RFID INTEGRATED SMART SURVEILLANCE SYSTEM

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RFID INTEGRATED SMART SURVEILLANCE SYSTEM

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This report is submitted in partial fulfilment of the requirements for the

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

DECLARATION

I hereby declare that this project report entitled

RFID INTEGRATED SMART SURVEILLANCE SYSTEM

Is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT: _____ Date: 17/05/2021

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I hereby declare that I have read this project report and have found this project report is sufficient in term of the scope and quality for the award of Bachelor of Computer Science (Computer Security) With Honours.

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DEDICATION

To my dearest parents, Nor Azrin Bin Md Latip and Zubaidah Binti Abdullah, my siblings, Nurul Nabilah Najwa Binti Nor Azrin and Muhammad Nafiz Bin Nor Azrin and the rest of my adorable family, thank you for the patience, support and prayers.

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May Allah bless us all. Aamin

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ABSTRACT

RFID is an abbreviation that stands for radio-frequency identification. It uses electromagnetic fields to automatically identify and track tags attached to objects. An RFID system consists of a tiny radio transponder, a radio receiver and transmitter. This technology has been actively used to track parcels and items in an inventory or even used to assist the toll payments in Malaysia, providing it as a service alongside manual payments and smart tags. In this project. RFID will be used as access control on each entrance and rooms in a university. This is to detect the movements of its users in the building. The RFID readers will be places at each entrance and the users are to tap their tags/card onto the reader to record their presence in the room. This project is aimed at creating an internal monitoring system to keep track of the movements of staffs and students within the university grounds.

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ABSTRAK

RFID merupakan singkatan yang bererti identifikasi melalui radio frekuensi. RFID menggunakan medan elektromagnetik untuk mengenalpasti and mengesan tag yang dilekatkan pada objek secara automatik. Sistem RFID terdiri daripada transponder radio kecil, penerima radio dan pemancar. Teknologi ini telah digunakan secara meluas dalam mengesan bungkusan dan item di dalam inventori. Ia juga bahkan digunakan untuk menyelia pembayaran tol di Malaysia. Ia disediakannya sebagai perkhidmatan tambahan di samping pembayaran manual dan tag pintar yang sedia ada. Dalam projek ini, RFID akan digunakan sebagai mekanisma akses kawalan pada setiap pintu masuk dan bilik di universiti. Ini untuk mengesan pergerakan pengguna di dalam bangunan. Pembaca RFID akan berada di setiap pintu masuk dan pengguna harus mengetuk tanda / kad mereka pada pembaca RFID tersebut untuk merakam kehadiran mereka di dalam bilik. Projek ini bertujuan mewujudkan sistem pemantauan dalaman untuk mengawasi pergerakan staf dan pelajar di kawasan universiti.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

RFID (Radio Frequency Identification) is a widely used technology in the modern days of this era. Its seamless and almost immediate detection of the tags exposed to the range of its readers allows it to track the movement of the object attached to it quickly. The main idea of this project is inspired from a variety of sources. Firstly, the usage of RFID in inventory and parcel warehouses is the main source of inspiration for this project. The idea of scanning objects as it passes to through the readers gave an insight of how humans could also be detected while passing through the range of the reader while possessing the RFID-readable tags or cards.

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Secondly, due to the ongoing pandemic, it has become a widely known procedure in Malaysia to scan the venues prior to entering it in order to create a log of where each citizen went. This is a good strategy to track the places that each individual have been to in case if they are tested positive of the Covid-19 disease. However, this has not been implemented in depth in a university's faculty compound. Faculties can register for the MySejahtera QR code to be implemented in their compound but this goes as far as detecting a person has entered the faculty building with the equipped technology.

The implementation of QR code scanning is also not as convenient because this meant that every student and staff are required to own a smartphone with a threshold of a certain Android or IOS version in order to be able to scan the QR codes. This will of course lead to additional cost on both parties (University and the users.) Thus, this project is aimed at creating an internal monitoring system to keep track of

the movements of staffs and students within the university grounds using the technology of RFID

1.2 Problem Statement (PS)

This project embarks on the following problems that exist in the current environment of the university. Firstly, the recent Covid-19-related issue is synonymous with the concept of contact tracing. Contact tracing is essentially tracking the places a person went to as soon as they step out of their houses. This issue is related to the university in such manner, that the university lacks the surveillance on the personnel that enter or leave a facility/rooms within the university compound.

Secondly, a university consist of multiple locations that are deemed as confidential and only allows a certain group of people to enter. Thus, they have implemented CCTVs and the existing access control system that allows certain staffs to interact with these facility. However, in events of 'tailgating' or 'piggybacking,' the methods of detecting these individuals are unavailable.

Thirdly, there is a possibility that the university might have to encounter emergency situations that requires them to pinpoint the last known whereabouts of its lecturers and students. In this case, There is a scarcity of a centralised system that can detect the locality of students' and lecturers' whereabouts.

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Table 1.1: Summary of Problem Statement

PS	Problem Statement
PS_1	Lack of mechanism in surveillance monitoring system to detect student and staff movement in the university.
PS_2	The method for detecting tailgating and piggybacking are not available.
PS_3	There is a scarcity of a centralised system that can detect the locality of students' and lecturers' whereabouts

1.3 Project Question (PQ)

Table 1.2: Summary of Project Question

PS	PQ	Project Question
PS_1	PQ_1	What is the mechanism that can be used to track the places students and staffs went to within the university?
PS_2	PQ_2	What is the method to detect the responsible personnel in events of tailgating/piggybacking?
PS_3	PQ_3	What is the ideal centralized method for detecting the locality of students and lecturers?

1.4 Project Objective (PO)

Table 1.3: Summary of Project Objectives

PS	PQ	PO	Project Objective
PS_1	PQ_1	PO_1	To study a mechanism to track the places students and staffs went within the university compound
PS_2	PQ_2	PO_2	To develop a method to detect the responsible personnel in events of tailgating/piggybacking.
PS_3	PQ_3	PO_3	To propose an ideal centralized method for detecting the locality of students and lecturers?

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1.5 Project Scope

The scope of this project involves the students and staff in the university areas. This project constructs a monitoring system that integrates with RFID technology to track the user whereabouts. This project aims to produce a product prototype. The RFID readers may not be able to detect long ranges due to cost.

1.6 Project Contribution (PC)

Table 1.4: Summary of Project Contribution

PS	PQ	PO	PC	Project Contribution
PS_1	PQ_1	PO_1	PC_1	Prototype of a Smart Access Control System that incorporates RFID technology as an additional layer of security to the existing access control system.
PS_2	PQ_2	PO_2	PC_2	A new method using RFID readable card/tags to every university members as their matric card
PS_3	PQ_3	PO_3	PC_3	A centralised model for Smart Access Control System that assign RFID readers to rooms to indicate the locality of the student or lecturer when they enter that room.

1.7 Thesis Organization

Chapter 1: Introduction

This chapter introduce the readers to the general background, the problem statement, the objective, and scope of the project

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Chapter 2: Literature Review

This chapter consists of the study in relation to the creation of the project. This includes the review of thesis, papers, journals, etc.

Chapter 3: Project Methodology

This chapter focuses on the materials and data gathered for the study. There will be elaboration on the data and information are collected from the previous studies.

Chapter 4: Design

This chapter discusses on how the data and information collected in the previous chapter are designed to form a plan of processes before implementation. Deliverables included in this chapter are charts and drawings to describe the planned processes

Chapter 5: Implementation

This chapter explains the implementation processes of the project based on the plan as explained in the previous chapter. This chapter includes pictures and steps of implementation.

Chapter 6: Testing And Analysis

This chapter consists of the testing and analysis executed on this project. All the data and information are collected and tested in this chapter.

Chapter 7: Project Conclusion

This chapter concludes the study, the project and explains some recommendations for the future improvements.

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1.8 Conclusion

To conclude, this chapter has explained the backgrounds of the project, its problem statements, and objectives as well as the scope of the proposed project. The thesis's structure was also briefly discussed in this chapter. The next chapter will discuss an in-depth on past related works of the proposed project.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter looks at previous RFID-related initiatives that have been completed. This section discusses the RFID's numerous applications and why it was chosen as the technology for this project. Finally, the chapter will wrap up and summarise the information presented in this chapter.

2.2 Related Work/Previous Work

The first issue that any user who has used or come across a personnel/company that employs barcode technology is that barcodes are a technology that relies on the concept of line of sight. To put it another way, the scanner must be able to view the barcode before it can read it. In addition, certain other difficulties impacting barcode technology, such as environmental conditions, have surfaced. Scanning barcodes on a label is inefficient due to factors such as temperature, grime, and dangerous contamination.

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RFID is not a new technology. It has been around for quite a while. It was initially employed by the US government in the 1940s to distinguish between hostile and friendly aircraft. Furthermore, it was not a technology that had lately been inhabited. RFID was used to track livestock and nuclear items during the 1970s.

The usage of radio tags was then commercialized in the 1980s and 1990s for sectors such as package delivery, luggage management, food tracking in supermarkets, and highway toll monitoring. Following that, in 1997, Mobil, a gas station firm, utilized RFID to record transactions and deduct the gas cost from the customer's credit card utilizing what is now known as the payWave concept.

As a result, to support my claim, RFID is not a new technology. It has been around for a long time and is still in use. RFID is frequently utilized in supply chain operations as well. Supply chain operation is an entire process of making and selling goods. This encompasses everything from getting suppliers to manufacturing the goods

This technology is employed because it is a cost-cutting strategy for a supply chain that is becoming increasingly expensive. This technology is implemented by attaching RFID tags to the goods, which are then detected by radio waves by the reader. Due to the discovery of various problems, some publications have said that RFID will replace the original barcode technology.

Finally, in attempt to lessen the risk of a Covid-19 pandemic, RFID was used to track and detect contact tracing. The staffs that are in same space as the Covid-19 patient can be detected from the tags that they wear and through the readers placed in the patient's rooms (Mehta, S., Grant, K., Atlin, C., & Ackery, A., 2020).

2.2.1 Project Domain

This domain for this project is access control system. Access control is concerned with limiting the activity of legitimate users. Access control consist of 4 models. (Gentry, 2021).

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- Mandatory Access Control (MAC)

  MAC limits access control administration to the owner. This means that the end user has no control over any settings that grant anyone access. MAC is related with two security models: Biba and Bell-LaPadula.
- Role-Based Access Control (RBAC)

  RBAC approach provides access control based on an individual's role in an organisation. As a result, rather than granting permissions to a person as a security manager, the role of security manager already has permissions.
- Discretionary Access Control (DAC)

  When compared to the most restrictive MAC model, the DAC model is the least restrictive. DAC gives a person complete control over any objects they possess, as well as the programmes that go with them.

- Rule-Based Access Control (RBAC or RB-RBAC).

  RB-RBAC assigns responsibilities to users dynamically based on the system administrator's criteria. RBAC would be the tool of choice if someone was only given access to files during particular hours of the day. The additional RB-RBAC "rules" that must be implemented may need to be "coded" into the network in the form of code by system administrator.

In this project, the role-based access control model will be used where the two users of the system are users and admin.

2.2.2 Project Terms

2.2.2.1 RFID

RFID is a technology similar to barcodes. It uses radio frequency waves as its medium of data transmission.

Technicality of RFID

RFID technology consists of 3 components

1. The tags/transponder

   RFID tags contains hard copper coils connected to an integrated circuit (IC) that has an antenna attached to it. These components are then attached to a house which can be a form of a card of a tag. RFID tags can be as small as a grain of rice or one third of a millimetre. Information are stored in the IC and the antenna is used by the reader to capture these information through radio frequency. There are 2 types of tags (Attaran, 2007).

   i. Active tags

      Active tags are self powered by batteries. They are the expensive version of passive tags and they have limited lifespan, unless recharged. They act as a mini computer and their prices ranged from $4 to $20 per tag.

   ii. Passive tags

      Passive tags are not battery powered. They are detected using the radiated energy from readers to transmit their data. They are cheap and

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they have unlimited lifespan. Their price ranges from 5 cents to 25 cents per tag.

RFID tags are read-only. RFID tags have memory spaces in them. Some of these memory spaces contain data that are reserved, permanent and not changeable. However, there are other spaces in the memory that are empty and can be filled with information of choice. One of the difference between a barcode and an RFID tags is the amount of information it can hold. Barcodes can hold 12 to 15 info characters consisting of digits from 0 to 9. RFID tags uses a 94 character technology to hold their information.

2. The reader

   RFID reads contains a radio frequency transmitters and receivers that is controlled by a microprocessor or digital signal processor that communicates with the tags.

3. Computer

   The RFID reader collect the information form the tag's antenna before sending it to the connected computer for information processing.

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2.2.2.2 Arduino

Arduino is a free and open-source platform for building and programming electronic devices. It can receive and transfer data to most devices, as well as transmit commands to specific electronic gadgets over the internet. It programmes the board using an Arduino Uno circuit board and a software programme using simplified C/C++

2.3 Critical Review Of Current Problem And Justification

The current situation of the faculty does not apply any access control mechanism to monitor the movements of its visitors. The labs in the faculty are equipped with access control systems but they are not able to detect the exact personnel (i.e. students) that exist in the current room. The current access control system are also not applied in every single room in the faculty. Thus, if a person is not in the lab, or within the sight of the CCTV cameras, there is no way to detect the location of this