

**ANALYSIS OF SECURITY METHOD IN AUTOMATED GATE SYSTEM**



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

## BORANG PENGESAHAN STATUS LAPORAN

JUDUL: ANALYSIS OF SECURITY METHODS IN AUTOMATED GATE SYSTEM

SESI PENGAJIAN: 2021/2022

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# ANALYSIS OF SECURITY METHOD IN AUTOMATED GATE SYSTEM

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This report is submitted in partial fulfillment of the requirements for the Bachelor of [Computer Science (Computer Security)] with Honours.

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY UNIVERSITI  
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## DEDICATION

In the name of Allah, the Most Gracious, the Most Merciful. This project is dedicated to my beloved parents, siblings and my supervisor who always support and inspire me along the way, completing this project. Without them, I would never be able to finish this project successfully.



## ACKNOWLEDGEMENTS

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I would also like to thank the authority of Universiti Teknikal Malaysia Melaka (UTeM) for providing me with a good environment and facilities to complete this project. Finally, an honourable mention goes to my families and friends for their understandings and supports me in completing this project. With the help of everyone that was mentioned above, I was able to overcome many problems and completed my project successfully on time.

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## ABSTRACT

Analysis of the Security Methods in Automated Gate System is an analysis to figure out which security method is the most secured to be implemented in the automated gate system. There will be three (3) platforms with different security methods that will be tested using specific tools and technique. The problem statements state that the current automated gate system offers many different security methods without knowing how secure it is. Besides that, some of the existing security methods have not identified specific tools that can be used to analyse them. Plus, clients do not know the best security method to be implemented in the Automated Gate System. To solve the current problem statement, security methods that need to be analysed need to be identified. Furthermore, tools to analyse the security methods need to be analysed and the platforms with different security methods need to be developed and analyse by using selected tools. The security methods that will be analysed are QR Code System, RFID System and Voice Recognition System. The security methods will be tested by using four parameters which are accuracy analysis, scan time, scan range and static analysis. The static analysis will be using Sonarqube and VisualCodeGrepper. Each platform will be developed in two phases which are hardware and software development. For QR Code, it will be using Arduino Uno Microcontroller and Visual Basic. For RFID, it will also be using Arduino Uno Microcontroller, RFID scanner and Arduino IDE. Lastly, for Voice Recognition, it will be using Arduino Uno Microcontroller, Python IDE and Arduino IDE. After the platform is developed, a security testing will be done to start doing analysis to identify which security method is the most secured.

## ABSTRAK

Analisis Kaedah Keselamatan dalam Sistem Gerbang Automatik adalah analisis untuk mengetahui kaedah keselamatan mana yang paling selamat untuk dilaksanakan dalam sistem gerbang automatik. Akan ada tiga (3) platform dengan kaedah keselamatan yang berbeza yang akan diuji menggunakan alat dan teknik tertentu. Penyataan masalah menyatakan bahawa sistem gerbang automatik semasa menawarkan banyak kaedah keselamatan yang berbeza tanpa mengetahui seberapa selamatnya ia. Selain itu, beberapa kaedah keselamatan yang belum mengenal pasti alat khusus yang dapat digunakan untuk menganalisisnya. Tambahan pula, pelanggan tidak mengetahui kaedah keselamatan terbaik untuk dilaksanakan dalam Sistem Pintu Automatik. Untuk menyelesaikan penyataan masalah semasa, kaedah keselamatan yang perlu dianalisis perlu dikenal pasti. Selanjutnya, alat untuk menganalisis kaedah keselamatan perlu dianalisis dan platform dengan kaedah keselamatan yang berbeza perlu dikembangkan dan dianalisis dengan menggunakan alat yang dipilih. Kaedah keselamatan yang akan dianalisis adalah Sistem Kod QR, Sistem RFID dan Sistem Pengecaman Suara. Kaedah keselamatan yang akan dianalisis adalah Sistem Kod QR, Sistem RFID dan Sistem Pengecaman Suara. Kaedah keselamatan akan diuji dengan menggunakan empat parameter iaitu analisis ketepatan, masa imbasan, julat imbasan dan analisis statik. Analisis statik akan menggunakan Sonarqube dan VisualCodeGrepper. Setiap platform akan dikembangkan dalam dua fasa iaitu pengembangan perkakasan dan perisian. Untuk QR Code, ia akan menggunakan Arduino Uno Microcontroller dan Visual Basic. Untuk RFID, ia juga akan menggunakan Arduino Uno Microcontroller, RFID scanner dan Arduino IDE. Terakhir, untuk Pengecaman Suara, ia akan menggunakan Arduino Uno Microcontroller, Python IDE dan Arduino IDE. Setelah platform dikembangkan, ujian keselamatan akan dilakukan untuk mula melakukan analisis untuk mengenal pasti kaedah keselamatan mana yang paling selamat.



## TABLE OF CONTENTS

	PAGE
DECLARATION .....	i
DEDICATION .....	ii
ACKNOWLEDGEMENTS .....	iii
ABSTRACT .....	iv
ABSTRAK .....	v
LIST OF FIGURES.....	viii
LIST OF TABLES .....	x
<b>1. CHAPTER 1: INTRODUCTION.....</b>	<b>11</b>
1.1 Introduction .....	11
1.2 Project Problem Statement .....	12
1.3 Project Research Question .....	13
1.4 Project Objectives .....	13
1.5 Project Research Hypothesis.....	14
1.6 Project Scope.....	15
1.7 Project Contribution .....	15
1.8 Conclusion.....	16
<b>2. CHAPTER 2: LITERATURE REVIEW.....</b>	<b>17</b>
2.1 Introduction .....	17
2.2 Related Work.....	17
2.3 Critical review of current problem and justification .....	27
2.4 Proposed Solution .....	30
<b>3. CHAPTER 3: METHODOLOGY .....</b>	<b>32</b>
3.1 Introduction .....	32
3.2 Research Process .....	32
3.2.1 Literature Review .....	34
3.2.2 Preliminary Research.....	35
3.2.3 Design.....	37
3.2.4 Implementation.....	38
3.2.5 Testing & Analysis .....	45
3.3 Methodology .....	46
3.4 Project Milestone.....	47
3.5 Conclusion.....	48

4. CHAPTER 4: DESIGN .....	49
4.1 Introduction .....	49
4.2 Network System Architecture .....	49
4.5 Requirement Analysis .....	53
4.5.1 Functional Requirement .....	53
4.3.2 Hardware Requirement .....	57
4.3.3 Software Requirement .....	61
4.4 Logical and Physical Design .....	64
4.5 Conclusion .....	66
5. CHAPTER 5: IMPLEMENTATION .....	67
5.1 Introduction .....	67
5.2 Environment Setup .....	67
5.2.1. Hardware Development Setup .....	67
6. CHAPTER 6: TESTING & ANALYSIS .....	80
6.1 Test Results and Analysis .....	80
6.2 Conclusion of Analysis .....	97
6.3 Conclusion .....	98
7. CHAPTER 7: PROJECT CONCLUSION .....	99
7.1 Introduction .....	99
7.2 Project Summarization .....	99
7.3 Project Contribution .....	101
7.4 Project Limitation .....	102
7.5 Future Works .....	103
7.6 Conclusion .....	103
8. REFERENCES .....	105

## LIST OF FIGURES

	PAGE
Figure 1.1 Project Research Hypothesis .....	14
Figure 2.1 Flowchart of the system.....	19
Figure 2.2 Flowchart of the process.....	20
Figure 2.3 Example of the salted hashing algorithm .....	21
Figure 2.4 Workflow of the system .....	22
Figure 2.5 Speaker Verification.....	23
Figure 2.6 The Process of Penetration Testing .....	25
Figure 2.7 Flow of the project.....	31
Figure 3.1 Flow of Research Process.....	33
Figure 3.2 Important Factors.....	35
Figure 3.3 The best security testing technique.....	36
Figure 3.4 The most secured security method .....	36
Figure 3.5 Type of Gate System .....	37
Figure 3.6 Hardware connection for QR Code System .....	38
Figure 3.7 Software Connection for QR Code System.....	39
Figure 3.8 Hardware Connection for RFID .....	41
Figure 3.9 Software Development for RFID .....	42
Figure 3.10 Hardware Connection for Voice Recognition System .....	43
Figure 3.11 Software Development of Voice Recognition System.....	44
Figure 3.12 Process of Waterfall Model.....	47
Figure 3.13 Gantt Chart .....	47
Figure 4.1 Flow of the analysis in a big picture.....	50
Figure 4.2 System Architecture for QR Code.....	51
Figure 4.3 System Architecture for RFID system .....	52
Figure 4.4 System Architecture for Voice Recognition.....	53
Figure 4.5 Block Diagram for QR Code.....	54
Figure 4.6 Block Diagram for RFID.....	55
Figure 4.7 Block Diagram for Voice Recognition.....	56
Figure 4.8 Arduino Uno Microcontroller.....	57
Figure 4.9 Tower Pro Micro Servo Motor SG90.....	58
Figure 4.10 Male to female jumper wire .....	58
Figure 4.11 PIR Motion Sensor .....	59
Figure 4.12 Piezo Buzzer.....	59
Figure 4.13 RFID Scanner .....	60
Figure 4.14 LCD Display.....	60
Figure 4.15 interface of IDE .....	61
Figure 4.16 interface of VB.NET .....	62
Figure 4.17 Python logo.....	62
Figure 4.18 Sonarqube .....	63

Figure 4.19 interface of VCG .....	63
Figure 4.20 Flowchart of platform using QR Code.....	64
Figure 4.21 Flowchart of platform using RFID.....	65
Figure 4.22 Flowchart of platform using Voice Recognition.....	66
Figure 5.1 Arduino Pins.....	68
Figure 5.2 Details of each pins number for QR Code.....	69
Figure 5.3 Platform developed using QR Code.....	69
Figure 5.4 Hardware Details for RFID System .....	71
Figure 5.5 Platform developed using RFID system.....	71
Figure 5.6 Hardware Details for Voice Recognition System .....	72
Figure 5.7 The platform developed for Voice Recognition System .....	73
Figure 5.8 System Deployment for QR Code.....	73
Figure 5.9 Arduino coding in QR Code system.....	74
Figure 5.10 Coding VB.NET for staff registration system.....	74
Figure 5.11 Coding VB.NET for video recording.....	75
Figure 5.12 System Deployment for RFID system.....	75
Figure 5.13 Coding for setup function.....	76
Figure 5.14 Coding for tag scanning.....	76
Figure 5.15 Coding for servo motor .....	77
Figure 5.16 System Deployment for Voice Recognition System.....	77
Figure 5.17 Coding for voice detecting .....	78
Figure 5.18 Coding for word recognising.....	78
Figure 5.19 Coding for user identification.....	79
Figure 6.1 Scanning code for Arduino.....	83
Figure 6.2 Scanning code for VB.NET.....	83
Figure 6.3 Scanning code for Arduino in RFID system .....	88
Figure 6.4 Details for the dangerous code .....	88
Figure 6.5 scanning code for Arduino in Voice Recognition.....	95
Figure 6.6 Scanning code for Python in Voice Recognition.....	95
Figure 6.7 Rules used to analyse Python code.....	96
Figure 6.8 Security Hotspots.....	96

## LIST OF TABLES

	PAGE
Table 1.1 Summary of Problem Statement.....	12
Table 1.2 Summary of the Project Research Question .....	13
Table 1.3 Project Objectives .....	13
Table 1.4 Project Contribution.....	15
Table 2.1 The comparison of the security methods .....	29
Table 5.1 Details of each pins number for QR Code.....	68
Table 5.2 Details of each pins number for RFID System .....	70
Table 5.3 Details of each pins number for RFID System.....	72
Table 6.1 Accuracy Analysis QR Code .....	80
Table 6.2 Scan Time for QR Code.....	81
Table 6.3 Scan Range for QR Code.....	82
Table 6.4 Accuracy Analysis RFID .....	84
Table 6.5 Scan Time for RFID .....	85
Table 6.6 Scan Range for RFID.....	87
Table 6.7 Accuracy Analysis Voice Recognition .....	89
Table 6.8 Scan Time Voice Recognition .....	93
Table 6.9 Scan Range for Voice Recognition.....	94

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## CHAPTER 1: INTRODUCTION

### 1.1 Introduction

As the crime rates are now raising, households and companies should take extra caution to prevent any unauthorized entries. Having an appropriate and secured gating system can prevent it from happening. However, there are a lot of approaches of security methods in automated gate. In this project, the security methods will be analyzed to come out which is the most secured to be implemented in the automated gate system.

There are many methods that can be implemented in automated gate system which are using QR (Quick Response) Code, Vehicle License Plate Recognition System, Radio Frequency Identification card reader, Voice Recognition System and Biometric System. Most of the companies will always pay more attention to the cost rather than the security aspect. It is crucial for companies to take security aspect more seriously to protect employees, sensitive data and the property from any unauthorized entries.

The current automated gate system in the market is offering a lot of different security methods to be implemented without knowing how secure it is. This analysis is being made to compare which security methods can offer better security and is actually worth every penny to splurge for it.

## 1.2 Project Problem Statement

For small companies and households, automated gate needs high installation and maintenance fees. Company will go for price, without taking care of the security aspect whereas security is an important element in gate technology. To make sure it is worth the price and also the security aspects, analysis should be done to compare the methods and knows which methods can provide a secure gating system. It is crucial for companies to use the most secured methods to be implemented in the Automated Gate System to protect employees and important documents from the unauthorized users. Nowadays, there are a lot of security methods that are being used in Automated Gate System. However, before deciding what security method to be used in the Automated Gate System, we need to know how secure it is, in order to protect the properties from unwanted entries. Thus, tools to analyze the security methods have not been identified yet. Automated Gate System is a part of a defense system that need a reliable security method to ensure only the authorized users can enter the property. To achieve that, tools to analyze the security methods need to be identified. Clients deserve to know the best security method before implementing them in the Automated Gate System.

**Table 1.1 Summary of Problem Statement**

PS	Problem Statement
PS1	The current automated gate system offers many different security methods without knowing how secure it is.
PS2	Some of the existing security methods have not identified specific tools that can be used to analyze them.
PS3	Clients do not know the best security method to be implemented in the Automated Gate System.

### 1.3 Project Research Question

Project Research Question is used to identify the question of the existing gate system. Based on the research, we can conclude that there are few weaknesses of the current gate system.

Table 1.2 shows the summary of the project research question.

**Table 1.2 Summary of the Project Research Question**

PRQ	Project Research Question
PRQ1	What is the security method that implemented in the Automated Gate System?
PRQ2	What tools can be used to analyse the security methods of the platform developed in Automated Gate System?
PRQ3	What is the best security method for Automated Gate System?

### 1.4 Project Objectives

Project objective defines the improvement that are achievable at the end of the project. The improvement must be considered based on the problem statement and the project research question of this project. The objectives of this project are shown at table 1.3 below.

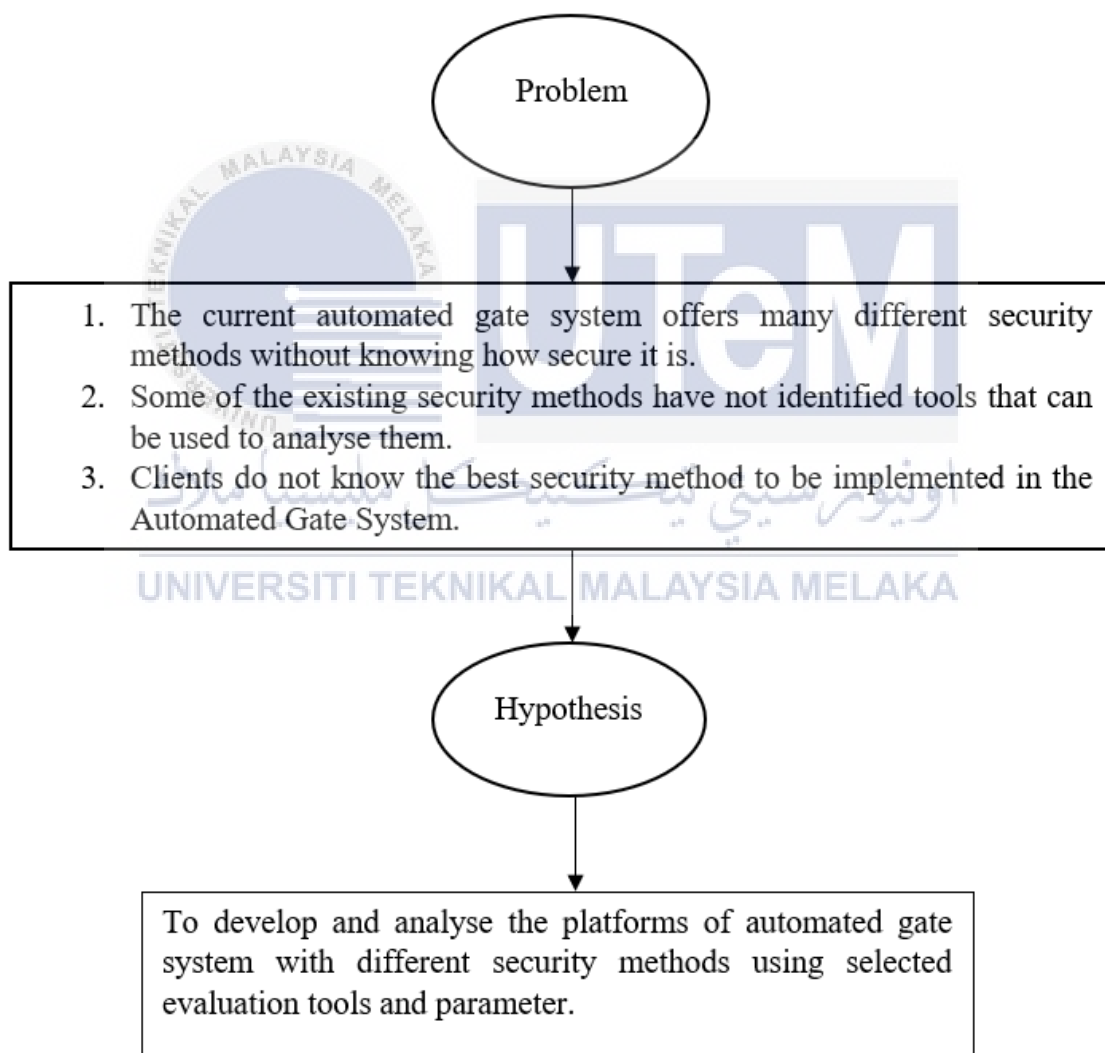
**Table 1.3 Project Objectives**

PO	Project Objectives
PO1	To identify security method, evaluation tools and parameter that implemented in Automated Gate System (AGS).
PO2	To develop the platforms of AGS with three (3) different security methods.
PO3	To analyse the platforms developed using the selected evaluation tools and parameter.



## 1.5 Project Research Hypothesis

A research hypothesis is the statement created by researchers to improve the outcome of a research. Based on the research, the current gate system has insufficient features and are installed blindly without having a reliable security implementation due to the lack of analysis have been made to compare the security methods, no tools to analyse the security method to be implemented and some of the existing automated gates do not provide any tools to monitor the system. Some of the hypotheses have been suggested to improve the current gate system. Figure 1.1 shows the problem of the current gate system and the hypothesis to make an improvement to the system.



**Figure 1.1 Project Research Hypothesis**

## 1.6 Project Scope

The main purpose of this research is to develop a platform of Automated Gate System with different security methods that is worth the money. The security methods will be analysed one by one, using selected tools to find out which security methods can offer the best security to be implemented in the Automated Gate System. After going through many aspects, such as the cost, installation fees, the most common security methods used in the current gate system, three security methods will be analysed using specified tools and techniques.

Techniques will be identified based on the types of security testing and after techniques have been identified, tools can be figured out.

Moreover, the system users will be the valid users and security department in the company. Any activities at the gate will be recorded for security purposes and if any unauthorized users are detected entering the properties, security department will be notified immediately to take any rapid response action.

The platform develop will then be analysed using the tools that will be promoted during project design phase. A literature review will be done to choose the tools that could be used to analyse the security methods listed.

## 1.7 Project Contribution

Project contribution defines the expected output from this project. This part can be referred to the objectives of this project. The project contribution can be referring to the Table 1.3 below.

**Table 1.4 Project Contribution**

PC	Project Contribution
PC1	Security methods that are going to be analysed are identified.
PC2	Proposed tools to analyse the security methods.
PC3	Proposed a platform that will be developed and analysed.

## 1.8 Conclusion

In conclusion, the Analysis of Security Method in Automated Gate System will be able to solve the problem that are facing by companies that know the importance of having a reliable security aspect. This analysis can help companies to choose the security method that will be implemented in the Automated Gate wisely. Companies can also have extra choices to choose and to decide which security methods are suitable to be implemented.

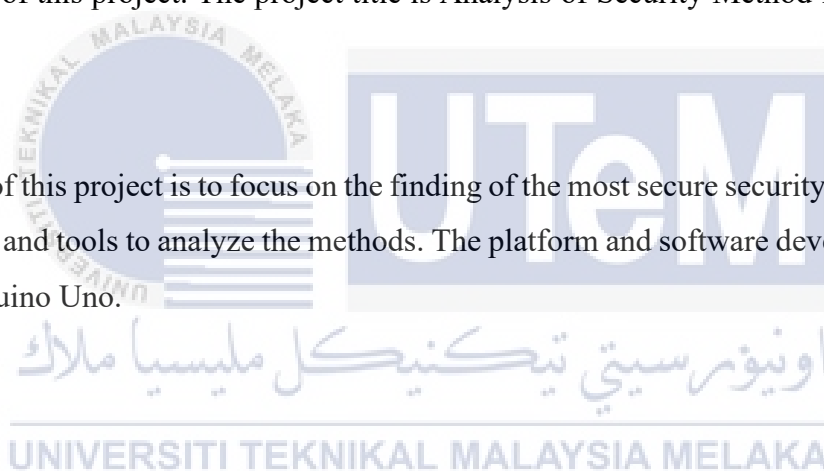


## CHAPTER 2: LITERATURE REVIEW

### 2.1 Introduction

This chapter will be discussing about the background of the security methods, the domain and the keywords, problem and solution of the security methods that will be used for the gate system and to have a better understanding about the concept, technique and tools needed to be implemented in this project. This chapter will also contain the related publish information and material or article, previous project findings and research that are related to the objective of this project. The project title is Analysis of Security Method in Automated Gate System.

The domain of this project is to focus on the finding of the most secure security method to be implemented and tools to analyze the methods. The platform and software development will be using Arduino Uno.



### 2.2 Related Work

An automated gate system without a secure security method applied is a big loss as it is a part of defense system to protect the property from unauthorized access. Based on Shoewu and Baruwa's work (2006), they used a microprocessor to monitor two gates that has sensors to sense any approaches from a vehicle. The gates will automatically open after sensing a vehicle, wait for a specified time and then close. It can be seen that these gates do not provide any appropriate security methods since any vehicle can enter the property.

According to Asha, Syed, Jayashree and Vijayashree (2018), security is the most fundamental issue wherever on the planet these days. Gate system is a part of

security system that is widely used in companies, personal properties and housing area to protect them against any unwanted intrusion from the outsiders. Knowing what security methods to be implemented will strengthen the security, increase the efficiency and secure the property from burglary.

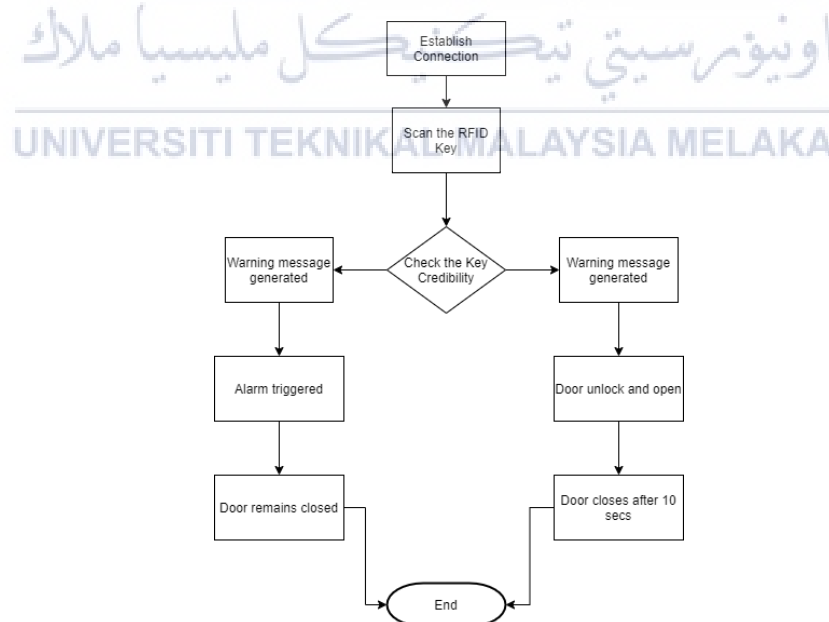
The idea of implementing automated gate system is not new as there are a lot of types already in the market. However, most of them are quite expensive and have a high installation fee. According to Erman, Lim, Nazrulazhar, Syarulnaziah and Zakiah (2018), installation and maintenance fees for automated gate systems in the market are expensive, which most of the small companies cannot afford to own. Erman et al. (2018) further described that small companies preferably taking risks not installing the gate system as they cannot afford the fee. Most companies will always go for the price first rather than paying attention on the security aspect. It is disappointing but companies are not at fault when they themselves do not know what the most reliable security method is to choose and the importance of implementing a secure security method.

Some of the existing and the most current security methods that are being implemented in the automated gate system are Radio Frequency Identification (RFID) technology (HR Choi, NK Park, DH Yoo, HK Kwon, JJ Shin, 2006), Biometric Identification system (Sanchez del Rio, Moctezuma, Conde, Martin de Diego, & Cabello, 2016), License Plate Recognition system (Al-Mahbashi, L. T. A., Yusof, N. A. T., Shaharum, S., Karim, M. S. A., & Faudzi, A. A. M., 2019) and QR Code (Hamid, Erman, Lim Chong Gee, Nazrulazhar Bahaman, Syarulnaziah Anawar, Zakiah Ayob, and Akhdiat Abdul Malek, 2018).

First, based on the work of HR Choi, NK Park, DH Yoo, HK Kwon, JJ Shin (2006), they were using RFID technology as a security method for the gate system. During the time they were working on the project in 2006, they have mentioned that the current security methods for automated gate system at that time were bar code and video identification technology. But bar code cards easily damaged that causes difficulty for the reading information process. For video identification, it offers better security than the bar code but it needs higher costs for installation and the possibilities to be affected by external

environments are high. Hence, they opted for RFID technology as it has a higher operational efficiency and can offer a tight global security. In this project, they had tested various positions of the tags and antenna to check identification rate along with two aspects which are truck access pattern and truck speed. After testing the tags with different position, access patterns and speed of the truck, the most optimal position were selected.

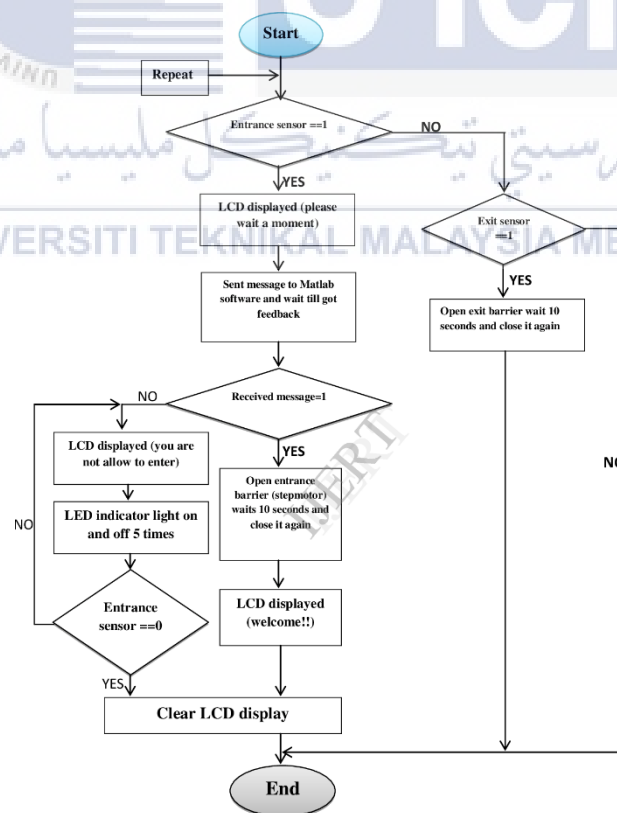
Another example for automated gate system using RFID is from Asha, Syed Navaz, Jayashree, & Vijayashree (2018) work. According to Asha, Syed Navaz, Jayashree, & Vijayashree (2018), the product that they worked on is made for administration, controlling, exchange activity and keeping up record of the different clients. Firstly, a new user will register with the system and the information of the new user will burn in RFID tag that will be accessible through the system. Then, whoever owns the RFID tag can enter to the property after the tag is put into the reader and the system admit the user as registered one and the information that in the RFID tag match with the information that is stored in the system. If the system recognised it as an imposter, the warning alarm will be triggered. Figure 2.1 will show the flowchart of system based on Asha, Syed Navaz, Jayashree, & Vijayashree (2018) work.



**Figure 2.1 Flowchart of the system**

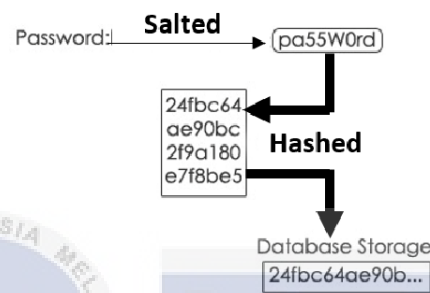
**(Asha. N, A. S. Syed Navaz, J. Jayashree, & J. Vijayashree, 2018)**

Next, another security method that is implemented in automated gate system is License Plate Recognition System. Ismail Saad Eltoun and Zhaojun Xue (2014) proposed an automatic gate control system based on vehicle license plate recognition. According to Ismail Saad Eltoun and Zhaojun Xue (2014), the system is based on PIC microcontroller and regular PC with video camera to catch video frames that also include a vehicle license plate and processes them. To implement the algorithm, they have used MATLAB software, Proteus and Micro C. For the flow of the system, the car will stand in front of the barrier first and then the IR sensor will send signal to the microcontroller to send message to MATLAB. A welcome message will then be displayed on the LCD. The image of the license plate from the camera will be analysed in MATLAB, where most of the data analysis part were done. Then, the analysed image of the license plate will be compared with the information stored in the database. If it matched, MATLAB would send a message to the microcontroller to open the gate and will be close again after some time. But, if the information did not match, the alarm will be triggered and a “you are not allowed to enter, please go back.” message will be displayed on the LCD. Figure 2.2 will show you the flowchart of the system.



**Figure 2.2 Flowchart of the process  
(Ismail Saad Eltoun & Zhaojun Xue , 2014)**

Next, QR Code is also one of the most recent security methods to be implemented in the automated gate system. Based on Erman, Lim, Nazrulazhar, Syarulnaziah and Zakiah (2018) paper, they have developed a QR code-based automated gate system. The main objective of the research is to develop a medium level security gate system mainly for small companies that cannot afford to install expensive auto gate system. Erman et al. (2018) further described that they implemented salted algorithm and hashing algorithm to increase the security level of the QR code and make it hard to crack. Figure 2.3 will show the example of the salted hashing algorithm.



**Figure 2.3 Example of the salted hashing algorithm**

**(Erman Hamid, Lim Chong Gee, Nazrulazhar, Syarulnaziah Anawar, & Zakiah Ayob, 2018)**

To produce a high-quality output, they also implemented RAD technology, where according to M. A. Hirschberg (1998), RAD is a four-phase software development cycle that combines the element of Standard System Development Life Cycle. The flowchart of the workflow of the system will be shown in Figure 2.4.