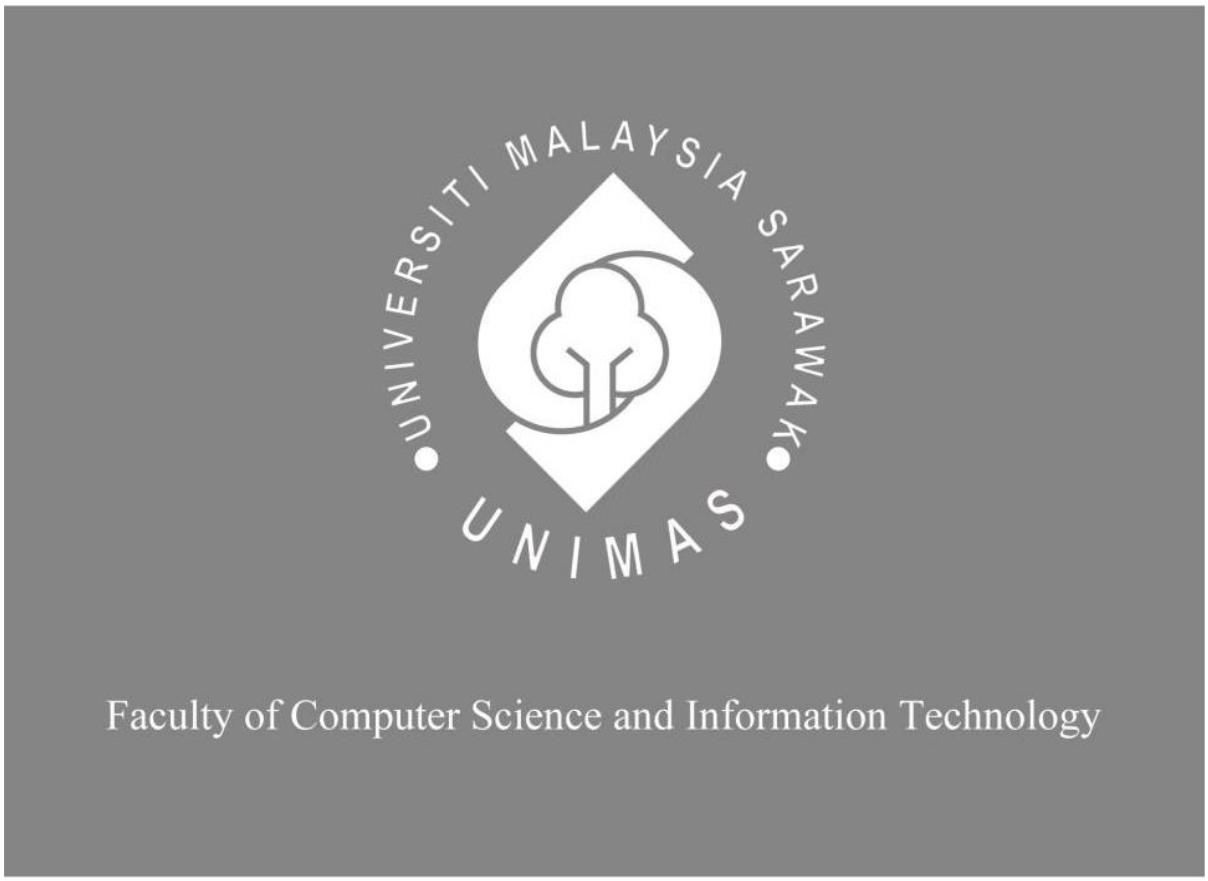

PeTARY ACCESS CONTROL SYSTEM WITH FACE RECOGNITION

Soh Yee Vone

Bachelor of Computer Science with Honours
(Software Engineering)
2020

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This project is submitted in partial fulfilment of the requirements for the degree of
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SISTEM KAWALAN AKSES PeTARY DENGAN PENGIKTIRAFAN WAJAH

SOH YEE VONE

Projek ini merupakan salah satu keperluan untuk Ijazah Sarjana Muda Sains Komputer
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(SOH YEE VONE) (03 August 2020)

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ABSTRACT

Perpustakaan Tun Abdul Rahman Ya'kub (PeTARY) is the main library of Universiti Malaysia Sarawak (UNIMAS). It provides a lot of resources for its library user. PeTARY allows UNMIAS students and staff to use library resources. However, if the public wish to enter and use the library resources, they need to apply for membership. Therefore, there is always a librarian or security guard at the entrance of PeTARY to check the student's matric card or public's membership. It is quite troublesome for them to check the matric card or membership one by one if there is a lot of users enter the library at once. Hence, PeTARY Access Control System with Face Recognition is proposed to help the librarian. The purpose of this system is to use the face recognition technology to help in identify legitimate library user, record their time in and time out and generate statistics on the utilization of the library. For produce and deliver a workable proposed system, the Waterfall model is applied in the proposed system. In the Waterfall model, each of the stages is described in detail in the proposed system report. The method and technique used to achieve each stage of Waterfall model also discussed in the report. Other than that, the system prototype and detail design of the proposed system also included in the report. After that, the steps in developing the proposed system and technique used for testing the system function also documented in this report. The reporting end with the achievement of the proposed system, limitations of the proposed project and its future enhancements is discussed. In the future, the proposed system would be an efficient and convenient system for the library user to access the PeTARY. Besides using in the library, the proposed system can be used in other places where need access control such as laboratory, office and government buildings.

ABSTRAK

Perpustakaan Tun Abdul Rahman Ya'kub (PeTARY) adalah perpustakaan utama Universiti Malaysia Sarawak. Perpustakaan tersebut menyediakan banyak sumber untuk pengguna. PeTARY membolehkan pelajar dan kakitangan UNIMAS menggunakan sumber perpustakaan. Walau bagaimanapun, jika orang ramai ingin memasuki dan menggunakan sumber perpustakaan, mereka perlu memohon keahlian. Oleh itu, sentiasa ada pustakawan atau pengawal keselamatan di pintu masuk PeTARY untuk memeriksa kad matrik pelajar atau keahlian awam. Keadaan tersebut agak menyusahkan bagi mereka untuk memeriksa kad matrik atau keahlian satu persatu jika terdapat banyak pengguna memasuki perpustakaan sekaligus. Sehubungan dengan itu, Sistem Kawalan Akses PeTARY dengan Pengiktirafan Wajah dicadangkan untuk membantu pustakawan. Tujuan sistem ini adalah untuk menggunakan teknologi pengenalan wajah untuk membantu mengenal pasti pengguna perpustakaan yang sah, merekodkan masa dan waktu mereka dan menghasilkan statistik mengenai penggunaan perpustakaan. Untuk menghasilkan dan menyampaikan sistem cadangan yang boleh dilaksanakan, *Waterfall model* digunakan dalam sistem yang dicadangkan. Dalam *Waterfall model*, setiap peringkat diterangkan secara terperinci dalam laporan sistem yang dicadangkan. Kaedah dan Teknik digunakan untuk mencapai setiap peringkat *Waterfall model* juga dibincangkan dalam laporan tersebut. Selain itu, prototaip sistem dan reka bentuk terperinci sistem yang dicadangkan juga termasuk dalam laporan tersebut. Selepas itu, langkah-langkah dalam membangun sistem dan teknik yang dicadangkan digunakan untuk menguji fungsi sistem juga didokmumenkan dalam laporan ini. Laporan ini berakhir dengan pencapaian sistem yang dicadangkan, batasan projek yang dicadangkan dan peningkatan masa depannya dibincangkan. Pada masa akan datang, sistem yang dicadangkan ini akan menjadi sistem yang cekap dan mudah digunakan oleh pengguna perpustakaan untuk mengakses PeTARY. Selain menggunakan di perpustakaan, sistem yang dicadangkan boleh digunakan di tempat lain yang memerlukan kawalan akses seperti makmal, bangunan pejabat dan kerajaan.

Table of Contents

Lists of Figures

Lists of Tables

CHAPTER 1: INTRODUCTION

1.1 Introduction

Perpustakaan Tun Abdul Rahman Ya'kub (PeTARY) is the main library of Universiti Malaysia Sarawak (UNIMAS) where provides lots of information for students. As UNIMAS students, they are free to use all the resources in PeTARY. For example, students can book a discussion room for project discussion. Besides that, PeTARY is a place where students can focus on their study due to its conducive environment and less distraction.

For accessing the library, students are required to bring their own matric card for authentication purpose. There is a librarian or security guard at the entrance of the library to ensure students bring their matric cards. However, the librarian or security guard might not be always on their post due to other official duties and shut of manpower. Thus, some outsiders might access the library easily.

There are two types of membership offered by PeTARY which is Internal Membership and External Membership. Internal Membership is eligible for UNIMAS staff and students whereas the External Membership is applicable for the public. Therefore, the public who wish to enter and use PeTARY resources, they are required to apply for membership from PeTARY Circulation Office or fill in the Online Patron Registration form from this website, http://cais-mill.unimas.my/selfreg. When they enter PeTARY, they need to show their membership card to the librarian or security guard at the entrance.

Nowadays, there is a lot of libraries forced to shut down due to the low utilization of the library. To operate a library, it needs a huge amount of expenditure for maintaining the library's facilities and upgrading library resources. Besides that, due to the advanced of

technology, the public rarely goes to the library since there is a lot of electronic resources easily can be found online. However, there is still have some resources that hard to be found online such as the books in the “Red Spot Collection” section. Therefore, for PeTARY to well prepare resources for library user, statistics of the utilization of library needed for better planning in library resources and facilities.

1.2 Problem Statement

At the present time, librarian or security guard at the PeTARY entrance has difficulty to check student’s matric card properly because students might not bring their own matric card or use their friend’s matric card. Other than that, the librarian and security guard might have other duties and no other staff replace their position. This will allow the outsiders to enter PeTARY freely. Besides that, the public is not allowed to enter PeTARY and use the resource. However, if they wish to enter the library and use the resources, they must apply for membership from the website mentioned in section 1.1. Therefore, before entering PeTARY, they also need to identify themselves with the librarian or security guard at the entrance by showing the member card applied. Other than that, there is no recording for user basic information and user’s time in and time out for using PeTARY. This, in turn, will cause the PeTARY management team hardly to prepare and manage resources for library user during peak hour and off-peak hour.

1.3 Objectives

1. To identify the legitimate library user through face recognition.
2. To record student time in and time out at the PeTARY entrance.
3. To generate utilization statistics of the library.

1.4 Brief Methodology

Waterfall model is chosen as the project methodology in order to create a system which meets the project's objectives and specifications. Due to its straightforward and unambiguous phases, it has been one of the reasons to be chosen as this project methodology. Besides that, in the waterfall model, each of the phases must be completed before it continues to another phase. This can help to ensure that every requirements and specification in each of the phases have been achieved before continues to the next phase. There are five main phases in waterfall model such as Requirement Analysis, Design, Implementation, Testing, Operation and Maintenance as stated in Figure 1.1.

For Requirement Analysis phase, it is necessary to point out the problem has been faced by the library and gather the requirements from the librarian in the library through an interview session. After that, analysing the requirements is necessary to come out with a project proposal which includes an introduction, problem statement, scope, objectives, methodology, significant of project, project schedule and expected outcome. During this phase, the study on a similar system in the market is reviewed. The purpose of this review is to have a better understanding of the existing systems and make a comparison between the existing systems and proposed system. Besides that, review on the tools and technology that going to use in this proposed system has been discussed. Detail of hardware such as Raspberry Pi and Raspberry Pi Camera

will be reviewed. In addition, library use in the proposed system, which is OpenCV, scripting language and programming language will be analysed too.

After all the requirement and specification have been analysed and documented, function and operation of the proposed system are explained in the design phase. Diagram including context diagram and data flow diagram (DFD) will be drawn in order to show the details design of the proposed system. Besides that, entity relationship diagram (ERD) and data dictionary are included to explain database design in the proposed system. Apart from that, two tables are built for description on the hardware and software used in the proposed system. Other than that, the prototype also included displaying the early design of the proposed system's user interface with the help of Justinmind.

Once the design is confirmed, the implementation phase will start by writing out the code. During this phase, the implementation part will follow the system designed and come out with a working system.

After the implementation of the system is completed, a system testing needs to carry out in order to point out the part which does not satisfy the requirement stated in the documentation. There are two types of testing suitable for the proposed system, which is functional testing and non-functional testing. For functional testing, black box testing approach will be used to confirm the functionality of the proposed system will return the expected output. During black box testing, the internal structure of the item will be ignored whereas input and output result is concerned. For non-functional testing, it is tested on the quality of the system such as performance, compatibility and accessibility. Non-functional testing will start once functional testing done. All the function in the proposed system will be tested and the test case will log down in template.

Lastly, we need to present our completed system and the flow of the system. Due to time constraint, the Operation and Maintenance phase will not include in this system since it takes quite a long time to deploy a system.

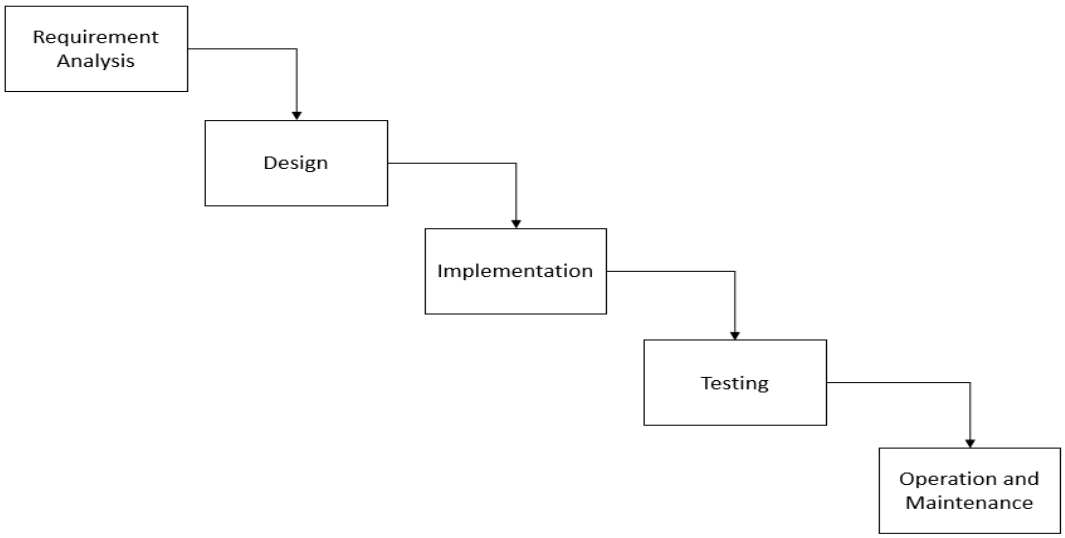

Figure 1.1. Waterfall methodology

1.5 Scope

The PeTARY access control system should be able to detect library user with face recognition technology. In addition, the system able to record and identify permitted library user. The project will target on UNIMAS student, UNIMAS staff and PeTARY librarian. However, due to time constraint, the project will only include few students from UNIMAS in the database for prototyping purpose.

Besides that, another scope of the proposed system is that for recording the utilization of PeTARY, student's basic information and time in and time out will be included in the database. The basic information including name, matric number, programme code and Faculty.

1.6 Significance of Project

The significance of this project is to design a system which can improve the library access control at the entrance. Besides that, it can reduce the librarian or security guard workload since they have other tasks to do. This project also can help the library management team to improve the management of library resources by providing utilization of library record with student time in and time out.

Other than that, this proposed system is not only restricted to be used in the library. It can be used in other places that need access control for example access control in the workplace to record the employee time in and time out. It can help to record employee working hour with face recognition technology. Apart from that, it is suitable for places that restrict the normal user to access, such as the laboratory that contains dangerous chemical.

1.7 Project Schedule

A project schedule is constructed to show the whole project timeline. A Gantt chart is drawn by using Microsoft Project 2013. The Gantt chart will include all the activities involved from the start time until the end of the project in each phase. Figure 1.2 shows the Gantt chart of the project.

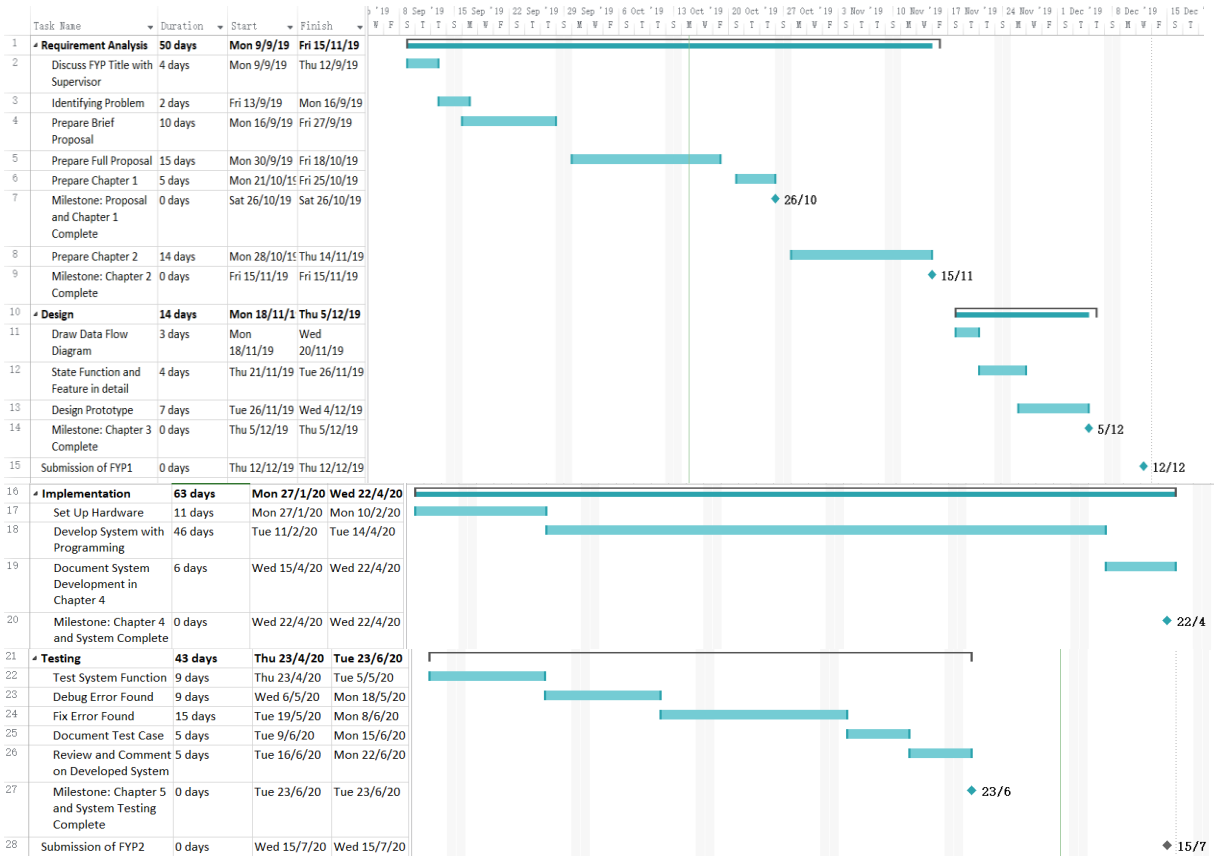

Figure 1.2. Gantt chart of the proposed system

1.8 Expected Outcome

The main outcome of the project is a face recognition system which is capable to detect student's face and allow the students to access PeTARY without presenting their matric card. Hence, preventing the cases where the student enters PeTARY by using other's matric card. Besides that, since the public are not allowed to enter PeTARY, the system will help to detect legitimate library user. For those who do not appear in the system database, they are not allowed to enter PeTARY.

Furthermore, the system will record the student's time in and time out into the database. These data will be used for recording the utilization of PeTARY. The system will display data about time spent by the student in the library. Thus, it can be used by the library management

team to have better planning on space and resources available during peak hour or off-peak hour. Consequently, it prevents the scenario like the books are not found from the rack even the PeTARY OneSearch system showing that the book is available for borrow.

1.9 Report Outline

For Chapter 2, research on the topic related to the proposed system is important. This chapter includes introduction, summary and critique of journal articles. In the introduction part, some of the major research that related to the proposed system will be discussed. After that, a summary is drawn out from the previous discussion in the introduction. Next, this chapter also needs to include the argument between the existing systems and the proposed system to show the importance and the purpose of the proposed system.

In Chapter 3, the method of obtaining detail requirements are discussed. Based on the requirement gathered, Data Flow Diagram (DFD) will be drawn for the proposed system. The purpose of drawing data flow diagram is to display the process flow of the system. Besides that, the Entity Relationship Diagram (ERD) is included to show the relationship between the entity in the database.

For Chapter 4, desired proposed system is created based on the requirements gathered. Step-by-step on how to set up the Raspberry Pi and Raspberry Pi Camera will be written in this chapter. Besides that, all the interface of the proposed system will be screenshot and included as documentation.

In Chapter 5, usability and functional testing will be done to ensure that the system fulfilled the requirement and specification. All the related test case will be log down in the test case template.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In this chapter, there are three similar existing systems will be reviewed and discussed. Besides that, the comparison between the similar existing systems and the proposed system will be included. After that, a table is drawn to do the features comparison between existing systems and the proposed system. Apart from that, hardware and software component that going to use in the proposed system will be reviewed.

2.2 Reviews on Similar Existing Systems

2.2.1 Bibliotheca RFID Gate

Bibliotheca RFID Gate is security gates which use in the library to detect RFID tags in library items (Bibliotheca Transforming Libraries, n.d.). This gate is used at the entrance of the library to reduce the chances of library user bring out the library items without borrow from the counter. This gate will output sound and visual warning once the detection is triggered.

Besides that, staffConnect gate software is provided by the company to connect the Bibliotheca RFID Gate to the staff computer. This software provides two main functions for the staff. First, it allows the staff to view visitors counts in the library directly from this software. It has a reset function for staff to keep track of daily visit (Bibliotheca Transforming Libraries, n.d.). Other than that, this software able to acknowledge staff immediately once the security alarm is triggered at the entrance of the library. For libraryConnect devices, it allows staff to obtain data from different places of security gates and combined into one main management centre. By using these data, staff able to create a report on the library usage.

This RFID gate provides several benefits to the user. First, for those non-deactivated RFID tags can be detected immediately once it passes by the gate. Secondly, since the staffs can access to libraryConnect, they are able to configure alarm setting and create monthly reports. Besides that, this gate is designed with energy-saving features which can help to save the energy cost during the off-peak hour (Bibliotheca Transforming Libraries, n.d.).

There is a drawback for this Bibliotheca RFID gate. This RFID gate does not provide any access control feature. Therefore, it is only suitable for the public library. However, UNIMAS PeTARY only opens for UNIMAS student, UNIMAS staff and PeTARY member. Thus, the proposed system able to solve this issue by using face recognition technology. This face recognition technology can help to recognize authorised library user and bar those unauthorised people from entering PeTARY.

Figure 2.1. Bibliotheca RFID Gate (Bibliotheca Transforming Libraries, n.d.)