UNIVERSITI TEKNIKAL MALAYSIA MELAKA

AUTOMATIC RADIO FREQUENCY IDENTIFICATION GATE SYSTEM

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BACHELOR OF MECHANICAL ENGINEERING TECHNOLOGY (BMMV) WITH HONOURS

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Bachelor of Mechanical Engineering Technology (BMMV) with Honours

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A thesis submitted
in fulfillment of the requirements for the degree of
Bachelor of Mechanical Engineering Technology (BMMV) with Honours

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2023

DECLARATION

I declare that this project entitled “Automatic radio frequency identification gate system” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

Name : MUHAMMAD AFIF BIN BORHAN

Date : 27 January 2023

APPROVAL

I hereby declare that I have checked this thesis, and, in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Mechanical Engineering Technology (BMMV) with Honours.

Signature : .....

Supervisor Name : Ts. Dr. Nur Rashid Bin Mat Nuri @ MD Din

Date : 27/1/23

DEDICATION

Dedicated, in grateful and thankful appreciation for support, encouragement, and understanding to my beloved mother, father, brothers, sisters, and all my friends.

ABSTRACT

Congestion during peak hours in fenced areas gives many negative impacts such as waiting for security guards to open fences as well and queuing up to take attendance. Therefore, the RFID system and a combination of attendance apps were built to speed up the opening of the barrier and take staff attendance. In this project, the RFID system will be utilized in combination with the google form application to filter outgoing and incoming information of RFID owners before and after visitors enter the premises. It aims to reduce time taken for gate opening and by using this system, there was congestion during the queue to tick attendance. An additional feature of this automated radio frequency identification project is the inclusion of a smart parking concept, which allows the holder of a RFID card to see the available parking space on an LCD display before entering the facility. A sensor on the automobile parking section detects an incoming vehicle, and when the WeMo's D-1 receives a signal from the sensor, it sends the lcd display the number of vacant parking spaces in the area to show. It is expected that this system will apply in specific areas such as companies, universities, schools, and government premises. As the result, when the RFID receiver detects the car that comes automatically the admin will get a notification from the telegram stating the name and time the user enters the premises as the attendance staff. A prototype test was performed to test the infrared sensor according to the detection of a predetermined area. There are 3 detection areas that have been tested which are detect zone, 1 sensor only detect and not detect. In addition, the integration system between the prototype and the coding was completely successfully. An analysis has also been made to take the time data taken by the user to complete a car cycle into a premise. As a result of this, the time taken by the RFID system is shorter than the manual system. Hence, the RFID gate system is effective in saving time and reducing congestion that occurs outside the gate barrier to get into a premise.

ABSTRAK

Pelbagai jenis kesesakan yang berlaku pada waktu puncak antaranya di kawasan berpagar terdapat impak negatif seperti menunggu pengawal keselamatan membuka pagar dan beratur mengambil kehadiran. Oleh itu, sistem RFID dan gabungan aplikasi kedatangan staff diwujudkan untuk mempercepatkan pembukaan pagar serta mengambil kedatangan staff. Dalam projek ini, sistem RFID akan digunakan bersama dengan aplikasi google form untuk menapis maklumat keluar dan masuk pemilik rfid sebelum dan selepas pengunjung memasuki premis. Ia bertujuan untuk mengurangkan masa yang diambil untuk membuka pintu pagar dan dengan menggunakan sistem ini, tiada kesesakan semasa beratur mengambil kedatangan. Selain itu, projek automatik radio frequency identification ini dilenglakapi dengan smart parking concept, sistem ini berfungsi apabila sebelum masuk ke dalam premis pemilik rfid kad akan nampak di paparan lcd jumlah parkir kereta yang kosong atau penuh di dalam premis. Ini kerana apabila sensor infrared yang dipasang pada bahagian parkir kereta mengesan kenderaan masuk ke dalam premis secara automatik sensor memberi tindak balas pada wemos D-1 untuk menghantar jumlah parkir yang kosong ke paparan lcd. Dijangka sistem ini akan terpakai di kawasan tertentu seperti syarikat, universiti, sekolah dan premis kerajaan. Sebagai hasil daripada projek ini, apabila penerima RFID mengesan kereta yang masuk secara automatik admin akan mendapat pemberitahuan daripada telegram yang menyatakan nama dan masa pengguna masuk ke sesuatu premis sebagai kakitangan kehadiran tersebut. Ujian prototip telah dilakukan untuk menguji sensor inframerah mengikut kawasan pengesanan yang telah ditetapkan. Terdapat 3 kawasan pegesanan yang telah diuji iaitu semua sensor dapat dikesan, satu sensor sahaja yang dapat dikesan dan tidak dapat dikesan oleh sensor. Selain itu, penyepaduan sistem antara prototaip dan pengekodan telah berjaya sepenuhnya. Analisis juga telah dibuat bagi mengambil data masa yang diambil oleh pengguna untuk melengkapkan satu kitaran kereta masuk ke dalam sesuatu premis. Hasil daripada kajian dibuat masa yang diambil oleh RFID sistem lebih singkat berbanding sistem manual. Oleh itu, projek RFID gate sistem ini berkesan untuk menjimatkan masa dan mengurangkan kesesakan yang berlaku di luar gate barrier untuk masuk ke sesuatu premis.

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TABLE OF CONTENTS

PAGE

DECLARATION

APPROVAL

DEDICATION

ABSTRACT i

ABSTRAK ii

ACKNOWLEDGEMENTS iii

TABLE OF CONTENTS iv

LIST OF TABLES vi

LIST OF FIGURES vii

LIST OF SYMBOLS AND ABBREVIATIONS ix

LIST OF APPENDICES x

CHAPTER 1 INTRODUCTION 11
1.1 Background 11
1.2 Problem Statement 12
1.3 Objective 12
1.4 Scope of project 12
1.5 Report Organization 13

CHAPTER 2 LITERATURE REVIEW 14
2.1 Introduction 14
2.2 Implementation of Open and Close a Housing Gate Portal using RFID Card 14
2.3 Implementation of RFID system in Libraries: A case study in UPES library 15
2.4 Attendance System Design and Implementation Based on Radio Frequency Identification (RFID) And Arduino 17
2.5 A Comparative Survey on Silicon Based and Surface Acoustic Wave (SAW)-Based RFID Tags: Potentials, Challenges, and Future Directions 19
2.6 Theoretical Calculations of Feeders 19
2.7 Automated Tracking System Using RFID for Sustainable Management of Material Handling in an Automobile Parts Manufacturer 20
2.8 Radio Frequency Identification (RFID) Based Attendance System with Automatic Door Unit 22
2.9 Conclusion 25

CHAPTER 3 METHODOLOGY 26
3.1 Introduction 26
3.2 Flowchart 27
3.3 Automatic RFID gate system development 28
3.4 Hardware Development 28
3.5 Automatic RFID gate block diagram 28
3.6 Automatic RFID gate system flow chart 29
3.7 Wemos-D1 30
3.8 Arduino Uno 31
3.9 Infrared sensor 32
3.10 RFID receiver and transmitter 33
3.11 Servo Motor 34
3.12 LED Display 35
3.13 Software Implementation 36
3.14 List of Component 37
3.15 Drawing Assembly 38
3.16 Drawing system 39
3.17 Hardware implementation 39
3.17.1 Circuit Flow 39
3.17.2 Breadboard Test 40
3.18 Software implementation 41
3.18.1 Making Telegram Bot 41
3.18.2 Telegram connection by microcontroller 42
3.19 Finalizing Project 43

CHAPTER 4 RESULTS AND DISCUSSION 45
4.1 Introduction 45
4.2 Pretesting device 45
4.2.1 Sensor Function ability check 45
4.2.2 Prototype Testing 47
4.3 Data Analysis 48
4.4 Result and Discussion 52

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS 53
5.1 Conclusion 53
5.2 Recommendation 53

REFERENCES 54

APPENDICES 56

LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1	Battery-Free Temperature Sensor with Liquid Crystal Elastomer Switching Between RFID Chips (Shafiq et al., 2020)	20
Table 3.1:	Spectification Wemos D-1	31
Table 3.2:	Servo Motor Specification	34
Table 3.3:	List of component	37
Table 4.1:	Data collected at Mydin MITC	48
Table 4.2:	Data Collected at Garden Plaza	50

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1:	Automatic Gate Portal design (Sari et al., 2021)	15
Figure 2.2:	Working in RFID System in Library(Chhetri & Thakur, 2019)	16
Figure 2.3:	The data communication of SPI pins (Rikabi et al., 2018)	19
Figure 2.5:	On-site system setup configurations using (a) single antenna, (b) doubled antenna (Jamaludin et al., 2018)	21
Figure 2.6:	RFID Technology Students attendance system.(Nosiri, 2013)	23
Figure 3.1:	Flow Chart in developing project	27
Figure 3.2:	The automatic RFID gate system block diagram	28
Figure 3.3:	Automatic RFID gate detection system flow chart	29
Figure 3.4:	Automatic RFID parking system	30
Figure 3.5:	Wemos-D1	30
Figure 3.6:	Ultrasonic sensor	31
Figure 3.7:	Infrared sensor	32
Figure 3.8:	RFID receiver and transmitter	33
Figure 3.9:	Servo Motor	34
Figure 3.10:	LED Display	35
Figure 3.11:	Software Implementation	36
Figure 3.12:	Drawing assembly	38
Figure 3.13:	Drawing system	39
Figure 3.14:	Arduino IDE Program	43
Figure 4.1:	Testing sensor prototype	45

Figure 4.2: Prototype testing 47

Figure 4.3: Total Time Taken against Number of car at Mydin Mall 49

Figure 4.4: Total Time Taken against Number of car at Garden Plaza 51

LIST OF SYMBOLS AND ABBREVIATIONS

RFID	-	Radio Frequency Identification
UPC	-	Universal Product Code
v	-	Voltage
w	-	Walt
LED	-	light-emitting diode
LCD	-	Liquid-crystal display
IoT	-	Internet of thinking

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
APPENDIX A	RFID receiver and transmitter data	56
APPENDIX B	Infrared sensor specification	57
APPENDIX C	Gantt chart psm 1	58
APPENDIX D	Gantt chart psm 2	59
APPENDIX E	Coding RFID System	60-61
APPENDIX F	Turnitin report	62-65

CHAPTER 1

INTRODUCTION

1.1 Background

Radio-Frequency Identification (RFID) is a technology that enables data to be transmitted securely at very fast speeds. It also doesn't require a line of sight like barcodes do, which means that it is more user-friendly and able to be used in a wide variety of settings. Data relating to an object is stored on an RFID tag which can be added to an item. The tag carries this data in a small but powerful chip and operates in a variety of radio frequencies. An RFID reader is used in conjunction with the chip in order to transmit the data securely and in that way, you can rely on the safe communication of information RFID compliance is required, applications that currently use barcode technology are good candidates for upgrading to a system that uses RFID or some combination of the two. In addition, RFID tags are not susceptible to the damages that may be incurred by barcode labels, like ripping and smearing. A singular challenge in modern security is controlling access to a facility (whether industrial or residential), while upholding the level of protection required. The traditional solution is a gated entry or security gate built in the center of a security fence or other structure. While it is always possible to have human-powered security gates with guards who check and clear those seeking entry and allow or deny access, it is not cost efficient or easily managed. It is an outdated system in the face of an RFID tag and vehicle access control system. This RFID automated gate system is ideal for use in government buildings, educational institutions, and commercial establishments. This is due to the fact that the system can lessen the amount of traffic outside the building during peak hours. The person

in charge of the building's security system will be able to access data on employee arrivals and departures thanks to this initiative.

1.2 Problem Statement

People need to wait outside until the security guard or person-incharge opens the door. Furthermore, during time peak hour, the gates will always be open, at the same time outsiders will take the opportunity to enter the area without permission. So this RFID gate will only allow registered vehicle to enter the car park. Finally, by using RFID gate manpower can be reduced.

1.3 Objective

1. To develop RFID autogate system prototype using Arduino platform
2. To develop vehicle parking and customer personnel monitoring system
3. To access the time management front of autogate system

1.4 Scope of project

1. To realize this type of radio frequency identification gate system by considering time constrain and low-cost device.
2. Physical prototype will be produced namely automatic RFID gate system.
3. An Arduino Uno and HCSR-04 ultrasonic sensor will be use.

1.5 Report Organization

This report is presented in five chapters. Chapter 1 fixated on brief prelude of the project carried. The paramount overview or description including problem statement, project objective and project scopes are well accentuated in this chapter.Chapter 2 will be predicated on literature review of the project. It is mainly fixatedon the precedent research and the conceptual information applied on this system.Chapter 3 will expound on the concept, theories and principles used to consummatethe project. This component consists of the methodology and the information on research and experiment during the project development.Chapter 4 will be explaining more detail about the outcome of the result. This is including data analysis, output of the project and how the experiment of the project thathad been done. Chapter 5 will be discussion about the project, future work and conclusion toconclude the entire project done

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will give a detailed description about what have been published on some topics by scholars and researchers. The main purpose of writing this literature review is to gets knowledge and ideas that have been established about automatic radio identification gate system that focusing reduce traffic congestion and maintains the lock system security.

Moreover, there are resources on the topic of automatic radio frequency identification that have been widely published. The information has been collected from different resources such as published documentation, white paper, and journals in the web site

2.2 Implementation of Open and Close a Housing Gate Portal using RFID Card

Needs assessment the housing gate portal was left open by security so that anybody could readily access the housing area, allowing criminal actions like as stealing to often occur, and this was examined by whydunit in Widia Graha I, which is situated at Jalan Srikandi, Kel. Delima Kec. Tampan, Pekanbaru - Riau. An automated gate portal that can open and shut to prevent people without an RFID card from entering the residential area and having to report to security was built based on the issues found in Widya Graha I am housing and the research done by kumar [17]. Fonda [18] investigated how the system can read sensors on the RFID card and then automatically activate the gate entrance at this moment.

Tool Design after the design phase of the design is done in roughly two months, this tool will be built and developed. The Making a PCB prototype containing gate portal for testing

prior to installation was a step in the development of this product by Joshi. Implementation is the stage when the design that was created in the previous stage is put into practise. This system was developed by rouan utilising Arduino Uno and the C++ programming language.

Testing In this step, the sensor is coupled to an RFID card, and the portal reads the sensor and subsequently opens. Upon exiting the gateway, it will immediately shut off. Zhang examined how user-conducted testing works. Currently, mohandes is doing maintenance on the housing gate portal sensor to ensure that it continues to function properly. Implementation, the fourth step in the process. Hardware Design A hardware design is a tool, or a set of tools used to put into practice housing gate opening and closing using an RFID card.

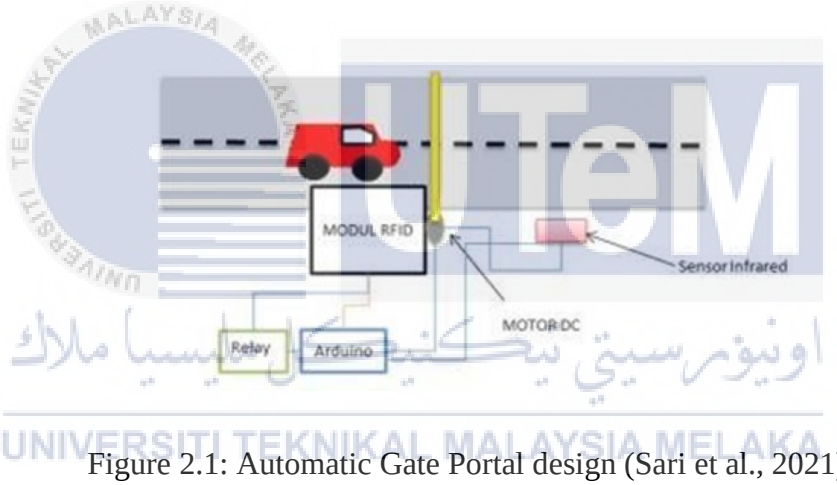


Figure 2.1: Automatic Gate Portal design (Sari et al., 2021)

2.3 Implementation of RFID system in Libraries: A case study in UPES library

The 21st century's most critical and cutting-edge technology is Radio Frequency Identification (RFID). Currently, it's one of the most contentious ICT innovations around. Library RFID systems were first used in the late 1990s to replace their barcode-based systems. RFID aids in the protection of library resources, as well as the circulation process, user service, and the reduction of library theft. An academic library or large public library's RFID implementation budget is a hot topic right now. However, the cost of RFID components is decreasing daily. With this research, we can gain an idea of the estimated

costs of deploying an RFID system in a library. Dehradun, Uttarakhand, is where UPES was founded in 2003. A central library, a school of law library, and a business library now exist at UPES. Books, dissertations, bound volumes of periodicals, and more make up around 2 million papers in the three libraries together. Securitization is needed for all of this. Using RFID in these three libraries is a major factor in their success.

More than 1.5 million volumes and 300 CDs in the domains of engineering, design, management, and law are housed in three UPES libraries: the Central Library, the School of Business Library, and the School of Law Library. The UPES library used LIBSYS software in the past. It was moved to open source ILMS KOHA in the year 2013. A scanner is used to check out library materials, which have been barcoded with the accession number as an identification. To ensure the accuracy of library materials, barcode scanners and laptop computers are used for stock checking. RFID and Koha were used at UPES library in order to improve stock taking, circulation, and document security. In order to enhance library services, RFID systems were installed in 2017 at three locations across two UPES campuses.

Requirement analysis, technical assessment, process evaluation and budget evaluation are all part of the RFID implementation process. First, a team of topic specialists, communication engineers, application developers, and professional staff was created, and the team worked together throughout the process.

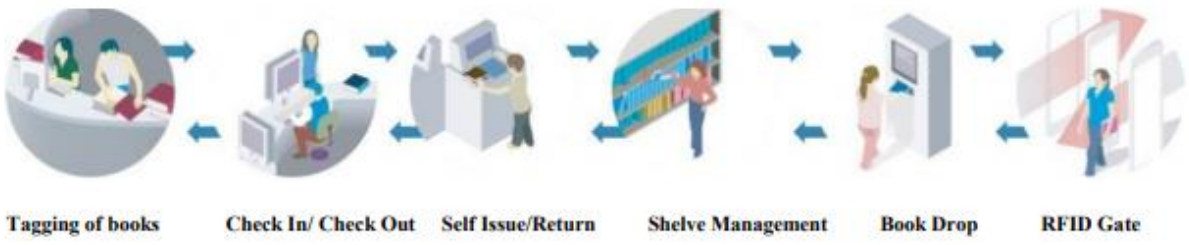


Figure 2.2: Working in RFID System in Library(Chhetri & Thakur, 2019)

2.4 Attendance System Design and Implementation Based on Radio Frequency Identification (RFID) And Arduino

When it comes to identification, RFID is the better option since it is both easier and more accurate. RFID is not the only way of identifying; barcodes, optical character recognition, and intelligent carts are all options. There are alternative methods, but RFID is the most often used since it is simpler and less expensive. There are a variety of uses for RFID technology, including transportation and logistics, postal tracking, time-and-attendance monitoring, security, and even animal identification and tracking. RFID tags may be used to uniquely identify each item. RFID tags and readers are the two major components of the RFID system. Small transmitters that reply wirelessly to queries or inquiries and broadcast a code number matching to the identifier make up an RFID tag. Electromagnetic waves emitted by a Reader are absorbed by the tags antenna and generate a current. In addition to student identification, this strategy may be used to get access to a facility or sell a business. The hardware and software components of the system described in this study divided into two major categories. The hardware is built utilising (RFID,Arduino, and microcontroller panel) that can expose a unique ID that is not found on the student card. The programme is set up to keep track of the number of hours a student has spent with an attendant and show that information on a screen. When it comes to the old method of registering students' guests, time and accuracy are two of the most typical issues. In a classroom with many pupils, some children are unable to hear their teacher's voice call out their names. The RFID system was created to address the issues raised above. Each student is given a unique ID card under this method. Attendees will be able to sign up right away, saving time and reducing the possibility of human mistake. At the same time, the university's website may be updated with a list of student attendees.

Using Bluetooth, Vishal Bhalla, Ankit Gahlot, and Vijay Gupta were able to implement an attendance tracking system in 2013. Using this strategy, an application was installed on the instructor's mobile phone that allowed it to query the student's phone over Bluetooth. The existence of the student may be established when the student's mobile phone data, Media Access Control (MAC) addresses, are sent to the instructor's mobile phone. This technique has certain drawbacks, such as the fact that a student's phone is essential for participation. A student's absence from class will not be recorded in the attendance system if he does not have his cell phone with him. An advanced method that is more advanced than RFID identification and punching the presence of authorised visitors was suggested by Gaganpreet Kaur Marwah, Yashi Mishra and Shekhar Verma back in 2015. "Voice greetings" will be a new feature to be introduced. The unique feature of this concept was the usage of an SD card module to store several audio files with unique names. Then quote them with each tag's unique identifier.

As a result, the selected audio file will be played anytime a card is identified. Students' attendance records may be stored on a memory card using an excel sheet if their card identifiers match those in the database. In this work, we come up with a novel concept.

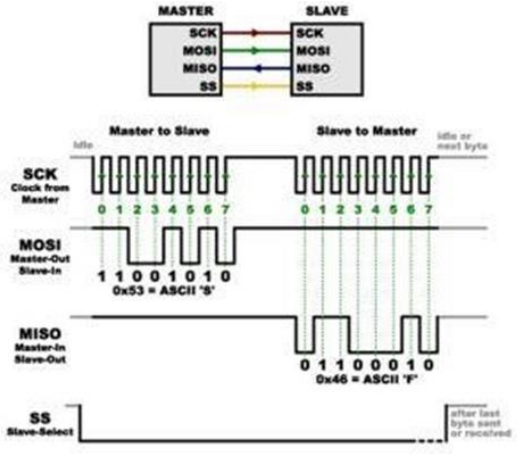


Figure 2.3: The data communication of SPI pins (Rikabi et al., 2018)

2.5 A Comparative Survey on Silicon Based and Surface Acoustic Wave (SAW)- Based RFID Tags: Potentials, Challenges, and Future Directions

Although the major emphasis is on comparing several RFID tag technologies that are well-known and widely used, an RFID system is only complete and usable if it includes an interrogation mechanism, which is generally from an external source. An RFID reader is the source of this information. An RFID reader interrogates proximity tags by emitting any sort of signal, which varies based on the type of tag utilised. Many critical characteristics, including as frequency of operation, transmit power, antenna gain, internal losses in the tag, and so on, influence how the tags are probed. As a result, prior to presenting different kinds of RFID tags, the reader technology must be taught (Suresh et al., 2020).

2.6 Theoretical Calculations of Feeders

As a result, a direct comparison of the functionality of a commercial RFID temperature sensor to our suggested solution is instructive. Table 1 depicts and emphasizes such a comparison. TABLE NO. 1 AMS technologies' SL-900A sensory tag chip is compared to our sensor. the benefits of our proposed sensor over AMS Technologies' SL900A Sensory Tag Chip [16], [17]. Passive RFID temperature sensors that function through controlled changes in antenna performance have been studied thus far.

[21], for example, described a sensor whose working frequency is determined by the ambient temperature. This sensor uses a mix of meandering transmission lines and a T-matching network to match a dipole antenna to an RFID IC.

Table 2.1 Battery-Free Temperature Sensor with Liquid Crystal Elastomer Switching Between RFID Chips (Shafiq et al., 2020)

Parameter	Developed Sensor in this Research	SL900A
Technology	Passive: Maintenance free and Cost-effective	Active Operation: Uses batteries that require yearly replacement [17] OR Passive Operation: Compromised accuracy due to EM heating [16, p. 14]
Temperature Range	-10° C (Adaptable to any temperature by modifying the design of the LCE)	-29° C to +58° C
Tracking Domain	Continuous Monitoring: Operates in real-time without any resetting	Data-Logger: Limited to a finite amount of temperature storage points (i.e., 841 points)
Sensing Functionality	Using Changes in Antenna Performance	Using an Onboard Sensor IC
Data Accessibility	Any RFID reader can be Utilized: Only EPCs need to be read	Extra Layer of Software is Required to Plot Temperature Data

2.7 Automated Tracking System Using RFID for Sustainable Management of Material Handling in an Automobile Parts Manufacturer

This RFID technology also has a favorable impact on the well-being of the general people. Reference In an experiment that used RFID technology to track the quantity of recyclable material collected, [6] has proven success. This initiative has had a positive impact on the community's well-being through reducing pollution and stimulating the economy. Furthermore, [3] has persuaded consumers and stakeholders that food supply chain information openness benefits to social sustainability. The term "information transparency"

refers to the availability of data that is accurate, trustworthy, timely, and particular to a certain item. RFID technology makes food product information readily available to all parties involved in the food supply chain. visibility of food products graduallyincreases consumer trust in food intake and creates a sense of security.

In the case study where an automated monitoring of material handling operations employing kitting trolleys at a receiving dock of an automobile manufacturing facility is sought, RFID technology is a good fit, according to the evaluation. A ten-day pre-implementation study of the RFID-based system was conducted prior to its deployment in the field. Specifically, the receiving dock's existing material handling performance was the focus of the investigation. In this research, the most important logistical operations were documented. The receiving dock's material handling operation is currently done by hand. Table 2's preliminary data suggest that emptying a completely filled kitting trolley takes an averageof 104.6 minutes, while loading an emptied trolley takes an average of 33.6 minutes. The two material handling procedures take varying amounts of time on average because of the quality and number of inspections necessary on vehicle components before they are sent to storage. While the kitting trolley transfer times were vastly variable, the time it took fordelivery order confirmation and loading/unloading was roughly 9 to 10 minutes.

Figure 2.4: On-site system setup configurations using (a) single antenna, (b) doubled antenna (Jamaludin et al., 2018)

2.8 Radio Frequency Identification (RFID) Based Attendance System with Automatic Door Unit

The Universal Product Code (UPC) is a 12-digit number that is used to uniquely identify retail merchandise. It appears on the product alongside a barcode, which is a machine-readable representation of the UPC. The first six digits of the UPC represent the vendor's unique identification number, which is the same for all products sold by that vendor. The next five digits identify the specific product, and the last digit is the check digit, used to verify that the UPC has been read correctly. The check digit is calculated each time the barcode is scanned, and if it does not match the check digit on the UPC, the computer knows that there is an error in the UPC.

RFID RFID (Radio-Frequency Identification) tags are devices that use radio waves to communicate information with a reader. There are three types of RFID tags: passive, active, and battery-assisted passive. Passive RFID tags do not have a battery and rely on the energy from the reader to power the tag's circuit. Active RFID tags have an on-board battery that is used to continuously broadcast or beacon its signal. Battery-assisted passive RFID tags have a small battery that is activated when in the presence of a RFID reader.

RFID tags typically consist of two parts: an integrated circuit, which stores and processes information and modulates and demodulates radiofrequency signals, and an antenna, which receives and transmits signals. RFID readers can be classified into two types based on mobility: fixed and mobile. Fixed RFID readers are stationary and typically set up in specific interrogation zones to create a "bubble" of RF energy that can be tightly controlled. This allows for a very definitive reading area for when tags enter and leave the zone. Mobile

RFID readers, on the other hand, can be moved around and read tags wherever they are located.

A RFID system designed by a student at the University of Malaysia, Mohd Firdaus Bin Muhyiddin in 2008 for attendance system for students, it only takes attendance and stores the information in the database but does not incorporate a door unit that only allows access to registered users.

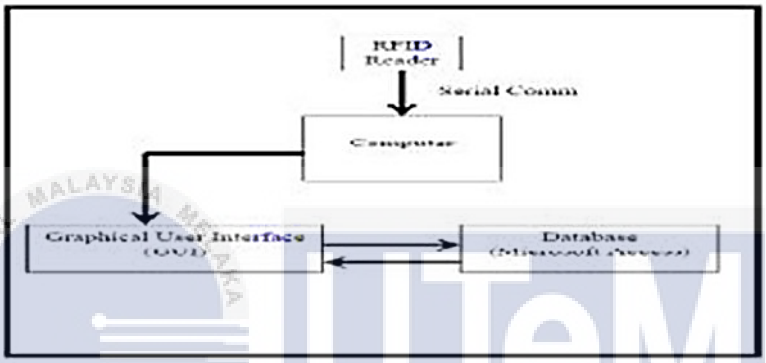


Figure 2.5: RFID Technology Students attendance system.(Nosiri, 2013)

The article "Smart Attendance System Based on Frequency Distribution Algorithm with Passive RFID Tags" describes a system that uses RFID technology to track attendance. The system's implementation is described in depth, covering the hardware and software used, as well as the experimental conditions.

a. Hardware: A system prototype was created using off-the-shelf RFID components, including an Imping R420 RFID reader, an Imping H47 omnidirectional tag, and an 8-dBi linearly polarized antenna. The reader was connected to a local server using an Ethernet cable. The system's default operating frequency was set at 920.625 MHz, with a wavelength of 32.587 cm. The antenna was placed 1m away from and 1.2 m above the tag and was parallel to it, with the tag at the centre of the line of sight (LOS) link.

b. Software: The system's software was written in C and ran on a personal computer using a low-level reader protocol. The program was connected with the Octane SDK during data collection and continually interrogated the tag at a rate of 340 readings per second in order to capture physical layer information such as phase, RSSI (received signal strength indicator) and Doppler shift. (Miao et al., 2020)

"A New Mutual Authentication Protocol in Mobile RFID for Smart Campus" is an article discussing the implementation and security of RFID technology in a campus setting. RFID technology has become widely adopted for identification and tracking in various applications, but the security of RFID systems has become a concern as their use has become more widespread and complex.

Three main categories of security concerns are highlighted in the article:

a. Data security: The security of the data stored and transmitted by RFID systems is a primary concern for campus card service providers.
b. Personal privacy: RFID systems raise concerns about the potential invasion of privacy for campus card holders, particularly with regards to the tracking and monitoring of their movements and activities.
c. The security of RFID systems: The protocol the systems use could be vulnerable to attacks that could allow unauthorized access to the systems and the data they store.

The article proposes a new mutual authentication protocol as a solution to address these security concerns in mobile RFID systems for smart campus. (Zheng et al., 2018).

2.9 Conclusion

As the conclusion, all the method in the application in previous research has its own advantages and disadvantages according to the specification of each project or the element that are used. Based on the previous research, it will be acting as a guideline or references to finish my project. The project will be a system where when someone tries to lift up the vehicle, the buzzer and led will turn on and the owner of the vehicle will get some notification through their smart phone application.

CHAPTER 3

METHODOLOGY

3.1 Introduction

In the methodology part will discuss how to achieve the objectives. Moreover, thispart will explain on how to do this project by making circuit, software and hardware.

3.2 Flowchart

Figure 3.1 shows the flowchart of the methodology used to develop this project. The method used is explaining detail in this chapter including literature review, hardware design, software design and project demonstration after completing the whole task.

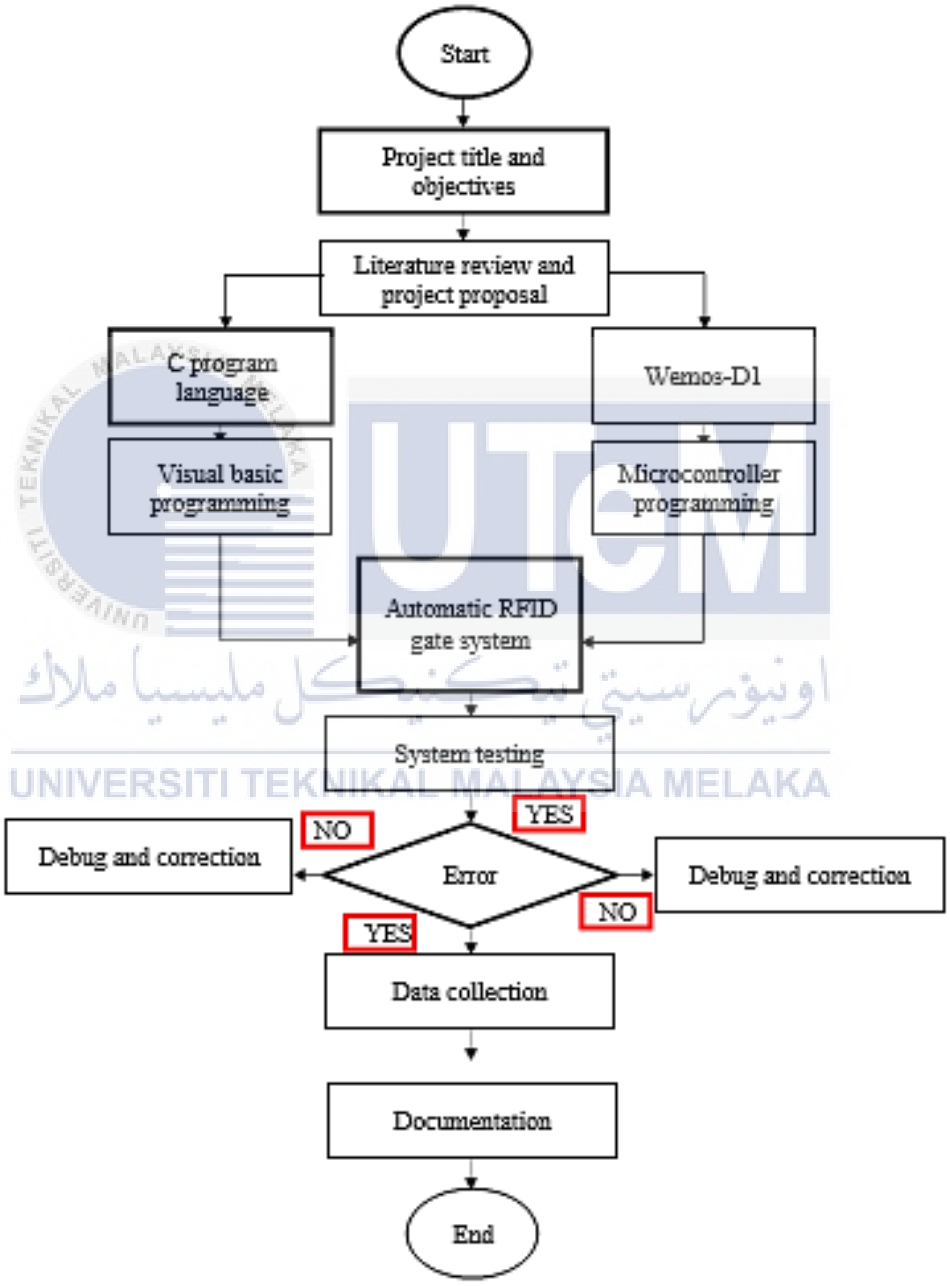


Figure 3.1: Flow Chart in developing project

3.3 Automatic RFID gate system development

The creation of both the hardware and the software for the automatic RFID gate system is one of the most important aspects that must be taken into consideration. The software portion is more focused on how to achieve the appropriate programming for the circuitry WeMos D-1 and the circuit of connect telegram data, while the hardware part focuses more on the component selection, the design of the WeMos D-1 circuits, the sensor, and the mechanical gate system.

3.4 Hardware Development

The sensor and motor gate system, as well as the WeMos D-1 circuitry, are all critical components of the automated RFID gate system's hardware development.

3.5 Automatic RFID gate block diagram

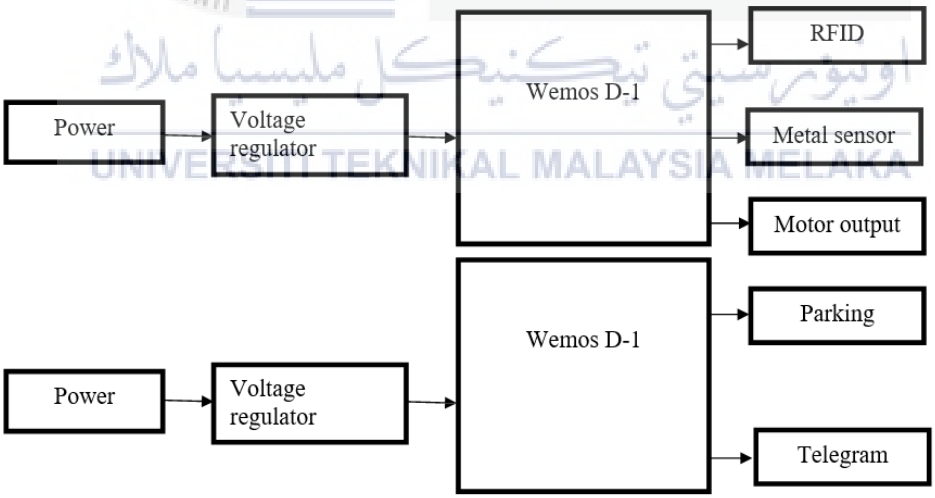


Figure 3.2: The automatic RFID gate system block diagram

3.6 Automatic RFID gate system flow chart

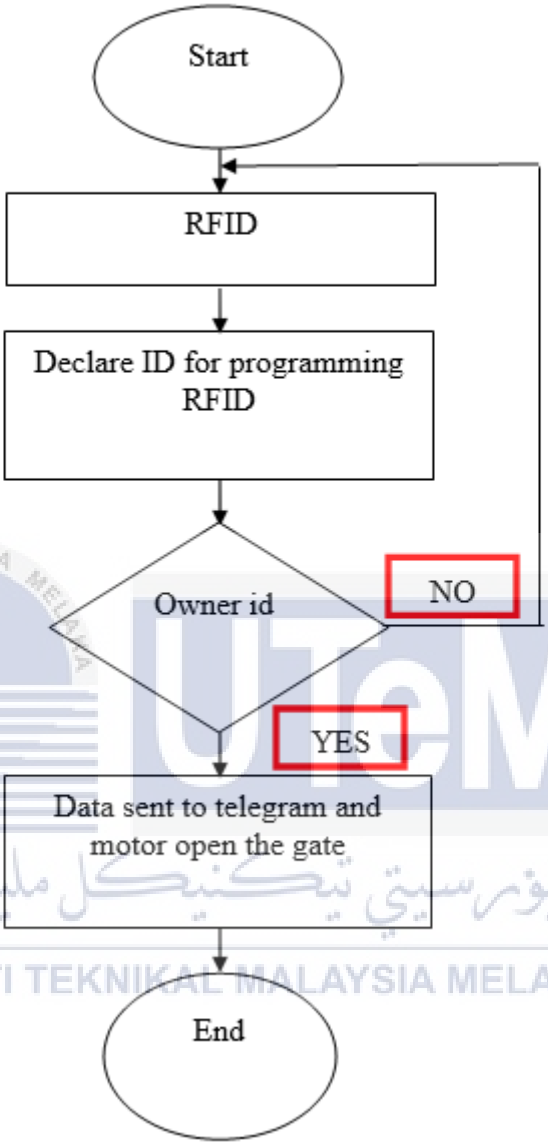


Figure 3.3: Automatic RFID gate detection system flow chart

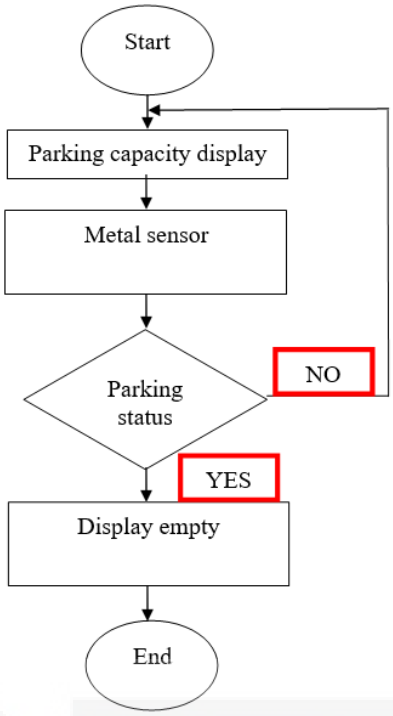


Figure 3.4: Automatic RFID parking system

3.7 Wemos-D1

WEMOS D1 is a WIFI development board based on ESP8266 12E. The functioningis similar to that of NODEMCU, except that the hardware is built resembling Arduino UNO. The D1 board can be configured to work on Arduino environment using BOARDS MANAGER. The power jack will be between 9-24v power inputs.

Figure 3.5: Wemos-D1

Table 3.1: Spectification Wemos D-1

Components	spectification
Microcontroller	ESP-8266EX
Operating voltage	3.3 V
Digital I/O	11
Analog input pins	1
Clock speed	80MHz/160MHz
Flash	4M bytes

3.8 Arduino Uno

The ATmega328P-based Arduino Uno is an open-source microcontroller board. A USB port, a power jack, an ICSP header, 6 analogue inputs, a reset button, and 14 digital I/O pins are all included. It includes every module required to support the microcontroller. To begin, simply use a USB cable to connect it to a computer or an adapter to provide electricity. Without too much concern, you may explore with your Arduino. The Uno is extremely affordable compared to other boards like the Raspberry Pi, STM.

Figure 3.6: Ultrasonic sensor

- Microcontroller: The Arduino Uno's main processing element is a microcontroller.
- Digital Pins: The Arduino Uno has 14 digital pins that may be used to connect devices like LEDs and LCDs.

- Six analogue pins are included on the Uno. Since all sensors typically have analogue values, these pins are typically utilised to link sensors. Here, the majority of the input parts are linked.
- Power supply: Because all sensors typically have analogue values, the power supply pins IOREF, GND, 3.3V, 5V, and Vin are utilised to connect sensors. Here, the majority of the input parts are linked.

3.9 Infrared sensor

Figure 3.7: Infrared sensor

An IR sensor is a gadget that produces light to detect objects in its immediate environment. As well as detecting motion, an IR sensor is capable of measuring an object's temperature. Every thing emits some sort of heat radiation in the infrared spectrum on average. Our eyes cannot see these radiations, but an infrared sensor is able to pick them up. IR LEDs and IR photodiodes serve as the source and detector, respectively. Infrared light of the same wavelength as the LED's IR light may be detected by the photodiode. The photodiode's resistances and output voltages will alter in accordance to the magnitude of the IR light received. A typical infrared detection system consists of an infrared source, a transmission medium, an optical component, infrared detectors or receivers, and signal processing, all of which are essential components. A certain wavelength of infrared lasers

and infrared LEDs are employed as infrared sources. Vacuum, atmosphere, and optical fibres are the primary mediums for infrared transmission. Infrared radiation may be focused using optical components, or its spectrum response can be limited.

3.10 RFID receiver and transmitter

Figure 3.8: RFID receiver and transmitter

It comes with a 13.56MHz RF reader/writer module, two S50 RFID cards, and an RC522 IC for reading and writing. Contactless communication at 13.56 MHz may be achieved with the MF-RC522 transmission module. The ISO 14443A/MIFARE mode is supported by RC522. You may use this NXP RFID Reader/Writer in smart metres and handheld devices since it consumes very little power and is very cost-effective. Various positive non-contact communication protocols may be used with the system's sophisticated modulation technology running at a frequency of 13.56MHz. 14443A response signal compatibility is required. Frames and error correction in ISO14443A are dealt with by DSPs. An excellent modulation and demodulation algorithm in the RC522 - RFID Reader allows for easy RF connection at 13.56 MHz. The 13.56 MHz RF transition may be added to your project with the aid of the S50 RFID Cards.

3.11 Servo Motor

SZGH-11180DC is 1800W servo motor system,6.0Nm,3000RPM. specailly design with bigger and beautiful contour, large load , long-term continuous working in rated working mode.

Figure 3.9: Servo Motor

Table 3.2: Servo Motor Specification

Product name	SZGH-11180DC 1800W SERVO MOTOR
Rated power	1800W
Rated current	6.0A
Rated voltage	220V
Rated speed	3000RPM
Encoder resolution	2500PPR
Rated torque	6.0Nm
Peak torque	18.0Nm
Rotor inertia	0.00076kg.m^2

3.12 LED Display

The LCD1602 is a type of character-based liquid crystal display (LCD) module that is used to display letters, numbers, and characters. It is composed of a matrix of dots, with each dot representing one character. The LCD1602 has a 5x7 or 5x11 dot matrix, with a dot pitch between characters and a space between lines to separate the characters and lines. The "1602" in its name refers to the fact that it can display 2 lines of 16 characters each.

The LCD1602 typically has parallel ports, which means that it requires several pins to be controlled at the same time. There are two ways to connect the LCD1602 to a controller, such as SunFounder Uno board, 8-port and 4-port connection. 8-port connection takes up all the digital ports of the controller and won't have any ports available to connect other sensors. So, the 4-port connection is recommended, it uses less pins of controller which is more convenient to connect more sensors.

Figure 3.10: LED Display

3.13 Software Implementation

Figure 3.11: Software Implementation

The next step was the construction of the programmed, which included the creation of detect sensors RFID and IR for the parking lots. In order to successfully write the code for this automated RFID gate system, you will need to utilize the Arduino IDE software version 2.0. It is the most current release that the Arduino company has made available. The Arduino programming language, Java, is based on the C++ programming language and is used to write the code.

3.14 List of Component

A project automated radio frequency is made up of several components that aid in its proper operation and processing. This component list has seven components, each with a variable amount value based on the product specifications. Online platforms and electronic stores are used to acquire this component.

Table 3.3: List of component

No	Hardware	Price	Quantity
1.	Wemos D-1	Rm 20.90	1 piece
2.	Arduino Uno	Rm 39.90	2 pieces
3.	Infrared sensor	Rm 5.80	3 pieces
4.	Servo motor	Rm 65.00	1 piece
5.	Rfid reader and transmitter	Rm 12.00	1 piece
6.	Display led	Rm 19.90	1 piece
7.	Wire jumper	Rm 3.50	40 pieces
Total		Rm 218.50	49 pieces

3.15 Drawing Assembly

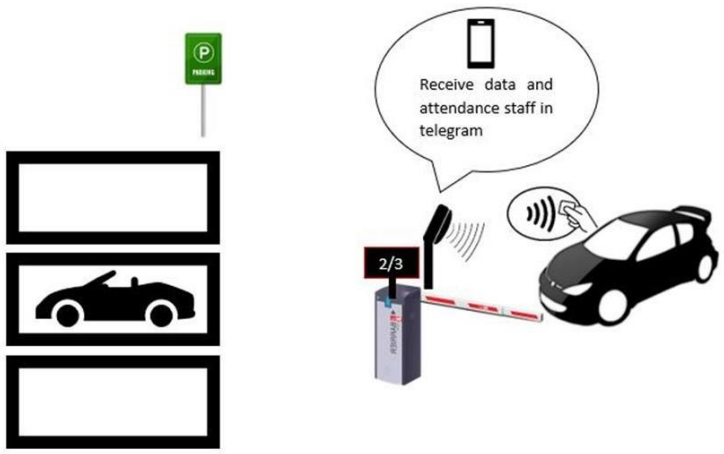


Figure 3.12: Drawing assembly

This automated radio frequency identification system detects sensors and sends data to the barrier system when a vehicle with a rfid card reaches the rfid reader area. The barrier gate will then open, and the parking lcd will indicate the total number of parking spaces available or full.

3.16 Drawing system

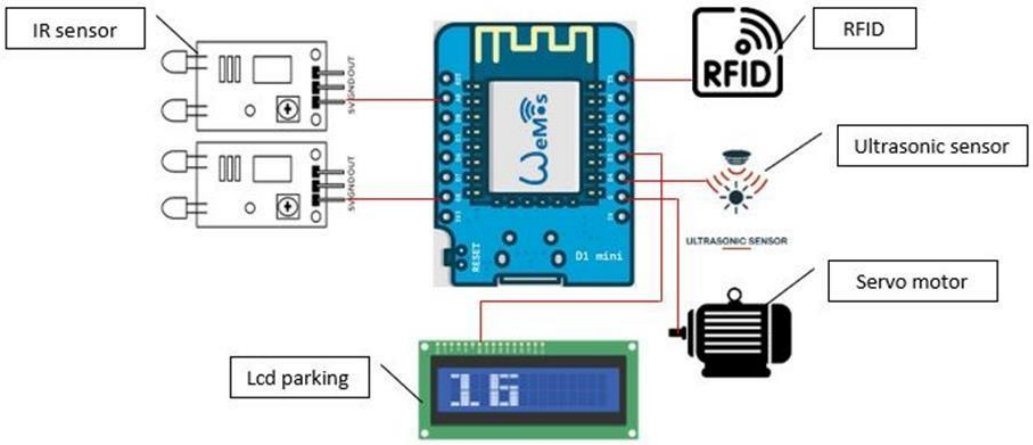


Figure 3.13: Drawing system

The wemos act as controller that control all the input and output of the device. When the car approaches the gate, RFID will be received the signal from the owner tag. The signal will send to wemos and process for open the gate and record the attendance by using IOT that send to telegram. After the car passing by the gate and go thru ultrasonic sensor, it will be trigger and send the signal to wemos for give an order to close the gate by send the close signal at the servo motor. Moreover, when the car parking at the parking lot, the infra-red sensor will be trigger and send the signal to wemos for activate the LCD output number.

3.17 Hardware implementation

3.17.1 Circuit Flow

The power source will be 9V from a battery that plugs directly into the Wemos-D1 port and can be turned on and off with a switch. When the switch ON button is pressed, the Wemos-D1, a microcontroller, will turn on and read the code to follow the instructions line. When that time comes, ESP 8266 will connect to the internet using the username and password written on the coding part. Next, the RFID reader will scan the user's ID and send the information to the microcontroller, which will decide if the output needs to be ON or

OFF. When the identification is correct, the microcontroller will process the signal and send it to the output component to turn it on. The output, which is the servo motor barrier, will turn on, and at the same time, ESP 8266 will send a message to the admin through the internet using Telegram.

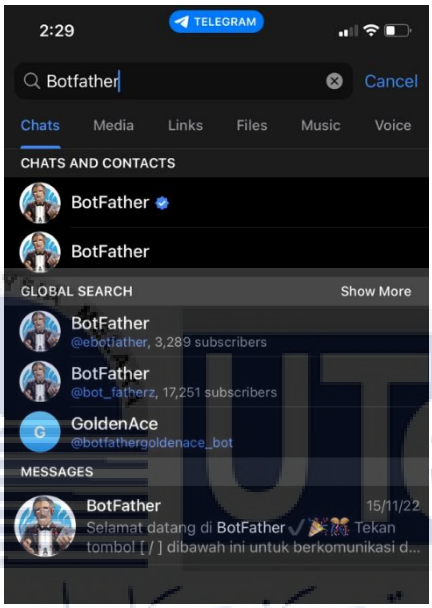
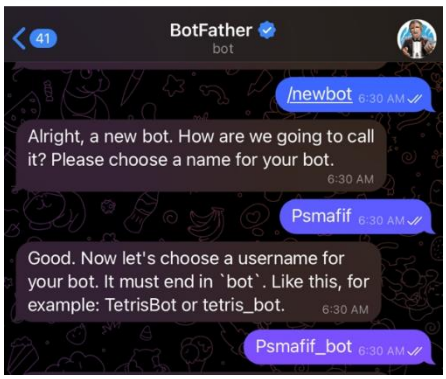
3.17.2 Breadboard Test

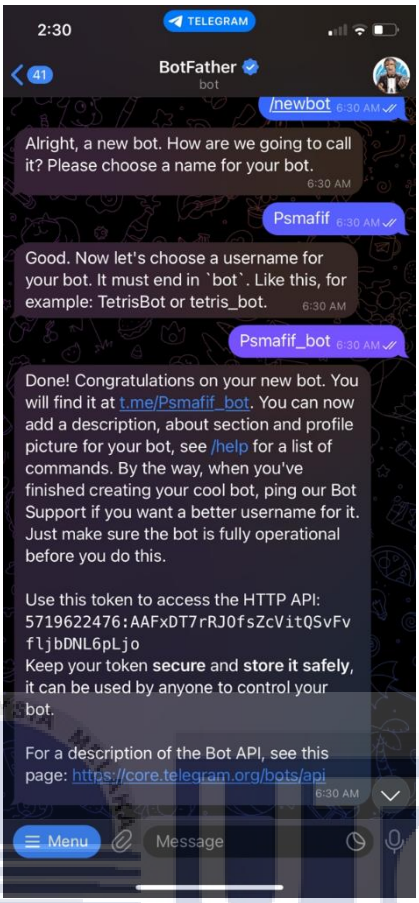
Every component will be tested first to see if it works well. Then, after testing each component, the whole circuit was put together on a breadboard. The polarities of each part had to be checked to ensure they were in the right place. After putting all the elements on the breadboard, a multimeter was used to check the voltage and flow of current. This step is where the analysis of the circuit part will be shown. If the values of the voltage and current you measure don't match the deals you get from the calculations, you'll need to recheck the circuit.

3.18 Software implementation

3.18.1 Making Telegram Bot

This step will make the bot respond to or get the instructions that were set on the microcontroller.

No	Step / Process	Explanation
1		Open Telegram and type "Bot father" into the search bar. Click on the Bot father logo to move on to the next step.
2	 Start by giving the name to create our own bot at telegram	Type /newbot to create a bot. Give any name such as psmafif to the bot

3	 Get the token for identify where the device that will communicate to telegram bot.	After given the name to the bot, the token number will automatically bot father send out. Save the token number to use it on the programming device.

3.18.2 Telegram connection by microcontroller

The connection code on the microcontroller is a crucial channel for the telegram to determine which account of the telegram the user was using. The user's smartphone will be able to be identified with the help of the token. The UniversalTelegramBot.h file specified that it would utilize its library on the Arduino IDE program. In most cases, the library has already been installed on the most recent version of the Arduino IDE program.

Figure 3.14: Arduino IDE Program

Following the declaration of the library, the bot token was inserted as a verification in order to get access to the user's Telegram channel. When the microcontroller provides instructions to ESP8266, this will ensure that the Telegram bot does not get confused about the position at which it should transmit and receive the signal data.

3.19 Finalizing Project

NO	STEP/PROCESS	EXPLANATION
1	Print casing by using 3D printer	Draw the casing by using SolidWorks and slice the product in Ultimaker Cura Software. Casing is important because to make the product tidy and components will be more organized.
2	Checking connection	The multimeter will be used to check the flow of the circuit's connections. If the multimeter shows both the value and the sound, then the connection are linked. If the track is broken, the multimeter won't show any numbers, so the board needs to be changed.

3	Installing component	Install the small component first and solder it because it will make the larger component easy to install later.
4	Soldering component	Each component needs to solder for making connection between board and components.
5	Circuit test	Checking the polarity of the component again to make sure the component in correct position. The multimeter was used to ensure all the connection not cut off. If the connection and polarity was correct, use power supply to check the functional of the circuit
6	Making prototype	The last step is to create a prototype of the product. Perform further testing on the finished prototype to validate that all the system's functions operate in accordance with the design.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This section will explain more details about the experiment work and the data analysis that get from the device. This chapter shows product testing and analysis such as the output outcome and the product influence using the input data. The analysis will be made to see if the final project is capable in a new age. There are many advances towards producing the expected product.

4.2 Pretesting device

4.2.1 Sensor Function ability check

This prototype has been tested in an open area by dividing some detection distance. Every distance had been testing by a ruler.

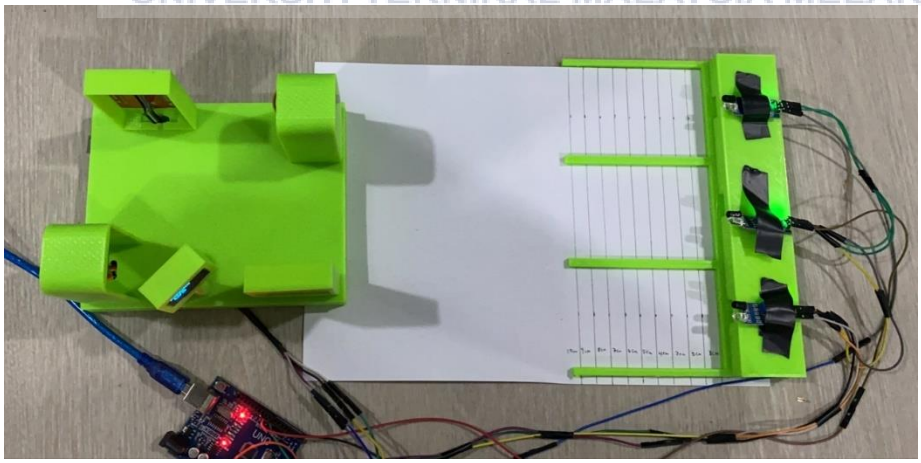
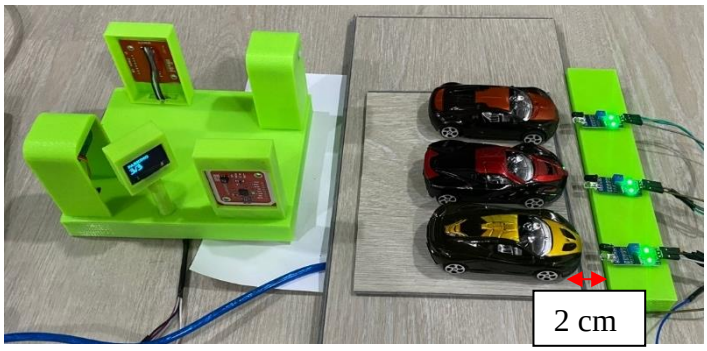
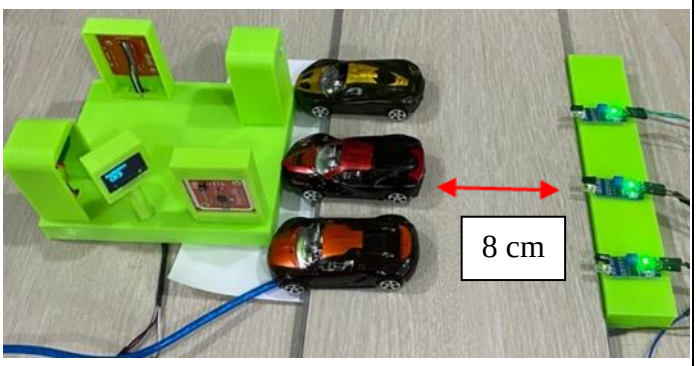


Figure 4.1: Testing sensor prototype

Functionality Check	Range	Sensor detects
	2 cm	Detect zone
	4 cm	Detect zone
	6 cm	1 sensor detect and 2 sensors do not detect
	8 cm	Not detect

4.2.2 Prototype Testing

The prototype testing is to check RFID system, monitoring parking system and infrared sensor to detect incoming cars.

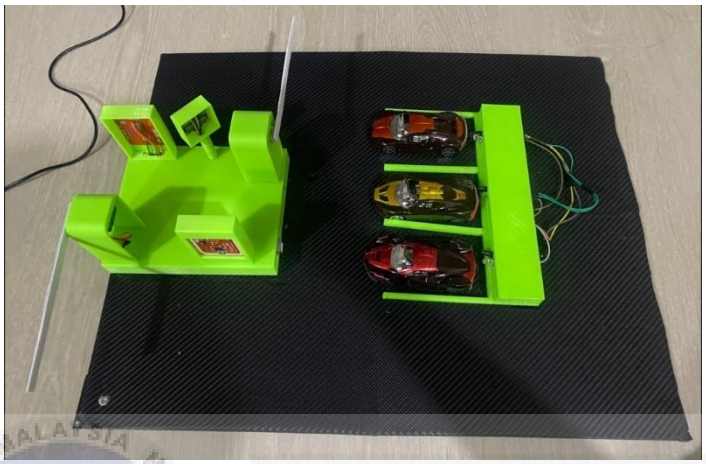


Figure 4.2: Prototype testing

The experiment was run to make sure the device functionality, switch ON all prototype device and wait for few second in order to make device automatically connect to the internet. Then, the system is ready to work in idle position. When the car enters the entrance automated radio frequency identification system receiver detects reader and send the data to microcontroller. The microcontroller will send signal to servo motor and ESP 8266 to activate. The barrier gate will open and ESP 8266 will send the signal by internet to telegram. The telegram will give notification on admin. The admin will get notification for the attendance and the parking lcd will display the total number of parking spaces available. The car will enter the parking system, and the infrared sensor will detect the vehicle according to the appropriate range, which is 2 cm to 4 cm. Next, the microcontroller infrared sensor is triggered and signals the LCD to display according to the parking vacancy.

4.3 Data Analysis

Table 4.1: Data collected at Mydin MITC

MYDIN MITC						
		TIME TAKEN (s)				
CAR	METHOD	LINE UP	PUSH BUTTON	TAKE TICKET	BARRIER OPEN	TOTAL TIME TAKEN
1	MANUAL SYSTEM	48	5	2	2	57
2		63	4	3	2	72
3		72	7	3	2	84
AVERAGE						71
		TIME TAKEN (s)				
		LINE UP	READER DELAY	TAKE TICKET	BARRIER OPEN	TOTAL TIME TAKEN
1	RFID SYSTEM	3	5	-	2	10
2		12	5	-	2	19
3		20	5	-	2	27
AVERAGE						19

Based on the analysis that have been made, the result has been recorded as shown at Table 4.1. The analysis was separate into 4 types of situations that need to be calculated for one complete cycle that need to be include into the time taken for 1 car pass thru the gate. This analysis was made into two situations. Firstly, the data was collected at Mydin MITC by using stopwatch. Mydin MITC was using manual system gate barrier that need user line up and take ticket before entering the gate barrier. Second, the data was collected by using RFID system for prototype model. Because there is no implementation at shopping mall yet.

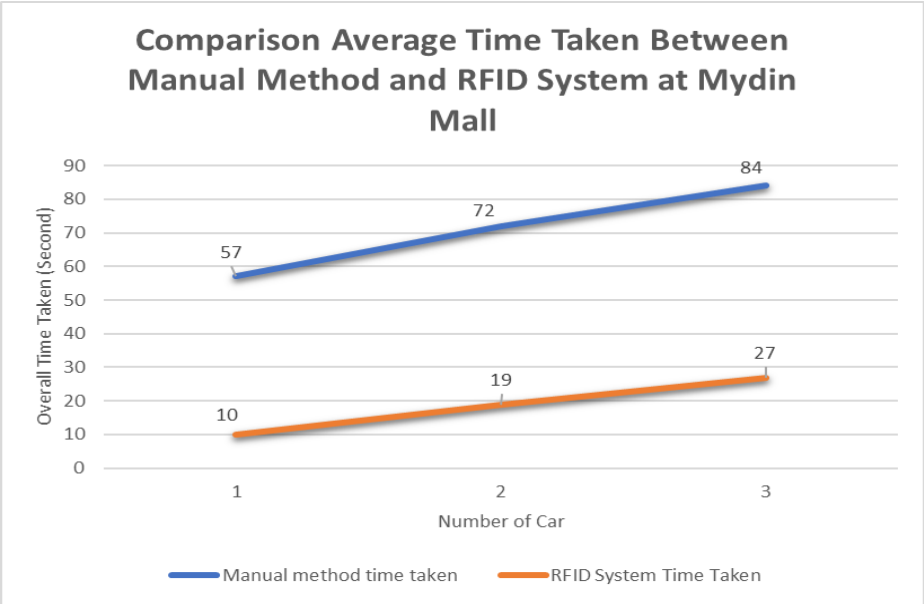


Figure 4.3: Total Time Taken against Number of car at Mydin Mall

The comparison for 3 car data results between manual system and RFID system is total time taken car 1 for manual system is 57 s and rfid system for car 1 is 10 s. For the car 2 total time taken for manual system is 72 and RFID system is 19. Then for car 3 the total time taken for manual system is 84 and RFID system is 27. This data shows that the time taken by RFID is lower than the manual system. Factors that affect this RFID system are still low because the user does not have to open the window or door to take the ticket and the user does not have to wait a long time to queue.

Table 4.2: Data Collected at Garden Plaza

GARDEN PLAZA						
		TIME TAKEN (s)				
CAR	**METHOD**	**LINE UP**	**PUSH BUTTON**	**TAKE TICKET**	**BARRIER OPEN**	**TOTAL TIME TAKEN**
1	**MANUAL SYSTEM**	56	4	2	2	64
2		67	4	3	2	76
3		78	3	3	2	86
AVERAGE						75
		TIME TAKEN (s)				
		LINE UP	**READER DELAY**	**TAKE TICKET**	**BARRIER OPEN**	**TOTAL TIME TAKEN**
1	**RFID SYSTEM**	5	5	-	2	12
2		15	4	-	2	21
3		23	5	-	2	30
AVERAGE						21

Based on the analysis that has been made, this second place is at the garden plaza. This place has two systems consisting of a manual system and an RFID system. This is because this place is divided into two parts that set the residence residents in the upper part,

and the lower part is the shopping mall. The result has been recorded as shown in Table 4.2. The analysis was separated into four types of situations that need to be calculated for one complete cycle that needs to be included in the time taken for one car to pass thru the gate. So, the data was collected based on observations analysis made using a stopwatch. The data analysis can be caused due to the manual system and RFID system.

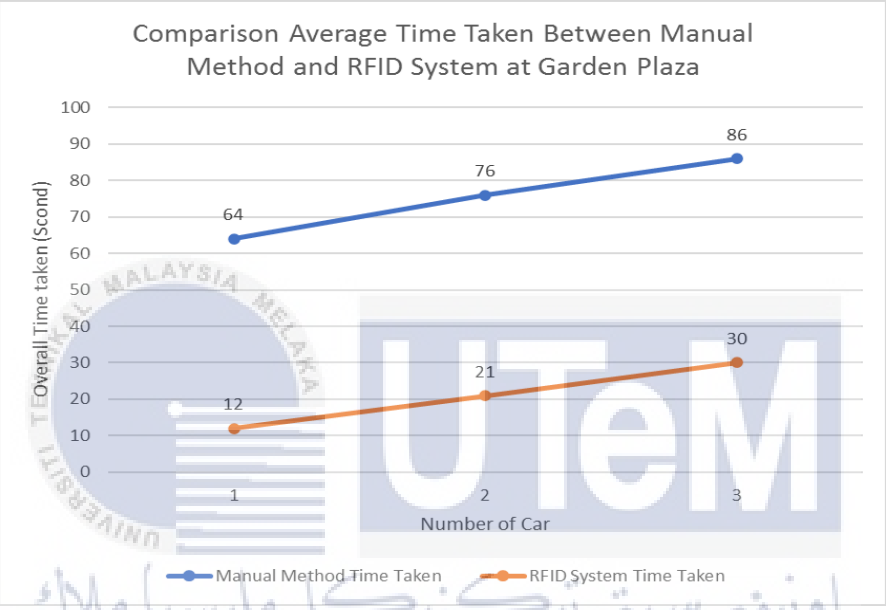


Figure 4.4: Total Time Taken against Number of car at Garden Plaza

According to figure 4.4, car 1 for the manual system is 64 s higher than car one RFID is 12 s, and the difference in total time taken for car one manual system and RFID system is 52 s. For car 2 manual system is 76 s higher than the RFID system, which is 21 s, the difference in total time taken for car two manual system and RFID system is 55 s. For car 3 manual system is 86 s higher than RFID system which is 30 s, the difference in total time taken for car 2 manual system and RFID system is 56 s. So based on the comparison data analysis that has been made for these two systems shows that the time taken RFID system takes for one complete cycle car to pass through the gate saves more time than the manual system.

4.4 Result and Discussion

This section will go over the problems that came during the journey of completing this project. There are numerous errors during the development of the hardware and programming of the RFID auto gate system. The first issue is that it is difficult to link between telegram apps and google sheets. To solve this issue, do the research about link telegram to google sheets and check coding. The problem was resolved, and the RFID auto gate system now functions as expected, producing the desired output of the system. Another problem during this project is had a encountered some issue about the sensor detection. The infrared sensor was not detected the object and LCD amount counting indicator did not receive the signal. Somehow, the sensor was a bit late to detect the car parking system. The delay is around 1-2 seconds. This situation is probably to a low budget sensor and its limitations. RFID auto gate system is created and developed by using suitable software, tools and technique. Suitable circuit and electronic component are identified to build that system. This system has the capability to reduce time and perfect due for limited parking to ensure organizing traffic at in and out terminals. Many journals and other refences that had to be read in order to understand which system and instrument are the best to be use. There are many methods to make this project success. For the hardware design, the best measurement sensor to detect the car parking is infrared sensor. The software part is a coding method that control the whole system and sending the data through internet via telegram to give the notification to the admin. This internet of thing (IoT) is the complicated part which needs to have user identification for telegram to access the data. Iot is based on Wi-Fi module and cheaper compared to global system for mobile communications (GSM). Iot also can be use around the globe and very useful for this project.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In the nutshell, plenty of new knowledge and techniques had been occurred to make this RFID auto gate system by using IoT. This project will help citizen to reduce time management by organizing traffic at in and out terminals and record of every vehicle that enters and leaves the parking garage. This project also teach how design and implement an RFID device to be installed at a parking system and notify the admin when the vehicle enters and leaves the premise. The entire objective was achieved, and the result can be referring for the evidence to this project. The literature review on the RFID auto gate system was completed successfully by reviewing past work executed by the others. Prototype components of RFID auto gate system and the coding were done during the project progress. Besides, system integration between the prototype and the coding was completed successfully.

5.2 Recommendation

Due to limited budget and sources, change infrared sensor to E18-D80NK Adjustable Infrared Sensor Switch in this project. The sensor has a detection range of 3-80cm. In the next time if have more budgets and chance that can improvise this prototype. Next for improvement for future works is adding led light for available parking at the carpark and will help the user to find the parking easier.

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APPENDICES

APPENDIX A RFID receiver and transmitter data

Input Supply voltage (V)	3.3V (Do not use 5V supply)
Operating Current (mA)	13 ~ 26
Idle Current (mA)	10 ~ 13
Sleep Current	< 80uA
Peak Current	< 30mA
Operating Frequency (MHz)	13.56
Module interface	SPI
SPI data rate (Mbit/s)	10
operating distance in reading/Write mode (mm)	50
Operating Temperature	-20 ~ 80 DegC
Storage Temperature	-40 ~ 85 DegC
Relative humidity	5% - 95%

APPENDIX B infrared sensor specification

Focal Plane Array	**Detector**	VPD PbSe
	Format	32 x 32
	Pixel size	100 microns
	Spectral range	MWIR (3-5 microns)
	Thermal sensitivity (NETD)	< 150 mK
	Frame rate	1,610 – 1,725 fps
	Integration time	7.36 microsec
System performance	**Contrast / brightness**	Automatic / manual control
	NUC	Background correction
Optics	**Focal length**	24 mm (single lens)
	FOV (Hor x Ver)	7.6º x 7.6º
	F#	1.2
	Lens mount	M35x1
Power	**Input voltage**	12 V
	Input power	18 W
Controls	**Camera communications and setup**	Ethernet 10/100 Mbps - RS232
Data characteristics	**Uncalibrated, raw data**	Int16 (-32,768…32,767)
Physical characteristics	**Size (in mm)**	120 x 120 x 150
	Weight	1.6 kg

APPENDIX C Gantt chart psm 1

Week **Activities**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1. PSM 1 briefing														
2. Finding article for literature review														
3. Do research about RFID														
4. Write report chapter 1														
5. Write report chapter 2														
6. Write report chapter 3														
7. Do prototype product and write report chapter 4														
8. Submit draft report														
9. Submit report psm														

APPENDIX D Gantt chart psm 2

Week Activities	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. PSM 2 briefing														
2. Buying all the component project														
3. Software implementation														
4. Hardware implementation														
5. Testing the product														
6. verify spesification / analysis data														
7. Write chapter 4 and chapter 5														
8. Send full thesis to supervisor checking														
9. Submit full thesis on epsm														

APPENDIX E Coding RFID system

```
#include <ESP8266WiFi.h>
#include <WiFiClientSecure.h>
#include <UniversalTelegramBot.h>

#include <SPI.h>
#include <MFRC522.h>
#include <Servo.h>
#define pinSS D10
#define pinReset D9
MFRC522 RFID(pinSS, pinReset);
Servo servo;


const char* ssid = "amir";// Enter your WIFI SSID
const char* password = "amirimran"; // Enter your WIFI Password


#define BOTtoken "339560502:AAGILzEPBo0DwUk6VRcZkBRjY5ZstlzriCQ" // Enter the bottoken you got from botfather
#define CHAT_ID "370301528" // Enter your chatID you got from chatid bot


X509List cert(TELEGRAM_CERTIFICATE_ROOT);
WiFiClientSecure client;
UniversalTelegramBot bot(BOTtoken, client);


void setup()
{
  Serial.begin(115200);
  configTime(0, 0, "pool.ntp.org");
  client.setTrustAnchors(&cert);

  WiFi.mode(WIFI_STA);
  WiFi.begin(ssid, password);

  SPI.begin();      // Initiate  SPI bus
  RFID.PCD_Init();   // Initiate MFRC522
  Serial.println("Approximate your card to the reader...");
  Serial.println();

  int a = 0;
  while (WiFi.status() != WL_CONNECTED) {
    Serial.print(".");
    delay(500);
    a++;
  }
  Serial.println("");
  Serial.println("WiFi connected");
  Serial.print("IP address: ");
  Serial.println(WiFi.localIP());
  bot.sendMessage(CHAT_ID, "Wifi Connected!", "");
  bot.sendMessage(CHAT_ID, "System has Started!!", "");

}
void loop()
{

  //Show UID on serial monitor
  Serial.print("ID CODE :");
  String content= "";
  byte letter;
  for (byte i = 0; i < RFID.uid.size; i++)
    {
     Serial.print(RFID.uid.uidByte[i] < 0x10 ? " 0" : " ");
     Serial.print(RFID.uid.uidByte[i], HEX);
     content.concat(String(RFID.uid.uidByte[i] < 0x10 ? " 0" : " "));
     content.concat(String(RFID.uid.uidByte[i], HEX));
  }
  Serial.println();
  Serial.print("Message : ");
  content.toUpperCase();

if (content.substring(1) == "BC 4E B6 52") {
bot.sendMessage(CHAT_ID, "AMIR", "");
delay(500);
Serial.println("Authorized access");
    Serial.println();
    delay(500);
    servo.write(0);
```

```
else if (content.substring(3) == "BC 4E B6 52") {
bot.sendMessage(CHAT_ID, "AFIF", "");
delay(500);
Serial.println("Authorized access");
    Serial.println();
    delay(500);
    servo.write(0);
    delay(500);
    servo.write(90);
    delay(1000);
    servo.write(0);
    delay(1000);
}
else {
    Serial.println(" Access denied");
    delay(500);
}

}
```

.....

```
#include <ESP8266WiFi.h>
#include <WiFiClientSecure.h>
#include <UniversalTelegramBot.h>
#include <Wire.h>
#include <PN532_I2C.h>
#include <PN532.h>
#include <NfcAdapter.h>
#include <Servo.h>
PN532_I2C pn532_i2c(Wire);
NfcAdapter nfc = NfcAdapter(pn532_i2c);
String tagId = "None";
byte nuidPICC[4];
Servo servo;
```