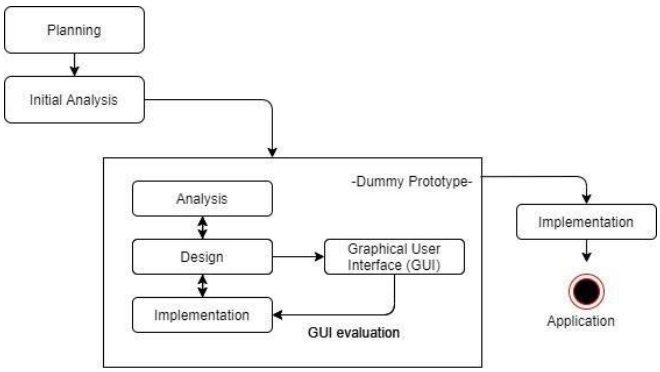

Fig. 1 The phases of Throw-away Prototyping

The requirement planning phase involves procurement of IoT application needs by researching the concept of client-server and remote-control pc. To obtain IoT application requirements to organize Wear Lock Application (WLA) lists is part of the requirements planning step using Unified Modeling Language (UML) diagrams [12], such as use case examples, sequences, and classes used to document and illustrate requirements. UML diagrams are usually used to show requirements systems such as those found in Adediran and Al-Bazi [13] and Hussain et al. [14]. This analysis phase will be divided into two: initial analysis and analysis under the building or dummy prototype. For initial analysis, start preparing a list of project requirements, then discuss in detail with the supervisor to get the final requirement specification.

The dummy prototype phase has four processes that are done one by one, starting with analysis, design, GUI, and implementation. This phase needs to create a quick design to give a brief overview of its application and then help develop the prototype in the stage design prototype or dummy prototype. It is necessary to build prototypes based on information with a quick design in stage design. If the current prototype is not at a satisfactory level, the prototype needs to be redone by repeating this phrase to be able to follow the project requirements specification.

Meanwhile, other stages of implementation must be passed. This phase occurs the process develops based on a complete high-fidelity prototype. Before that, the prototype needs to be tested to make sure the prototype is free of any bugs. By the way, users are given questionnaires and WLA tests; users need to provide feedback to improve the user interface and the effectiveness of the latest functionality of its users. Otherwise, it will be repaired again until clean and smooth. After that, the application will undergo further routine testing and maintenance to be minimized stop time and prevent failure. All phases, namely requirements planning, analysis, and dummy prototype phases, will be described in the Design and Development of the WLA section; temporarily, the implementation phase will be described in the Evaluation of WLA section.

4. Design and Development of WLA

We are very grateful to experts for their appropriate and constructive suggestions to improve this template. This section will describe the design and development of IoT applications that will be used to operate and lock computers remotely by following the four phases of the Throw Prototype. Following the first four phases of the Prototyping model. Two sections will be divided into several sub-sections: (1) collection of WLA requirements of the adoption key application and (2) prototype of the development of WLA, an IoT -based application developed to demonstrate aggregated needs. The requirement gathering approach was carried out through interviewing and questionnaires.

Using Google Meet as an online platform is a primary medium to connect and interview users. The second method is to analyze the document and existing applications related to this project for this project. Every need has priority, whether Mandatory (the system must be done), Desired (the system should be done) and Options (the system may apply). Table 1 Shows the requirements of the Wear Lock Application function.

TABLE 1. List of Requirements for WLA

ID	Requirement Description	Priority
1	CONNECT	
1.1	Users require a connection between pc and android by entering the IP address using the same connection, Wi-Fi or hotspot.	High
1.2	If users do not enter an incorrect IP address, the error message, “Server not listening.” will be displayed on the android pop-up.	Medium
2	POWER OPTION	
2.1	This application will allow users to control the pc remotely.	High
2.2	The application shall also be remotely controlled with a pc lock if the IP address entered is correct.	Medium
2.3	If the Wi-Fi or Hotspot connection on the pc or android is suddenly disconnected, then automatically, the connection between the devices will be disconnected as well.	Medium
3	REMOTE CONTROL PC	
3.1	This application shall allow the IP address of the user’s pc to be used by android for connection purposes.	Medium
3.2	This application shall allow users to reset the IP address and connection to pair again.	Optional

Table 1 shows the requirements that during the requirements gathering phase from the analysis phase it is important to avoid unexpected setbacks in the software development life cycle. The next phase is to use appropriate modelling methods and tools to illustrate and simulate the application requirements, which is the Unified Model Language (UML). There are two diagrams showing the behavior, which is a case of the use of diagrams, activity diagrams and class diagrams.

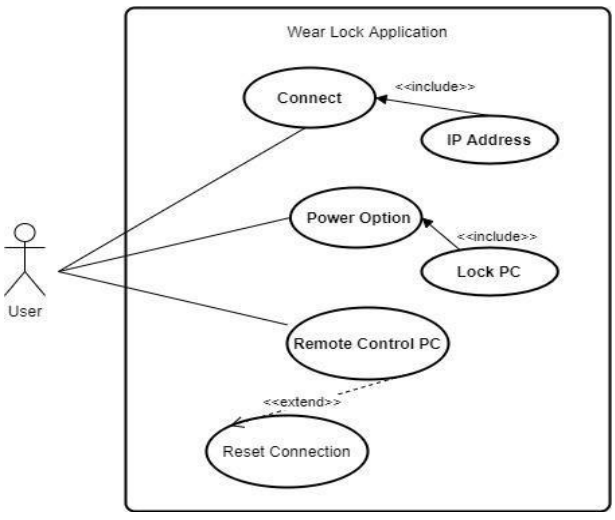

Fig. 2. The use case diagram of Wear Lock Application (WLA)

The use case diagram above has been detailed to show the function of the application. In addition, the operations involved in the use of the Wear Lock Application (WLA) are illustrated in the activity diagram in Figure 3 and Figure 4,

which are very clear.

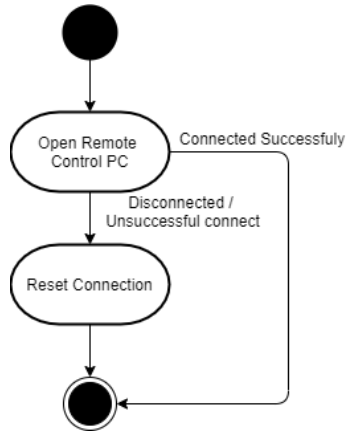

Fig. 3. The activity diagram of Wear Lock Application (WLA)

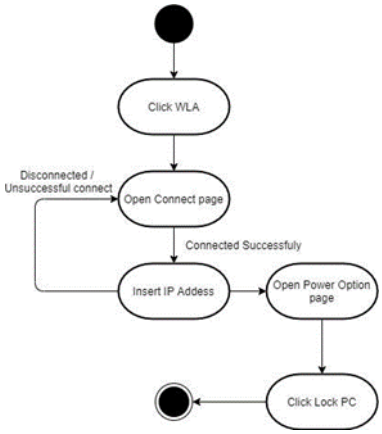

Fig. 4. The activity diagram of Wear Lock Application (WLA)

Figures 3 and 4 show the process of the application attributes and operations function. This work shows the four main classes that have been identified, namely user, connect, power option and remote-control pc. At the same time showing how classes interact is also clearly illustrated in the diagram. The application structure components used for Application Wear Lock (WLA) are shown in the class diagram as shown in Figure 5.

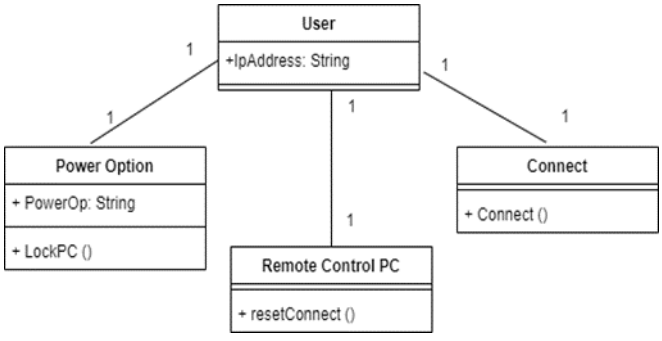

Fig. 5. The class diagram of a Wear Lock Application (WLA)

5. The Wear Lock Application Prototype Development

A prototype Wear Lock (WLA) application has been developed. This prototype represents all the requirements gathered at the analysis phase into an application that can make normal people understand how to use this application. To develop this prototype, the developer used two types of IDEs, NetBeans and Android Studio, to integrate all the requirements explained in the previous subsection. Figure 6 to Figure 9 shows the application interface for Windows and Android.

Fig. 6 The Interface of Remote-Control PC

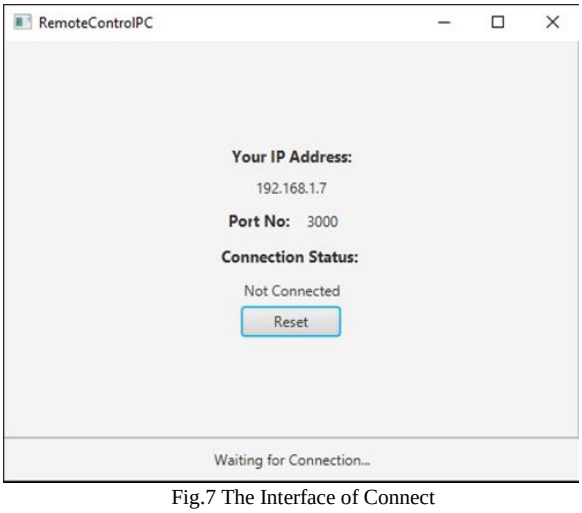

Fig.7 The Interface of Connect

Fig. 8 The Interface of drawable

Fig. 9 The Interface of power option

6. Evaluation of Wear Lock Application

This section will discuss the evaluation process that has been conducted on the developed prototype.

6.1 The Evaluation Setting

This section will discuss the evaluation process conducted on the developed prototype. This usability assessment was conducted on 35 respondents, consisting of a list of contacts, and some were randomly selected from the age group of 16 years to 35 years and above. Respondents were approached using social media, which is the WhatsApp application. The instrument used to evaluate the Wear Lock Application is to provide post-assignment questionnaires through the Google Form platform.

Meanwhile, the Google Drive and Google Document platforms are used as a place to provide instructions and files to users that will be used to make assessments. For respondents who answered the questionnaire was voluntary. While the questionnaire is divided into two parts, part A asks for respondents' demographic information while Part B asks for respondents' opinions on Wear Lock Application in a five-point Likert scale where one represents strongly disagree, and five represents strongly agree.

6.2 The Respondents' Demographic Information

Analysis of the demographic information of the respondents showed that 80% of them were women and more than 20% were men, while 66.7% of them were aged between 35 years and above and 3.3% were from the age group between 16 years to 20 years and the remaining age group between 21 years to 25 years. 26 years to 35 years earned 13.3% and 16.7%, respectively. 56.7% use a personal computer (pc) every week, and as many as 26.7% of users use a computer daily; the remaining 3.3% and 13.3%, respectively, use it monthly and occasionally.

6.3 The Usability of Wear Lock Application

Analysis for application evaluation was performed on the respondents' answers in Part B of the post-task questionnaire. This section measures respondents' perceptions of the use and convenience of users towards the use of the WLA. It also measures the level of respondents' satisfaction with the WLA. Tables 2, 3, and 4 show the frequency and average of the response. Respondents rated four or five post-task scales for three aspects of usability. Only a small number of respondents disagreed with evaluating one or two, and none of the respondents rated one or two for strongly disagree.

TABLE 2. THE RESPONDENTS' RESPONSES ON THEIR OVERALL USABILITY OF THE WEAR LOCK APPLICATION

The post-task questionnaire items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Average
Overall, I am satisfied with the ease of completing this task	0 (0.00)	0 (0.00)	6(20.0)	13(43.3)	11(36.7)	4.16
Overall, I am satisfied with the amount of time it took to complete this task	0 (0.00)	0 (0.00)	7(23.3)	13(43.3)	10(33.3)	4.10

TABLE 3. THE RESPONDENTS' RESPONSES ON THE USEFULNESS OF WEAR LOCK APPLICATION

The post-task questionnaire items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Average
Wear Lock Application enhances my effectiveness in accessing the pc.	0 (0.00)	0 (0.00)	9(30.0)	14(46.7)	7 (23.3)	3.93
Wear Lock Application increases my productivity.	0 (0.00)	0 (0.00)	7(23.3)	14(46.7)	9 (30.0)	4.06
Wear Lock Application makes it easier to access the lock pc	0 (0.00)	0 (0.00)	10(33.3)	11(36.7)	9 (30.0)	3.96
Wear Lock Application gives me greater control over my work.	0 (0.00)	0 (0.00)	3 (10.0)	17(56.7)	10 (33.3)	4.25
Wear Lock Application enables me to accomplish tasks more quickly.	0 (0.00)	0 (0.00)	6 (20.0)	12(40.0)	12 (40.0)	4.15
Wear Lock Application saves me time when I use it.	0 (0.00)	0 (0.00)	7 (23.3)	12(40.0)	11 (36.7)	4.15
Wear Lock Application meets my needs.	0 (0.00)	0 (0.00)	8 (26.7)	11(36.7)	11 (36.7)	4.15
Wear Lock Application does everything I would expect it to do	0 (0.00)	0 (0.00)	7 (23.3)	13(43.3)	10 (33.3)	4.05
Wear Lock Application is useful in overall.	0 (0.00)	0 (0.00)	5 (16.7)	16(53.3)	9 (30.0)	4.15

TABLE 4. THE RESPONDENTS' RESPONSES ON THE EASE OF USE OF WEAR LOCK APPLICATION

The post-task questionnaire items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Average
Wear Lock Application is easy to use.	0 (0.00)	0 (0.00)	7(23.3)	12(40.0)	11(36.7)	4.15
Wear Lock Application is user-friendly.	0 (0.00)	0 (0.00)	7(23.3)	14(53.3)	9(30.0)	4.10
Wear Lock Application is flexible.	0 (0.00)	0 (0.00)	3(13.3)	16(53.3)	10(33.3)	4.25
Wear Lock Application required fewer steps to accomplish what I want to do with lock pc.	0 (0.00)	2(6.7)	7(23.3)	13(43.3)	8 (26.7)	3.80
I can easily remember how to use it.	0 (0.00)	0 (0.00)	7(23.3)	11(36.7)	12(40.0)	4.25
I don't notice any inconsistencies as I use Wear Lock Application	0 (0.00)	1(3.3)	7(23.3)	12(40.0)	11(36.7)	4.00

TABLE 5. THE RESPONDENTS' RESPONSES ON THEIR SATISFACTION OF WEAR LOCK APPLICATION

The post-task questionnaire items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Average
I am satisfied with Wear Lock Application.	0 (0.00)	1 (3.3)	8(26.7)	13(43.3)	8(26.7)	4.15
I would recommend Wear Lock Application to my friend	0 (0.00)	1 (3.3)	7(23.3)	14(45.7)	8(26.7)	3.95
Wear Lock Application works the way I want it to work.	0 (0.00)	1 (3.3)	8(26.7)	15(50.0)	6(20.0)	3.95
Wear Lock Application is wonderful and pleasant to use.	0 (0.00)	0 (0.00)	10(33.3)	14(46.7)	7(23.3)	3.90

The evaluation results show that the WLA is easy to use and useful to the respondents. Overall, it shows that most users agree that the ease and time it takes to complete the tasks are adequate. Meanwhile, also agree that this application is easy to understand and use through clear instructions and complete files provided have further facilitated the task of using this application. However, a small number of respondents gave feedback on this application. One of the feedback items given by the respondents is to improve the way to download the application on the PC and color selection.

7. Conclusion and Future Works

In conclusion, this paper explains about the design and evelopment of WLA. There are many aspects that can be studied. For the future, we plan to complete the Wear Lock Application function by completing the pc unlock function and repair and further strengthen the application design from time to time to satisfy and meet all user needs. Therefore, it is hoped that the work of this application in the future can be extended to other functions to users.

8. Acknowledgment

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