Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF REAL TIME SMART PARKING SYSTEM USING DATABASE AND ANDROID APPLICATION

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

MUHAMMAD HAZIQ BIN NAZARUDIN

Bachelor of Computer Engineering Technology (Computer Systems) with Honours

2022

DEVELOPMENT OF REAL TIME SMART PARKING SYSTEM USING DATABASE AND ANDROID APPLICATION

MUHAMMAD HAZIQ BIN NAZARUDIN

A project report submitted
in partial fulfillment of the requirements for the degree of Bachelor of Computer Engineering Technology(Computer Systems) with Honours

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DECLARATION

I declare that this project report entitled "**DEVELOPMENT OF REAL TIME SMART PARKING SYSTEM USING DATABASE AND ANDROID APPLICATION** "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 : 

Student Name : MUHAMMAD HAZIQ BIN NAZARUDIN

Date : 6/1/2023

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

APPROVAL

I approve that this Bachelor Degree Project 2 (PSM2) report entitled "**DEVELOPMENT OF REAL TIME SMART PARKING SYSTEM USING DATABASE AND ANDROID APPLICATION** " is sufficient for submission.

Signature :

Supervisor Name : NOOR MOHD ARIFF BIN BRAHIN

Date : 6/1/2023

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEDICATION

I would like to dedicate my research project to my beautiful wife, my family, my supervisor, friends and everyone who help me throughout the projects.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
اونيۏرسيتي تيکنيکل مليسيا ملاك
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ABSTRACT

Development Of Real Time Smart Parking System Using Database And Android Application is a project that is proposed as an IOT solution for parking facilities to make the parking system much better and easy to manage. Looking onto the current situation with some observation that has been made regarding parking system in the area, congestion always occurred inside the parking facilities whether driver is waiting for a parking spot which can stack a longer queue during peak hour and weekends. This problem cannot be solved with only adding much more parking spot. It needs a system which can shown to driver which slots is available and which is not so that driver can plan ahead and avoid parking facilities that full and congested. The project use ESP32 as the main controller and IR sensor for its hardware implementation while using Firebase to send and receive data in real time. A android application is developed so that user can track which parking slots is available or not in real time. In conclusion this project is helpful for driver who which to avoid congestion in parking facilities.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

TABLE OF CONTENTS

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
اونيۏرسيتي تيکنيکل مليسيا ملاک
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF TABLES

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF FIGURES

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 1

1.0 INTRODUCTION

Smart Parking System explores the possibility of reducing the problem faced by road user who wishes to use the parking facilities. Eventhough technology evolved every year, most of parking facilities still use outdated method to monitor and manage parking spaces. Most of parking facilities does not have the ability to gather data on in and out of every vehicle and user also have a very limited information on parking facilities before entering one. During rush hour,congestion constantly occurred when every road users needed parking spaces. The current method of controlling the parking facilities is by manual method which a few workers will move around and count on how many available parking left.

In the year 2020, 17,486,589 registered vehicles were reported compared to the year 2010 where there were only 11,556,947 registered vehicles, which makes it a rough estimate of 40% to 50% increase in a span of 10 years [1].Referring to the aforesaid statistics provided by the Malaysian Ministry of Transportation, the current transportation infrastructure and car park facilities are deemed insufficient in sustaining the influx of vehicles on the road. The smart parking system, which is mostly used in Europe, the United States, and Japan, is created by combining modern technology and research from numerous academic areas [2].

It is intended that by deploying it in the vehicle park, it will eliminate the aforementioned concerns encountered by car park consumers. Parking has been a severe issue in Malaysia due to the growing number of car users in all states, hence smart parking systems require the development of an IoT-based system that transmits information about available and occupied parking spaces via a web/mobile application.Each parking spot has an IoT gadget, which includes sensors and microcontrollers. The user is given a real-time update on the availability of all parking spaces and is able to select the best option. By the name of the project, user be able to manage parking facilities easily without having to monitor the facility manually. This IoT based system will be introduced mainly into shopping malls across Malaysia where managing parking system in malls has become a major issue in almost all malls in Malaysia.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

1.1 PROBLEM STATEMENT

With the increase trend of vehicle user in Malaysia, managing a parking facilities has become a very serious issues for the management. With a very limited parking spaces provided, users sometimes need to wander around for awhile to get a parking spot. This is very time-consuming. In some malls, they provide nearly more than a hundred parking spaces thus this will create confusion among users. As a result, parking is difficult, and the time required to park the car increases, as does the vehicle's fuel usage. Parking is a major issue in retail malls, train stations, and airports. People spend the majority of their time looking for parking to park their autos. As a result, there is a lot of traffic congestion, which makes it difficult to find a parking space to park their vehicle. Thus,with the help of this system may solve problems regarding parking management

The primary goal of this project is to build a smart parking system that will satisfy all parties concerned, including road users and parking administration.

1.2 PROJECT OBJECTIVES

The objective of this project is :

1. To study the characteristics and functionality of IR sensor, wifi module and microcontroller.
2. To develop mobile based parking system that utilizing database system.
3. To validate the developed project prototype for Smart Parking System.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

1.3 PROJECT SIGNIFICANCE

1. The system will help user to find a parking spot easier by displaying on the map if one is available.
2. This system can assist management in monitoring in/out of any vehicles
3. The system will reduce the time consumed to find a parking spot. Users be informed on which parking slot is available thus if the parking facilities is full, users get to decide to just search for another parking facilities or wait until one is available

1.4 SCOPES OF PROJECT

The project's scope of work includes the following areas:

Appropriate for parking facilities as low as 8 parking spaces and up to hundreds. Depending on the budget from management, there is so much alternative on IR sensor to choose from.

This device is managed by management and may be used by anyone. For example, user can access this system by using android application which shows parking spot. On the other hand, management can access into the device used which is ESP 32, arduino and cloud database such as firebase and thingsboard.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
UTeM
اونيۏرسيتي تيکنيکل مليسيا ملاک
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 2

LITERATURE REVIEW

2.1 CHAPTER OVERVIEW

This chapter outlined the research methods utilised in system development methodology and approach. This chapter's major purpose is to do research on previously completed projects involving smart parking systems and IoT. The study is not limited to the title; as long as it meets the criteria for hardware use, it can be used as a reference. Furthermore, the search method's applicability for the implemented project will be addressed. In this chapter, we will also discuss the system's advantages and disadvantages. Finally, past research findings and methodologies will be examined and compared in order to ensure that the best references and hardware are used as the basis for this project.

2.2 INTRODUCTION

According to Ahmed Shah of the Institute of Technology India's Department of Engineering, smart parking has become a major worry for individuals living in a congested metropolis. Because of the increase in the number of cars in cities, obtaining a vehicle parking space has become time demanding and critical for all road users [3]. Parking troubles in Malaysia's main city, Kuala Lumpur, increase the appeal of a locality, according to Shubhankar Gautam's blog posted on March 4, 2020. Due to a scarcity of parking space and an obsolete system offered by parking management, some cars double and, in some cases, triple park. Even though parking places are congested, some users tend to reserve the spot by placing someone in the area, signifying that the position is 'reserved' even if other cars come through first. This is illegal and inconvenient, because there are no rules in place to govern 'parking reserves.' [4]

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.3 STUDY ON PARKING DURATION AND DEMANDS

According to a Boston Consulting Group (BCG) study, residents in Kuala Lumpur spend 25 minutes per day looking for parking. In South-East Asia, people spend an average of 30 minutes seeking for parking. In Singapore, the shortest time spent parking is 19 minutes, while the longest time spent parking is 45 minutes in Hanoi. Kuala Lumpur's parking situation is similar to that of Bangkok. Despite the fact that the problem is out of control, the authorities and parking management appear to be oblivious about the situation and continue to use archaic

methods of managing parking spaces. This difficulty can often lead to even bigger problems, such as competing for a parking spot, high traffic when looking for an available spot, and even accidents[5].

In Siti Asmah Hassan research paper,she has made a study regarding parking in a public hospitals. The research was carried out at six Malaysian public hospitals in Malaysia is only a small portion of the reality of parking problems that happened across Malaysia. In her study, she has made a brief conclusion that parking congestion happened because the parking duration of user is high with limited spaces. She also concluded that demand on parking spaces is higher on public days and peak hours [6].

Hospital	*Actual Number of Parking	Average Parking Duration (hours/veh)			Average Parking Turnover (veh/12 hour)		
		Public Bay	Staff Bay	Overall	Public Bay	Staff Bay	Overall
Hospital Sultanah Bahiyah, Kedah	1500	3.30	5.42	3.57	4.70	1.75	3.87
Hospital Tengku Ampuan Afzan, Pahang	989	3.50	4.63	3.74	5.56	1.69	3.73
Hospital Tuanku Jaafar, Seremban	1841	3.33	4.12	3.47	4.55	2.02	3.74
Hospital Melaka	1439	3.28	4.98	3.45	6.02	1.51	4.62
Hospital Raja Perempuan Zainab II, Kelantan	1113	3.90	6.51	4.49	4.96	1.67	3.42
Hospital Tuanku Fauziah, Perlis	658	3.18	5.08	3.48	6.61	1.75	4.60
Average (Daily)		**3.41**	**5.12**	**3.70**	**5.40**	**1.73**	**3.99**

*Based on actual parking counted at site

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Figure 2.1 Parking Duration And Turnover At The Public Hospital [6]

$$Parking\ Duration = \frac{Parking\ Load}{Parking\ Volume}$$

$$Parking\ Turnover = \frac{Parking\ Volume}{Number\ of\ Parking\ Bays}$$

Figure 2.2 Parking Calculation Equation [6]

By referring figure 1, this paper can conclude that the average parking duration and turnover time is over 4 hours Figure 2 is utilised to do the computation. This study's findings reveal the nature of extended parking hours with few spots in public hospitals, which leads to congestion and double park concerns. A traditional supply-based strategy that adds more parking as a remedy to capacity issues does not work in the long run. Parking is an essential component of urban transportation networks, and efficient integration of other transit systems might aid in resolving parking issues within public hospitals.

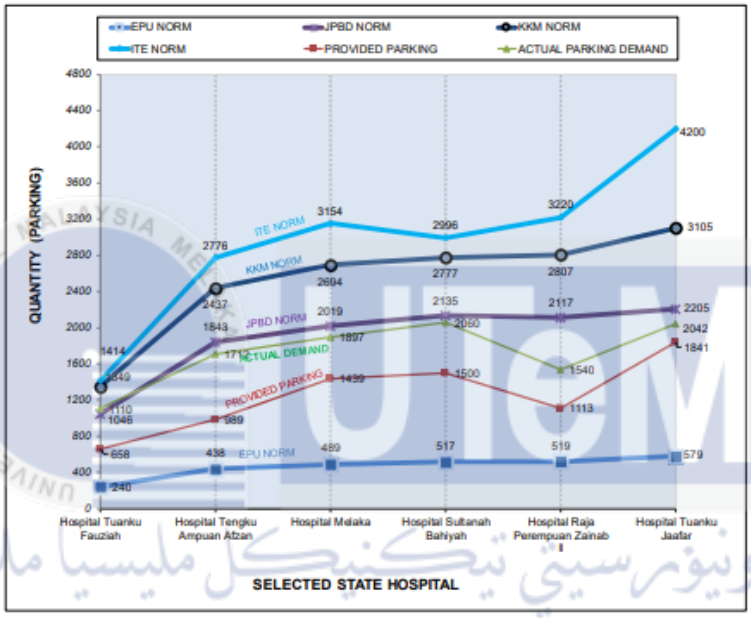


Figure 2.3 Parking Supply And Demand Trends

2.4 Causes of Parking Problems

People choose to buy vehicles before parking became a serious issue due to a variety of factors because cars provide an unrivalled mix of speed, autonomy, and privacy. However, no private vehicle is constantly in motion; most private cars spend the majority of their time at rest, either during working hours or at night. This means that every automobile in the city should have two parking spaces. The two locations should be at opposite ends of the journey. This is one of the most often debated subjects among general and public professionals. This is due to a supply and demand imbalance, and the parking system plays a big part in causing issues. Although extra parking spaces may ease the problem in the near term, automobile usage

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

in Malaysia is rising year after year. According to Rakuten Insight's poll, around 61 percent of Malaysian respondents claimed that they owned a car. Malaysia's automobile ownership rate has been greater in recent years than in surrounding nations . Malaysia has 31.2 million vehicle registrations, whereas the country's population is expected to be approximately 32.6 million [7] .

Parking issues arise on a daily basis at airports, transit stops, and retail centres. A lack of accessible parking can harm local businesses and reduce inhabitants' quality of life. Because parking is so important, cities constantly evaluate and analyse parking plans and performance. The following list describes the types of difficulties that are commonly encountered in a community:

I. **Outdated system.** Parking management still rely on an old and outdated model of parking system to manage the flow of in and out of parking user.

II. **Inefficient utilisation of available parking space.** Local zoning rules, construction codes, and other development practises can lead to an excess of parking spots and poor use of existing parking.

III. **Excessive automobile use**. Automobile dependence costs society a lot of money. Reduced travel options, increased automobile and residential parking fees, and greater accident risk are all user costs. Increased road and parking facility expenses, congestion, uncompensated accident damages, environmental degradation, negative land use consequences, and reduced mobility for non-drivers are all external costs.

IV. **Economic, environmental and aesthetic impacts of parking facilities.** Businesses eventually incur the expenses of unpriced parking, either directly or indirectly through taxes that must be passed on to customers. Excessive parking restrictions might limit enterprises in other ways.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

V. **Parking places that cause problems** for adjacent households and businesses. Businesses may have problems keeping clients, while residents may have difficulty obtaining parking near their houses.

VI. **Demand for handicapped parking spaces**. These spots are often situated as near to access ramps and curb cuts as practicable in both garages and surface lots.

VII. **Impact of additional parking spaces** on area traffic and local residents.

VIII. **Existing, severe, spillover problems**. When all of the parking demand generated by a certain use (or group of uses) is not being accommodated on the site of those uses or within the adjacent on-street spaces.

IX. **Out-of-town parking**. The majority of vehicles parked in a residential area are from outside of the neighborhood.

X. **Lack of sufficient parking at event site**. Special events can potentially disrupt traffic flow and require crowd management. Each event can generate its own unique transportation issues. This may cause road user to park at shopping malls which will distrupt malls visitors

2.5 SMART IN SYSTEM

The growth of Industry 4.0 is encouraging businesses and governments to adopt and develop new technologies that will allow them to optimise strategies, produce new goods, shorten development periods, achieve resource efficiency, and give more personalised products. Another important aspect of this trend is the change from product-oriented to service-oriented businesses, as well as the rising use of the Internet of Things (IoT). The emphasis on closing the gap between physical and cyber components is a fundamental element

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

of this new scenario, which is accomplished through the integration of operational systems with information and communication technologies (ICT) [8] .

With technological growth, man has a tendency to create goods that benefit all life, regardless of race or religion. Our lives would be more manageable, easier, and productive if we had a smart system. The combination of technologies and ICT broadens human thinking and broadens the perspective to push to the limit. According to Manuel Silverio's essay, the definition claimed that a smart device includes three essential features: context-awareness, autonomous computing, and networking. This description adheres to the IoT's central concept, which is that any "thing" can be a component of the IoT. If a sensor, a small amount of processing power, and network connectivity are added to a chair, it can be transformed into a smart chair [8].

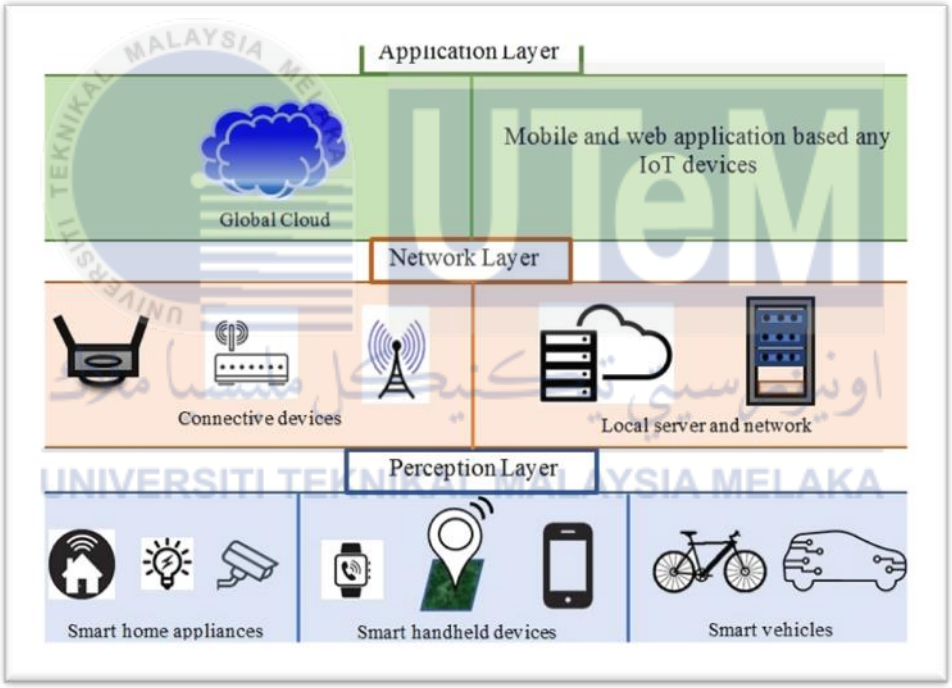


Figure 2.4 Layer in Smart System[9]

While humans adjust to the shift from the fourth to the fifth industrial revolution, civilization has grown accustomed to the speed of rapid invention and revolution with the help of IoT. Humans continue to demand increasingly effective and efficient technological solutions. This type of thing alters the way humans think and shifts perceptions toward technologies supplanting traditional methods. The term "SMART" refers to "self-monitoring, analysis, and reporting technology”[9] , according to netlingo.com. Smart technology is classified into three categories:

Internet of Things (IoT) devices	Sensors, chips, software, internet connection, analytics, and apps are used in a network of devices to bring static physical things to life. These technologies add significant value and are futuristic, scalable, and automated. Smart cities, smart homes, and smart factories are some noteworthy examples.
Smart Connected Devices	Smart linked devices, which are controlled by a remote and connected to the internet or Bluetooth, can provide a customised experience but must be handled because they do not adapt to the extent that IoT devices can. Smart linked gadgets include smart security cameras, smart lighting, and smartphones.
Smart Devices	Smart devices, such as smart coffeemakers, give certain personalised services at a certain time due to minimal automation, no requirement for internet connectivity, and programmability.

Table 2.1 Smart Technology Categories

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.6 INTERNET OF THINGS

The Internet of Things (IoT) is a new paradigm that enables electrical devices and sensors to communicate with one another over the internet to improve people's lives. IoT leverages smart devices and the internet to provide innovative solutions to many businesses, governments, and public/private entities worldwide [10]. IoT is quickly becoming a vital component of life, and its presence can be felt all around people. Overall, the Internet of Things (IoT) is an innovation that brings together a diverse set of smart systems, frameworks, intelligent gadgets, and sensors.

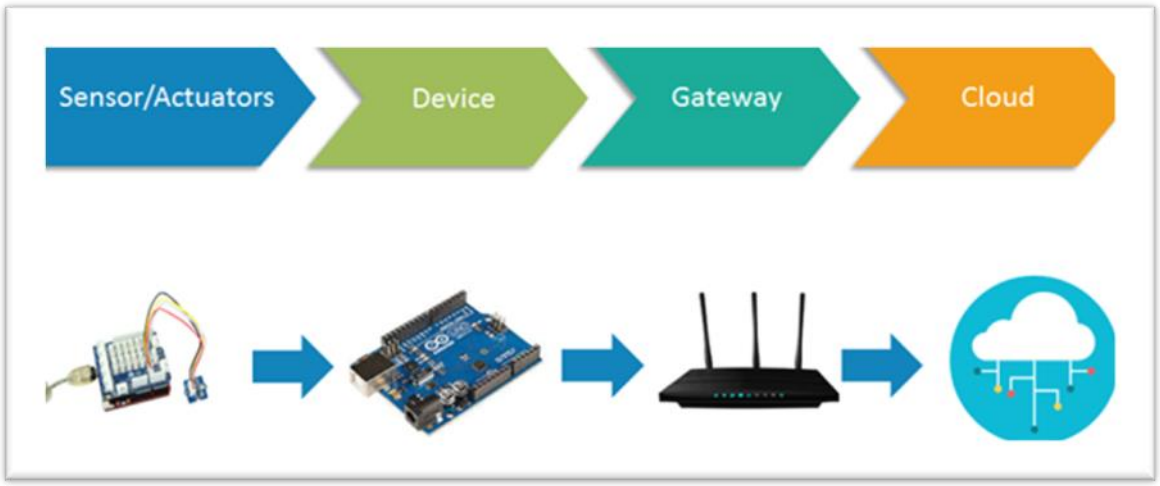


Figure 2.5 Components of IoT Architecture[10]

IoT has also shown to be effective and promising in the economic and industrial growth of emerging regions. It is also viewed as a game changer in the trading and stock exchange sectors. Data and information security, on the other hand, is a major concern and desirable aim, as well as a challenging issue to manage. As the primary source of security threats and cyber-attacks, the Internet has opened several channels for hackers, making data and information susceptible. The Internet of Things, on the other hand, is committed to delivering the finest possible solutions for dealing with data and information security challenges. As a result, security is the most important concern of IoT in commerce and business. IoT offers a multidisciplinary perspective that will help several sectors, including the environment, industry, public/private, medical, and transportation. Various scholars have discussed the Internet of Things in various ways, depending on their individual interests and concerns.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

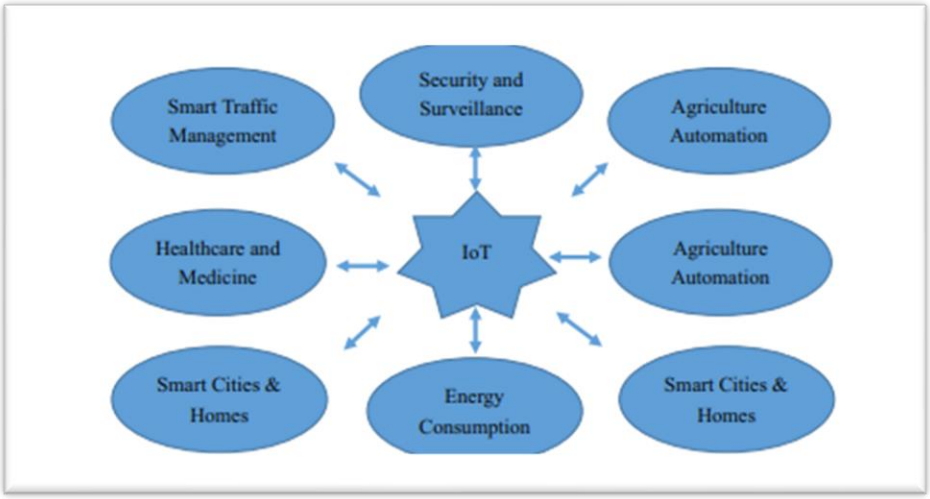


Figure 2.6 Some of IoT potential application domain

To provide the best solution to businesses and end-users, multiple layers of IoT are built on the capabilities and performance of IoT elements. The IoT architecture is a critical strategy for building various IoT components so that they can provide services over networks and fulfil future expectations. The following are the essential phases (layers) of IoT that provide an answer for IoT architecture:

Sensor/Actuators[11]	The operation of IoT systems is primarily reliant on sensors and actuators. Sensors are used to monitor processes and equipment in order to provide data on how the systems work. They are used to simply monitor performance and offer data that can be evaluated over time to uncover inefficiencies, as well as to detect faults or malfunctions in the system and equipment. Actuators are utilised in IoT systems to execute dull or normal tasks on equipment in order to increase process efficiency. An actuator, for example, may be utilised to cause a machine press to press widgets far

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

	more effectively than a human operator.
Gateways and Data Acquisition[12]	Sensors acquire enormous volumes of data in analogue form. The data is then processed and converted into digital representations by acquiring systems in the second stage. They also filter the data and select only the most important information, decreasing the amount that must be processed and saved. Gateways send data via Wi-Fi, LANs, or the internet. They can also work in reverse, pulling commands from the cloud or transmitting firmware upgrades. Network security is crucial at this step since data is being exchanged.
Edge System[13]	Edge computing occurs at or near the physical location of either the user or the data source. Users benefit from quicker, more reliable services with better user experiences, while businesses profit from being better equipped to handle latency-sensitive applications, recognise trends, and offer better products and services by locating computing services closer to key places. Edge computing is one method for a corporation to leverage and distribute a shared pool of resources across a large number of places to assist in scaling centralised infrastructure to meet the needs of a rising number of devices and data.
Data center / Cloud [13]	Cloud computing is one component that

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

	contributes to the success of the Internet of Things. Cloud computing allows users to do computing activities by utilising Internet-based services. The adoption of the Internet of Things in conjunction with cloud technologies has acted as a catalyst: the Internet of Things and cloud computing are now inextricably linked. These are actual future technologies that will provide several benefits. The difficulty of storing, processing, and accessing massive volumes of data has developed as a result of the rapid advancement of technology. The collaborative usage of Internet of Things and cloud technologies has resulted in significant innovation. It will be feasible to apply advanced processing of sensory data streams in conjunction with new monitoring services. Sensor data, for example, can be uploaded and preserved in the cloud for later use as intelligent monitoring and activation via other devices. The goal is to turn data into insights, which will then drive cost-effective and productive action.

Table 2.2 Layers Of IoT

2.7 PREVIOUS RELATED PROJECT

To ensure that end results of this project at a higher level, the study of previous related project is important to ensure that additional knowledge can be gain and to examine the weakness of each previous project so that the implementation of our project may be near perfect. By doing

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

research via internet and books, this section will be discussing a few previous related project that apply the same hardware requirement that needed for the project to work such as sensor,light dependent resistance and real time database management.

2.7.1 Automated Smart Parking System Using Raspberry PI 4

According to Rahman Atiqur & Li, Yun , "most of the time, we have to travel through multiple parking places to find a position that is free." When the parking is multi-story, the problem becomes considerably more cumbersome [14] . As a result, the problem takes a long time to fix. This situation needs the employment of an automated system. A parking system that not only controls parking in a certain area but also decreases the need for manual intervention. The proposed system includes autonomous automotive parking, which restricts the number of vehicles that may be parked in a certain place based on the availability of parking spots at any given time.

The goal of this research is to present a concept for an Automated Car Parking System that is controlled by an Android application that restricts the number of automobiles that can be parked in a defined parking space by automating the parking and un-parking of cars using commands from an Android application. The level of automation in certain existing systems is restricted to functions such as number plate extraction, comparison based on snapshots of parking spaces, image processing, or mechanical elevators in multilevel parking, according to a study of some existing systems. By automating the car parking procedure, our technology attempts to reduce human interaction to a bare minimum. This, in turn, would be beneficial in minimising the time spent physically driving through many slots in search of a free parking place. Path Tracing with Sensors is a feature that allows the car to be automated.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

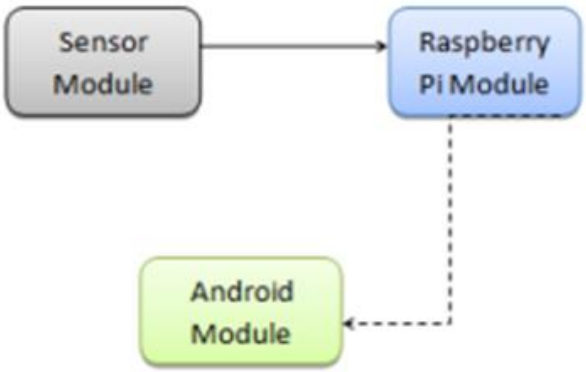


Figure 2.7 Block Schematic Diagram [14]

According to figure 2.6, the system will be implemented in 3 modules:

Module	Description
Sensor Module	This module will be positioned in the parking spot, and each parking space will have a sensor node. The sensors that will be utilised are infrared (IR).
Raspberry Pi Module	This module will be linked to the internet and will receive data from all sensor nodes.
Android Module	This module will be deployed on the users phones as an Android app. In addition, the parking lot status will be displayed.

Table 2.3 System 3 modules[14]

The system will require a Raspberry Pi with several infrared sensors added. The parking status will be determined by the infrared sensors. The Raspberry Pi's operating system is Raspbian, and utilise the Android App to check the status of parking in the parking lot. The parking lot setup (Raspberry Pi and IR sensor) will be accessible through Wi-Fi network to the Android app. Users will utilise the Android application to check the parking status on their phones, and it will serve as the project's user interface. The Raspberry Pi is connected to the infrared sensors to determine the park's location.

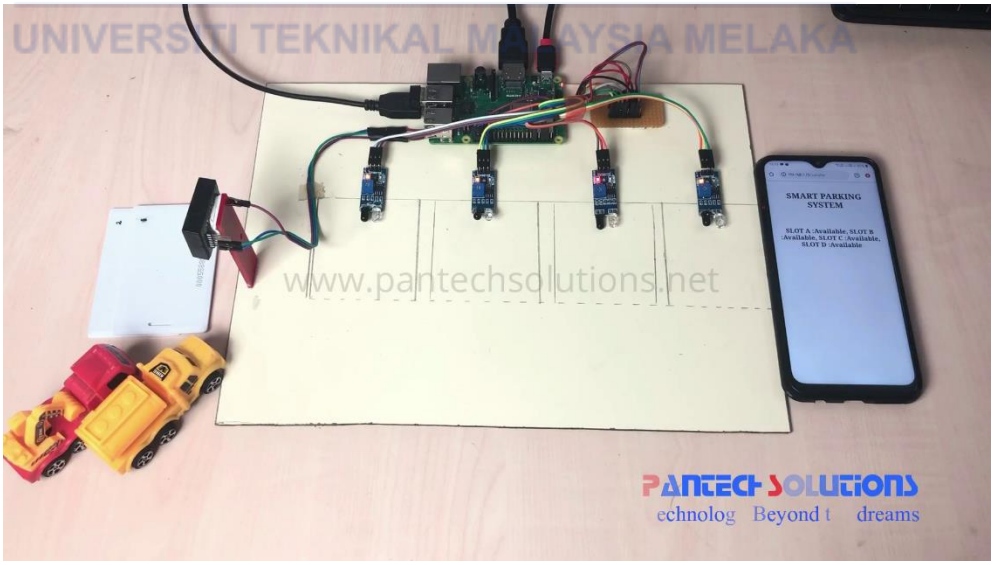


Figure 2.8 Full Circuit of the systems[14]

2.7.2 Automatic Car Parking System with Visual Indicator along with IOT

According Mendiratta, Sarthak, Debopam Dey and Deepika Rani Sona, one of the primary issues we face in today's overcrowded society is finding adequate parking spaces in various public venues such as hospitals, workplace retail malls, movie halls, courts, schools, and colleges. In this day and age, we are striving to decrease our effort in every way possible, and the advent of the Arduino and IoT platforms has expanded the scope of this option in our daily lives [15].

This project focuses on a parking system that already has an IR sensor installed, but instead of utilising an IR sensor, it will utilise an Ultrasonic Sensor and a Lan Cable instead of a Wi-Fi module, lowering the cost even more. The execution of this project is separated into two parts. The first is hardware, which uses indicators (in this case, two bulbs: one red and one green) that are put outside the parking slot, with the red bulb signalling an occupied parking spot and the green bulb showing an unoccupied space. This is done so that the motorist can tell from a distance whether the slot is empty or occupied throughout the night. Following that is IoT implementation, in which the driver can check through the Internet/Mobile App which slot or area is empty and can directly go to that area and park his car, without the assistance of anyone else, or security personnel in public parking areas or malls can check the spots in their systems and can direct incoming cars to the specific locations.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

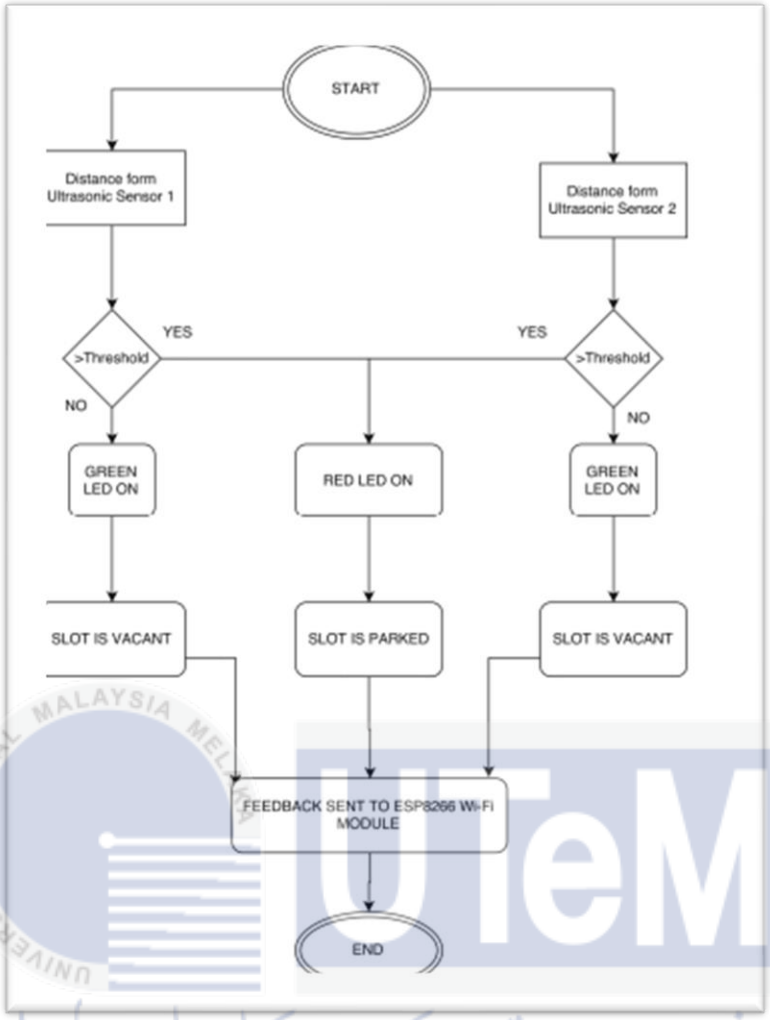


Figure 2.9 Flowchart [15]

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

The goal of this project is to ensure that drivers can easily determine if a slow is vacant or occupied, especially at night. On a local level, for example, in colleges and shopping malls, the main entry Guard has access to all parking space information. As a result, even if the motorist does not have time to check the slot availability on his own, the guard can direct him where to park his vehicle. This project makes use of an Arduino Uno Board, an ESP32, two Ultrasonic Sesnor for output, and an open source platform to create the output.

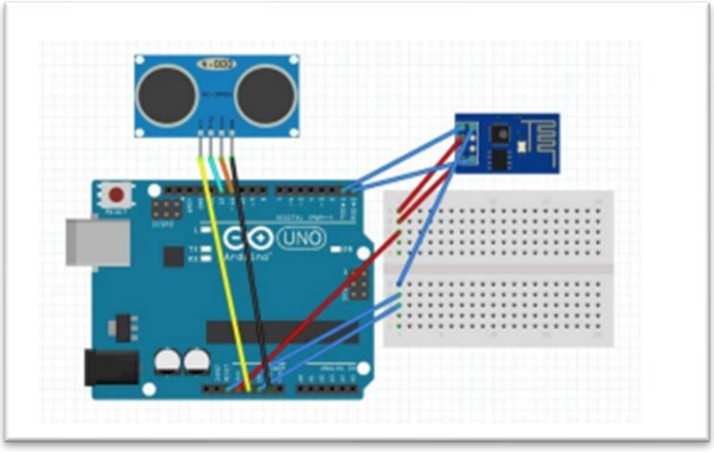


Figure 2.1.0 Circuit connection[15]

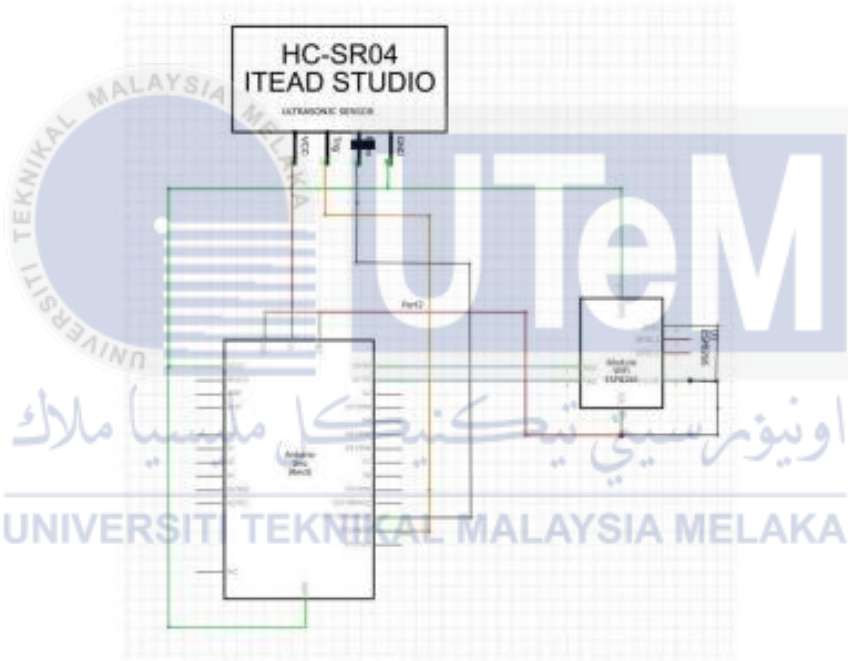


Figure 2.1.1 Schematic connection[15]

To achieve the best results, we used Embedded C Programming to set the ultrasonic threshold based on the size of the parking lot in the Arduino code. The difficulty encountered throughout this investigation was that the ultrasonic sensor's surface was rusting, causing the device to misbehave. Careful nanocoating of sensors and the Arduino board is required for the project's long-term execution. The data that the ESP receives from the Ultrasonic Sensor after connecting to Wi-Fi is successfully transmitted to the open source platform.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Certain studies have been conducted in order for this project to be enhanced in the future. The future work focuses on commercialising a business prototype and making a website more reliable using a much better version of the ESP module, which has a high business value because a mobile application can be created instead of using the public IoT platform, making it better for business purposes. A camera can also be linked, and a number plate detecting technique can be added to make the area more secure. Finally, in the same arrangement, an online parking ticket system may be developed.

2.7.3 SMART PARKING SYSTEM USING RFID

According to Anusooya, G. & Jackson, Christy & Sathyarajasekaran, K. & Kannan, K. With the massive flood of people moving to urbanised, industrialised, and technologically advanced urban areas, there is a pressing need to make cities smarter. Data exchange, artificial intelligence, machine learning, analytics, and hundreds of RFID tags and sensors are all used to make cities smart. One of the major issues of today's smart cities is the growing requirement to control on-road vehicles as well as develop enough and well-managed parking lots to avoid traffic congestion in metropolitan areas. This necessitates the development of a highly automated parking management system capable of guiding the driver to an open parking space in the immediate vicinity[16]. A real-time prototype of a smart parking system based on the Internet of Things (IoT) is addressed in this study. The suggested smart parking system is based on an electronic device that collects parking availability information and assists drivers in identifying and selecting the needed parking space among the available parking spaces, thereby significantly reducing traffic congestion and mismanagement in cities.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

RFID is the most basic technology for transmitting data wirelessly over networks. Despite the fact that this technology has been around for a long time, current standardizations and lower costs have greatly increased its utility. This technology communicates and collects data from things that have RFID tags attached to them via electromagnetic fields.

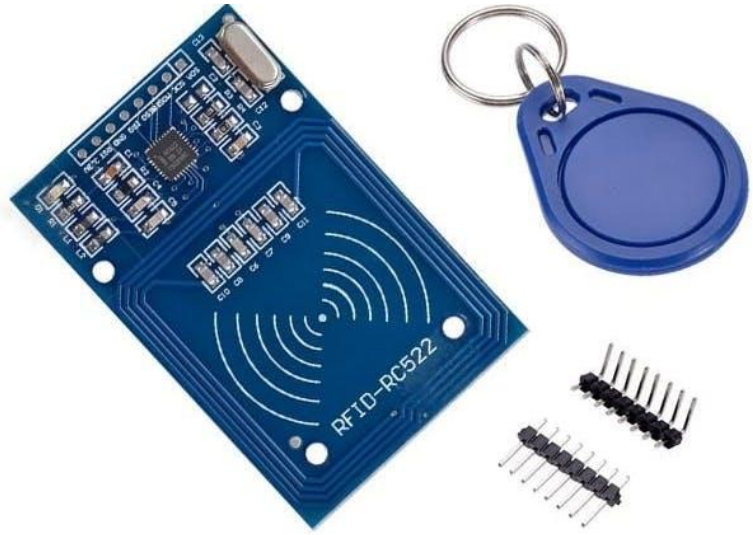


Figure 2.1.2 RFID tag

To accomplish smart parking capability, the system employs a variety of technologies. This system is made up of RFID scanners, Wifi Modules, module motors, IR sensors, Microcontrollers, and electrical components. In order to achieve the intended operation, the microcontroller is employed to operate the complete system. The user begins by checking the availability of parking spaces on the internet. The parking sensor values are read by the microcontroller, which subsequently sends the data online via IoT over wifi. The rfid scanner is used to scan for user cards and transfer the data to the microcontroller, which then sends the data to the internet of things server to check if the card is valid and has sufficient balance. The access to the vehicle is denied if the card is invalid or does not have adequate balance. If the card balance is sufficient, access is granted, and the sensor, which is blocked by the automobile parking, indicates which slot the car is parked in.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

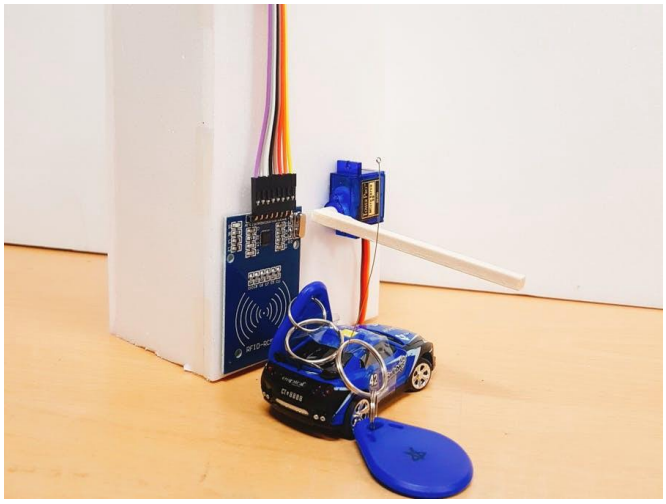


Figure 2.1.3 Example of System that use RFID [16]

2.7.4 FINDINGS BETWEEN PREVIOUS RELATED PROJECT

In this findings between the relations between the projects, the similarities that can be concluded is that, all of the projects use the same IR sensor model to detect either motion,light and other elements. This can be concluded that each project is reliable with IR sensor and without it, most of the part will not be well functioning. Eventhough similarities can be find, there are also some differences such as in hardware which include the use of microcontroller for each project and prices and realibality.

Project name	**Method**	**Advantages**	**Disadvantages**
Automated Smart Parking System using Raspberyy Pi 4	Autonomous parking that restrict the number of vehicles that can be parked in a certain place based on the avaibility of the parking spot at any facilities	Using Raspberry Pi which include Wifi module Raspberry Pi is easy to use and user friendly Comes with a large output voltage that can support many sensors and actuators	Raspberry Pi is very expensive and every model is different in terms of system information and specification.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Automatic Car Parking System with Visual Indicator along with IoT	Using Arduino Uno , Ultrasonic Sensor and Wifi Module along with IoT	Arduino Uno is cheap and easy to use Open source platform such as Php is very easy to use and user friendly.	Arduino Uno has fewer pins option compared to other model Arduino Uno doesn't come with Wifi module,one must buy a Wifi module such as ESP8266 that crossed connected with Arduino Uno
Smart Parking System using RFID	Smart parking system which use RFID and indicator to park and pay. RFID stores digital money which is used to pay for parking	RFID is a new technology which in terms of security and reliability is very secure and easy.	Compatibility issues will arise because the technology is new and still need a lot of improvement from its implementation

Table 2.4 Comparsion between related projects

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 3

METHODOLOGY

3.0 INTRODUCTION

In this chapter, we will present an outline of the research techniques employed in the study, including the system development methodology and system development technique. Systems methodology refers to a process that incorporates system-scientific methods, is supported by system thinking and simulation tools, and is carried out by people with appropriate systems, applied science, and engineering skills, whereas system development techniques refer to the techniques used in the methodology we have chosen.

3.1 SYSTEM DEVELOPMENT METHODOLOGY

We are developing our project using the waterfall model. In the waterfall Model, each stage must be completed before proceeding to the next, and no stages overlap. The waterfall methodology is a formal process, with each phase consisting of a list of particular tasks, documentation, and exit criteria. SDLC methodology solutions are frequently required by larger organisations, particularly in larger IT application projects. This is also the strategy that SIs take when developing IT applications for their clients, because budget, resources, deliverables, and scope must all be handled extremely carefully. Because each phase is processed and completed one at a time, the waterfall development is basic and easy to grasp and utilise. The model's stiffness makes it easier to manage. Each phase includes its own set of deliverables and a review process.

Furthermore, the waterfall model's clearly defined stages make it easier to organise work. Furthermore, it enhances resource utilisation by allowing project members to split activities in parallel or group them to regulate resource expertise. It is also a better application design because all needs and deliverables are better understood. Furthermore, unlike Six Sigma or Scrum, the Waterfall progression is delicate because it does not demand qualifications or specific training for project managers or staff. Team members will be able to jump into the Waterfall system without a high learning curve if you visually sketch the process at the start using a Lucid chart and explain the philosophy.

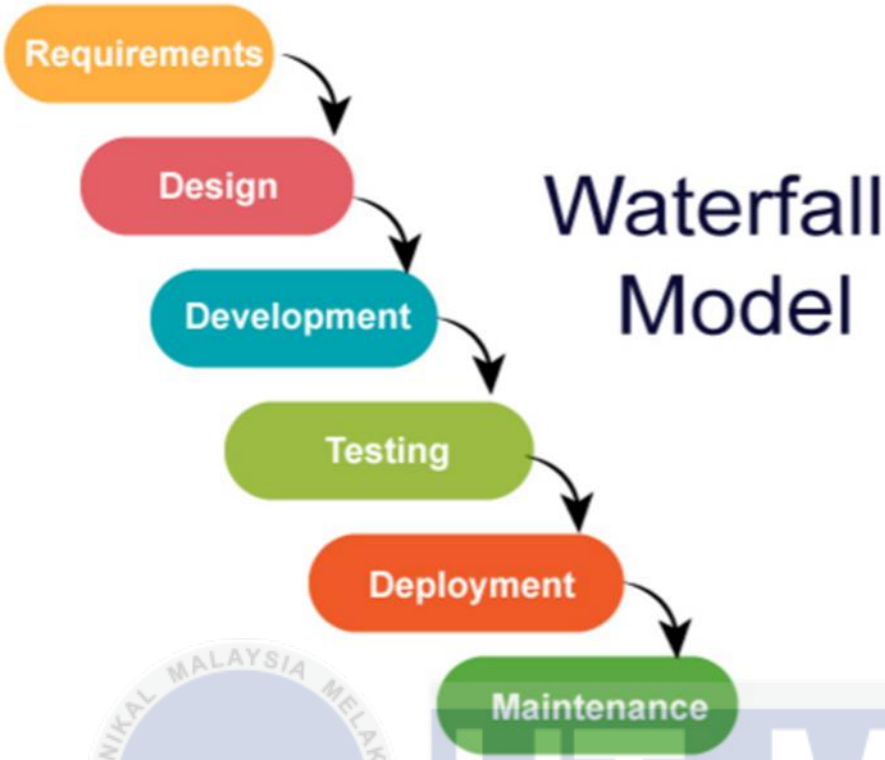


Figure 3.0 Waterfall Model [17]

In this Waterfall method, there are 6 sequence of the water model which is [17]:

Requirement	During this step, the student will gather all feasible system requirements to be produced and document them in a requirement specification document through a meeting with the supervisor. The ESP32 is used to detect automobiles in order to carry out the project.
Design	This phase studies the need specifications from the first phase and prepares the system design. This system design aids in the identification of hardware and system requirements as well as the definition of the overall system. architecture. In our project, we will use

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

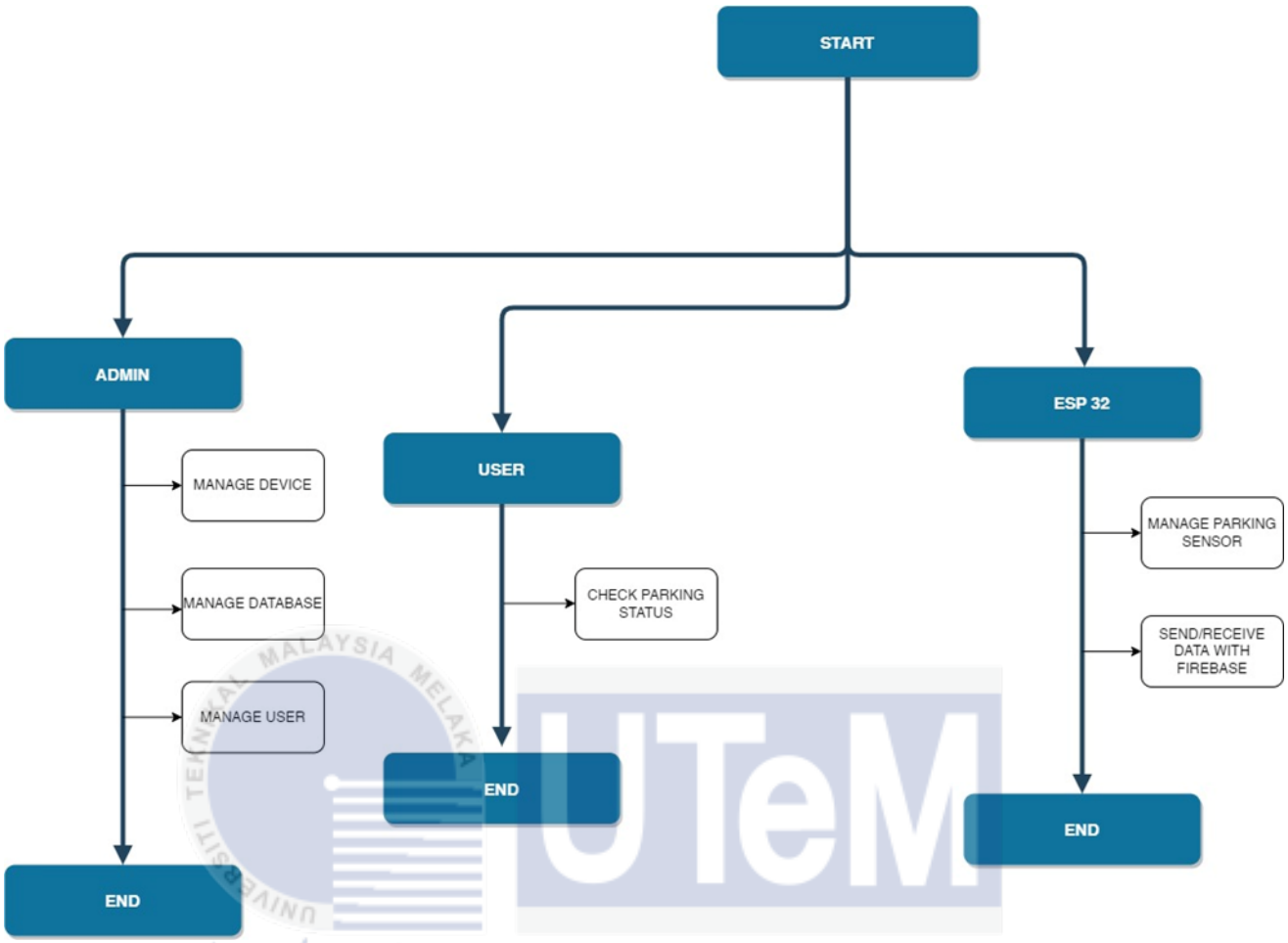
	Arduino coding for the main devices, the ESP-32, and the Firebase realtime database cloud service for communication between devices and software, as well as Android Studio as the major software coding programme.
Development	At this point, we will create the project according to the plan, termed units, with input from the system design. Its unit has its own characteristics, and it is critical to track each development in accordance with the time graph.
Testing	Following unit testing, all units generated during the implementation phase are integrated into a system. Following integration, the complete system is tested for flaws and failures.
Deployment	Project will be released to the supervisor for checking and marking once the functional and non-functional testing is completed.
Maintenance	If there are any issues that arise in the client environment during this period. We will address such concerns. In addition, better versions of the product are issued in order to improve it. Maintenance is performed in order to implement these modifications in the custome

Table 3.0 Waterfall model description [17]

Finally, the waterfall technique provides an excellent means for our project to stay within time and budget constraints while maintaining a well-defined, predictable project. Clear and detailed organisation can even be beneficial during difficult initiatives with a clearly defined purpose

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

3.2 MODULE DIAGRAM FOR SMART PARKING SYSTEM



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

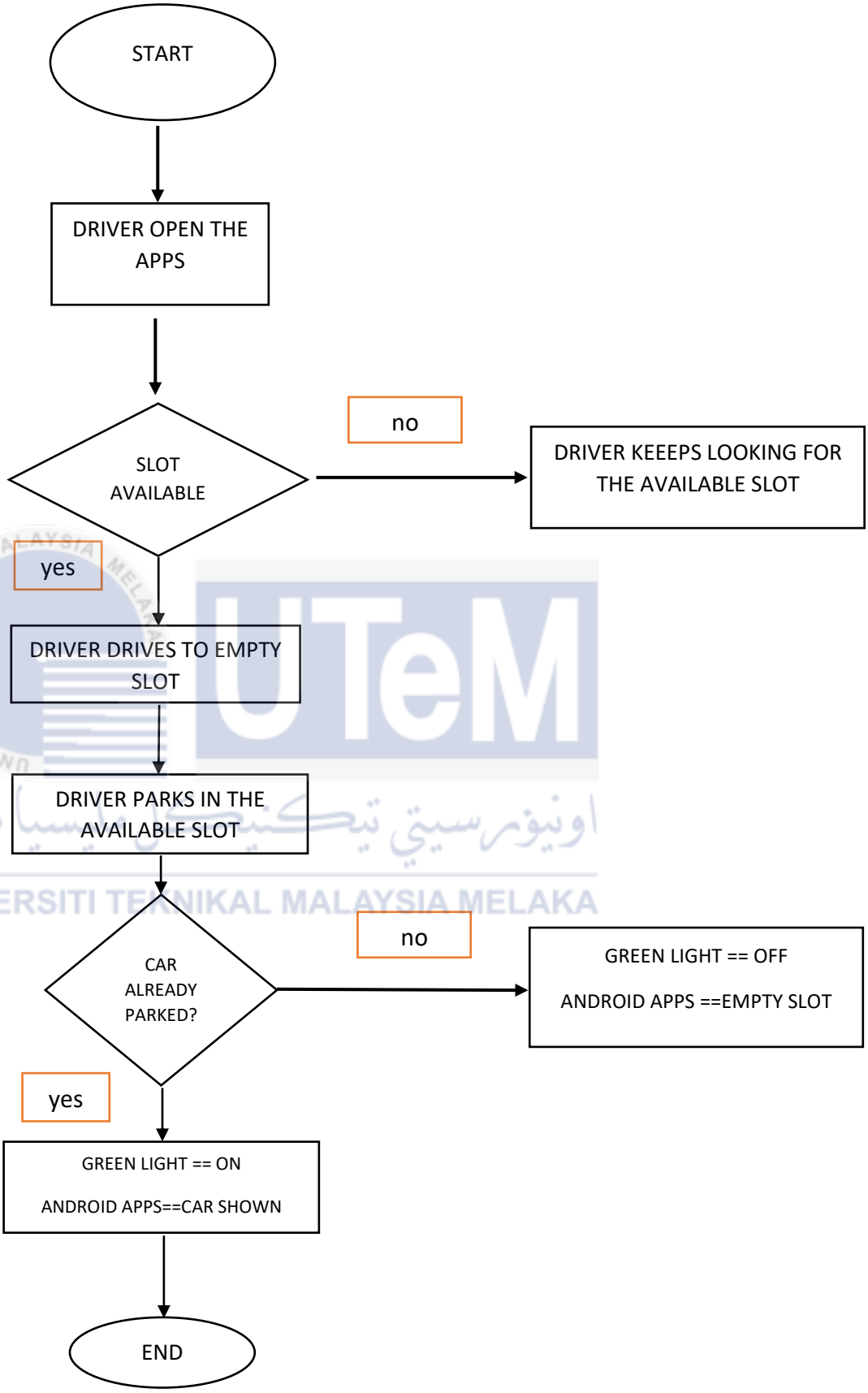
Manage Device	This module allows administrator to add, remove, and update Firebase devices.
Manage Database	This module allow administrator to add,remove and update real time database in Firebase.
Manage User	This module allows administrator to add, remove, update and delete user account into the Firebase
Check Parking Status	This module allows administrator to update parking status of the parking lots is occupied or empty by using Firebase

Manage Parking Sensor	This module allows the ESP 32 to scan and detect the arrival and departure of the car when ir sensor detects.
Send/Receive Data With Firebase	This module allows ESP32 to send and receive data across android application and Firebase Database.

Table 3.1 Description for each module

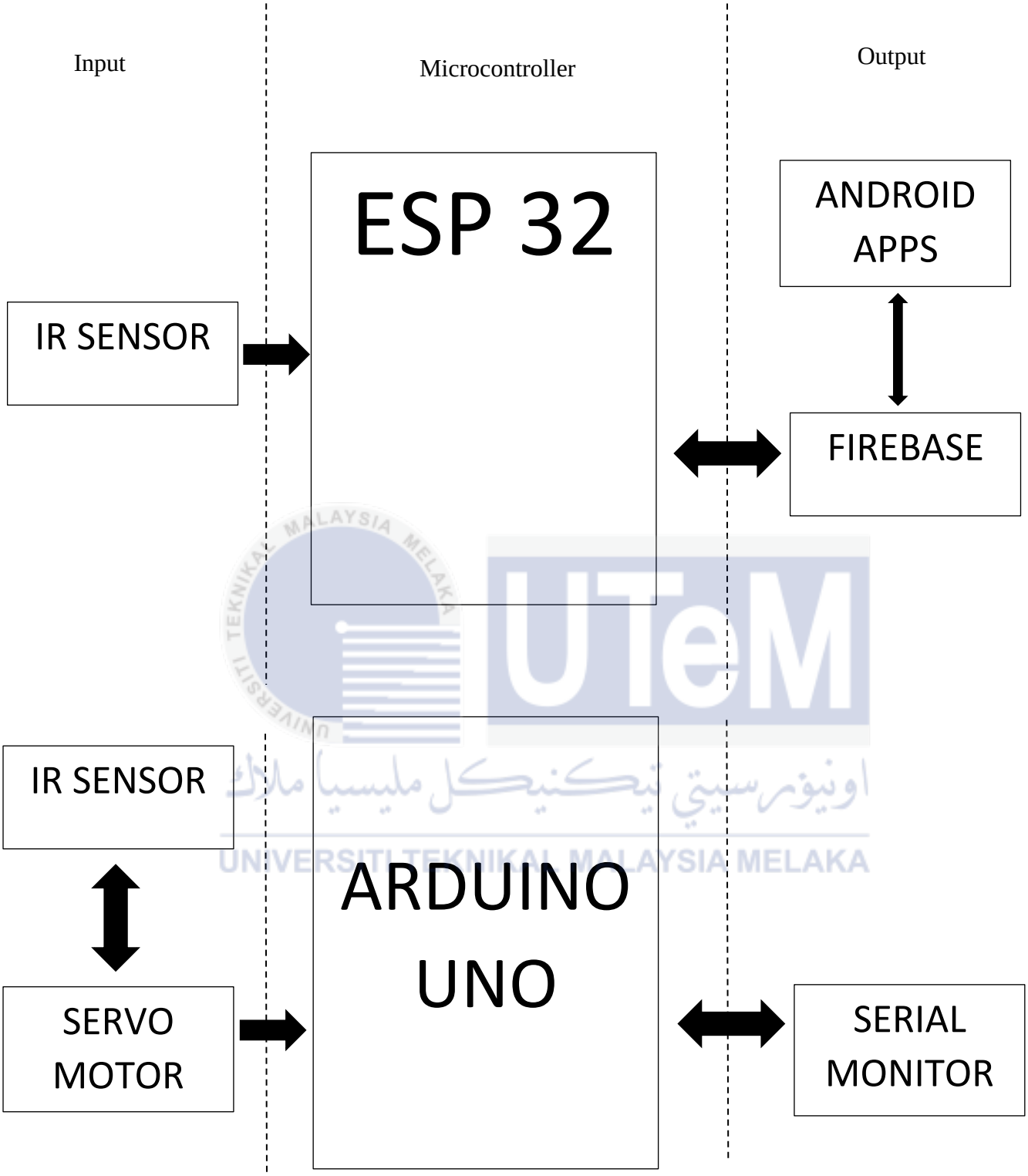
UNIVERSITI TEKNIKAL MALAYSIA MELAKA
اونيۏرسيتي تيکنيکل مليسيا ملاک
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

3.3 FLOWCHART DIAGRAM FOR SMART PARKING SYSTEM



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

3.4 BLOCK DIAGRAM FOR SMART PARKING SYSTEM



UNIVERSITI TEKNIKAL MALAYSIA MELAKA
اونيۏرسيتي تيکنيکل مليسيا ملاک

Based on the block diagram, ESP32 is the main controller that will be used in this projects. ESP32 works as a connection between the IR sensor and the firebase database. Firebase will be our main realtime database platform which record variable change in realtime database and send the data to Android Application. The diagram is direct with its connection. IR sensor as a input is directly connected to the ESP 32 pin by jumper wire. Then the data received from the sensor,mainly as a result from sensor detecting motion, the IR sensor will light on indicate the sensor is detected and it will send the data to ESP32. The microcontroller then sends data to Firebase and by developing a code to be uploaded to the microcontroller. The ouput can be translated into numbers of alphabet according to the developer choice. The data that has been collected will be displayed on android application which will be installed into user mobile phone.

Based on block diagram that focuses on arduino uno as it microcontroller, Arduino uno works as a connection between IR sensor with servo motor and serial monitor. IR sensor is connected to servo motor instruction and the microcontroller will shown the data to the serial monitor of arduino ide.

The primary objective of a block diagram is to provide an overview of the workflow that can be expected from the system after it has been completed. Engineers may easily examine the smooth running of the process and identify any present or missing aspects that may impede, impair, or unduly delay the output thanks to the clear illustration.

اونيۏرسيتي تيکنيکل مليسيا ملاک
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

3.5 INTRODUCTION TO NODE MCU

The ESP 32 is a more advanced microcontroller in the same family as the ESP 8266. It comes with a dual-core low-power co-processor.This microcontroller offers a dual-core of 160 MHz to 240 MHz. With WiFi module present, users may manage and monitor their system at a low cost. As it is engineered for IoT applications, ESP 32 has a ultra-low power cosumption and also includes fine grained clock gating,various power mode and dynamic power scaling. With it robust design, ESP32 capable of operating at a temperature ranging from 40 celcius up until 125 celcius [18]. There are three types of ESP 32 that we can use but for this project, it is justified that ESP 32 DEVKIT V2 is the best option for this project. Another option for microcontroller board is ESP 8266.

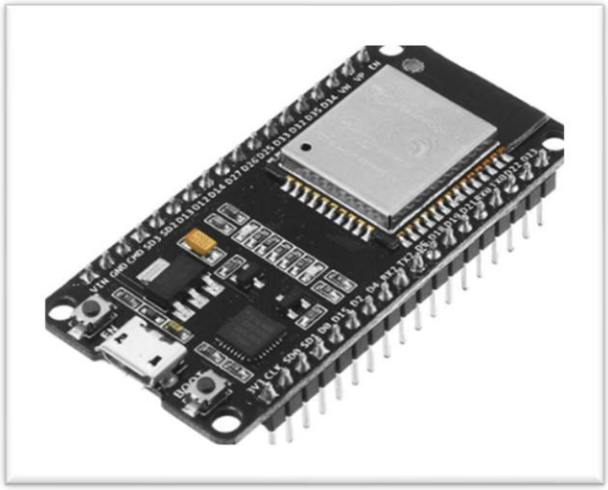


Figure 3.1 ESP 32 V2 microcontroller

Figure 3.2 ESP 32 Pinout Reference[18]

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

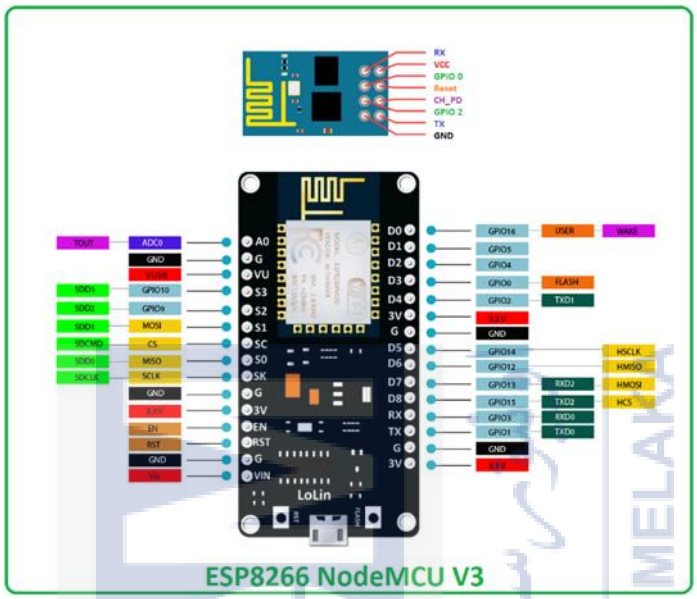


Figure 3.3 ESP8266 Pinout Reference

Feature	ESP-32	ESP-8266
Bluetooth	BLE & Bluetooth 4.2	No
SRAM	Yes	No
MCU	600 DMIPS Xtensa Dual-core 32-bit	L106 Xtensa Single-core 32 bit
Frequency of use	160MHz	80MHz
Software or Hardware PWM	16 channels/none	8 channels/non
Flash	Yes	No
ADC	Has 12 bit	Has 10 bit
GPIO	Has 34	Has 17
Sensor of temperature	Has (old version)	No
Sensor of touch	Yes	No

Wi-Fi 802.11 b/g/n	HT40	HT20
Sensor with a half	Yes	No

Table3.2: Comparison of ESP8266 and ESP32[18]

3.6 INTRODUCTION TO IR SENSOR

A sensor is a device that generates an output signal that can detect physical contact, light, and a variety of other factors. In this project, we will concentrate on the light sensor, which is an infrared sensor, and investigate the idea of employing another sensor as an alternative. Basically, an IR sensor is a light-emitting electronic gadget that detects objects in its surroundings. The following are the major specifications and features of the IR sensor module:

Features
The operating voltage is 5VDC
I/O pins – 3.3V & 5V
Mounting hole
The range is up to 20 centimeters
The supply current is 20mA
The range of sensing is adjustable
Fixed ambient light sensor

Table 3.3 IR Sensor Features

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

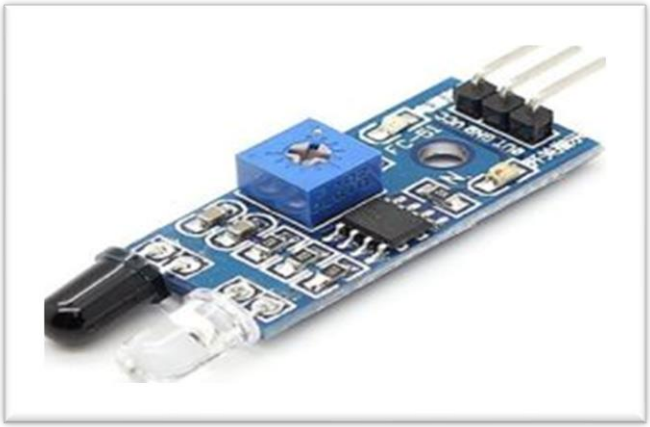


Figure 3.4 IR sensor

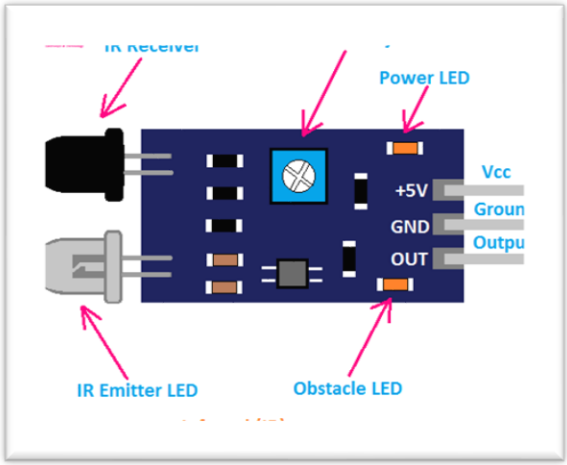
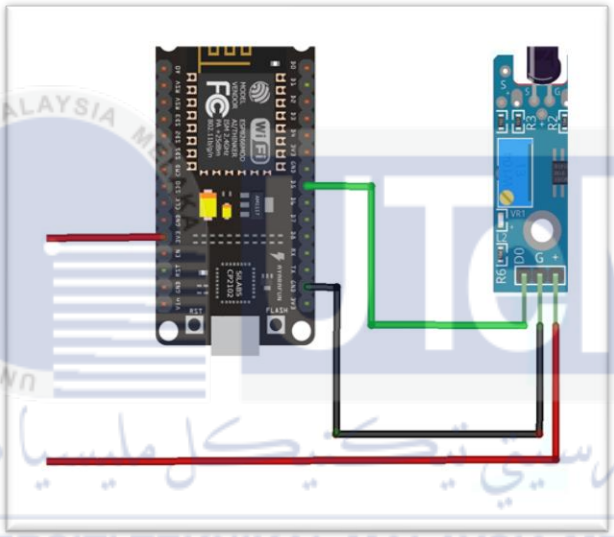


Figure 3.5 IR sensor module



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

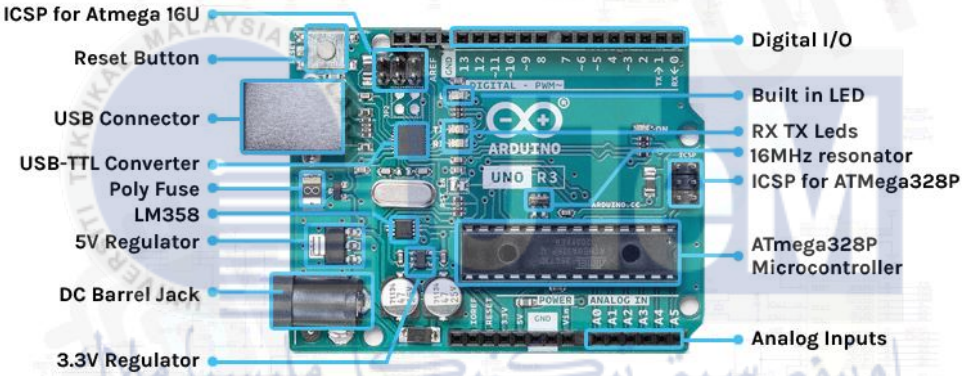
Figure 3.6 IR sensor connected to Node MCU(ESP32)

Ir sensor also known as LDR sensor (Light Dependent Resistance) mainly used to detect the intensity of light. By referring to figure 2.4, IR receiver is the module which detect the motion while IR emitter LED will statically blink green when receiver receive motion. The 3 pins below the sensor module is connected with microcontroller and coded into IDE to active the functionally of the sensor module

In general use, there are two types of IR sensor classification which is active or passive IR sensor. In Active IR sensor, this type include both emitter and receiver which also known as transmitter and receiver. This type of sensor mainly use LED or laser diode as a source. Futhermore it is processed through a signal processor to fetch the required data.

3.7 INTRODUCTION TO ARDUINO UNO

The Arduino Uno, based on Microchip's ATmega328P microcontroller, is an open source microcontroller board developed by Arduino.cc and first released in 2010. Interface to various expansion boards (shields) and other circuitry. Board has 14 digital I/O pins (6 with PWM output), 6 analog I/O pins, programmed with Arduino IDE (Integrated Development Environment) via USB type B cable Is possible. It can be powered by a USB cable or an external 9 volt battery, but accepts voltages between 7 and 20 volts.



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Figure 3.7 Arduino Uno Hardware

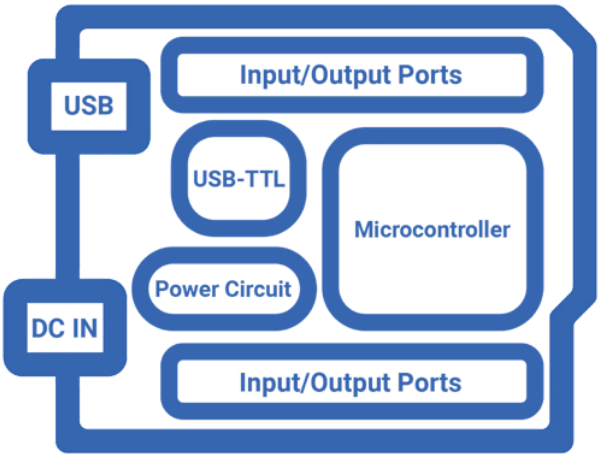


Figure 3.8 Arduino Uno Block Diagra

3.8 INTRODUCTION TO SYSTEM DEVELOPMENT ENVIROMENT

System development Enviroment also known as SDE is a collection of of software tools developer uses to build the software system. The development environment consists of a variety of programming software and tools, which are used to develop the final product. The environment can also be referred as the place where developers complete the majority of their work. Android Studio, Arduino IDE, IoT thingsboard platform and Firebase are the main technologies utilized in this IoT system.

3.8.1 ANDROID STUDIO IDE

Android Studio is a Google-approved integrated development environment for the Android operating system. It is developed for Android programming and is based on JetBrains' IntelliJ IDEA software. The primary user of this system will park their vehicle utilising a mobile app. This IDE offers a choice of framework and code libraries for app development, as well as a straightforward way to access and apply them to projects.. The android studio also come with a strong in-built emulator that can handle almost all version of SDK, together with the graphical debugger, it mades development more easier. Overall, this IDE is suitable for this project to develop the main application for the system[20].

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

PROS	CONS
Installation is easy and updating regularly	System requirement is demanding, older PC takes longer time to run emulator
Compatible to any devices	Slows down on system with limited RAM
Testing and diagnosing plaform issues easily and quickly	Takes a lot of time building and application

Table 3.4 Pros and Cons of Android Studio IDE[20]

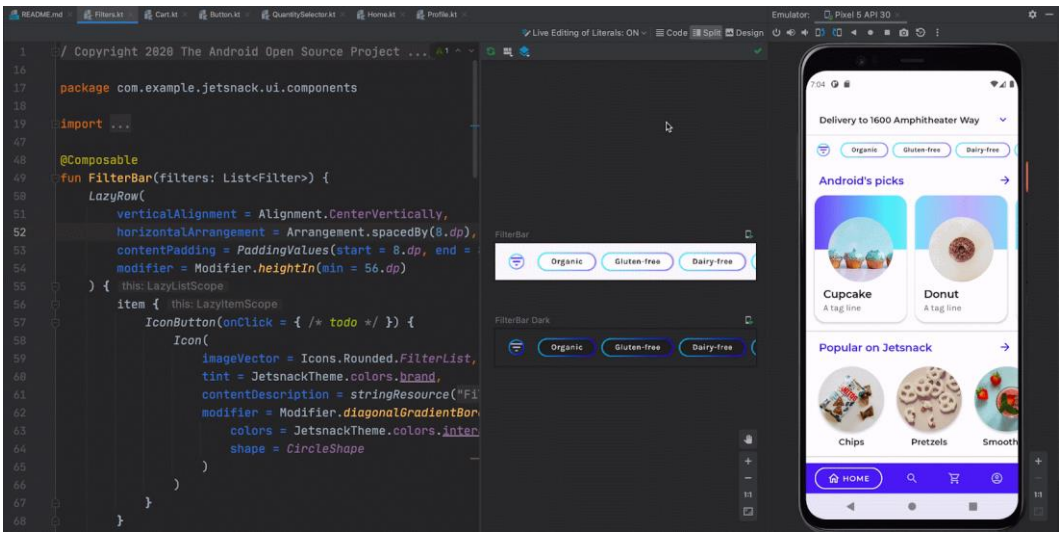


Figure 3.8 Android Studio IDE UI

Android studio IDE is very demanding in terms of hardware. Older PC with lower spec is unsuitable to run android studio IDE. The **recommended** system requirement include:

Recommended System Requirement	Minimum System Requirement
Higher core processor such as Intel 5th gen or Ryzen 2nd gen or higher	x86 64 CPU architecture (at least 2nd generation Intel Core)
16GB DDR4 RAM or higher	8GB DDR3 RAM or higher
Nvidia GTX 1050 Ti 4GB or higher	Nvidia GT1030 or higher
120gb SSD with atleast 50gb free spaces or higher	20 GB HDD free disk space or higher
1920 x 1080 resolution	1280 x 800 minimum screen resolution or higher

Table 3.5 Android Studio IDE system requirement[20]

3.8.2 ARDUINO IDE

This is an open-source Arduino Software (IDE), which made writing code and upload it to a board easy. This IDE can be used with any Arduino board. Esp32 will be the main board in this project. In order for the esp32 to function as a parking lot, developers need to code it to be able to detect vehicle and send signals to get verification and data transmission. With the simple

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

interface and variety of code support from this IDE, it helps the project developer in setting up the board used.

The key advantages of the Arduino IDE include its ability to act as both an on-premise and online editor, direct sketching, board module possibilities, and integrated libraries. Here are the specific benefits that users can expect from the system[21]:

- **Board Module Options**

The tool includes a board management module that allows users to select which board they want to utilise. If they require another board, they can easily select another alternative from the dropdown menu. PORT data is automatically updated anytime the board is modified or a new board is selected.

- **Direct Sketching**

The Arduino IDE has a text editor that allows users to create sketches. The procedure is straightforward and simple. Furthermore, the text editor includes extra features that encourage a more interactive experience.

- **Integrated Libraries**

Hundreds of libraries are built into the software. The Arduino community created and freely shared these libraries. Users can use this for their own projects without requiring third-party installations.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

- **Documentation**

The tool allows users to have their work documented. They can track their progress and be aware of any adjustments made thanks to this tool. Furthermore, documentation allows other programmers to use the sketches on their own boards.

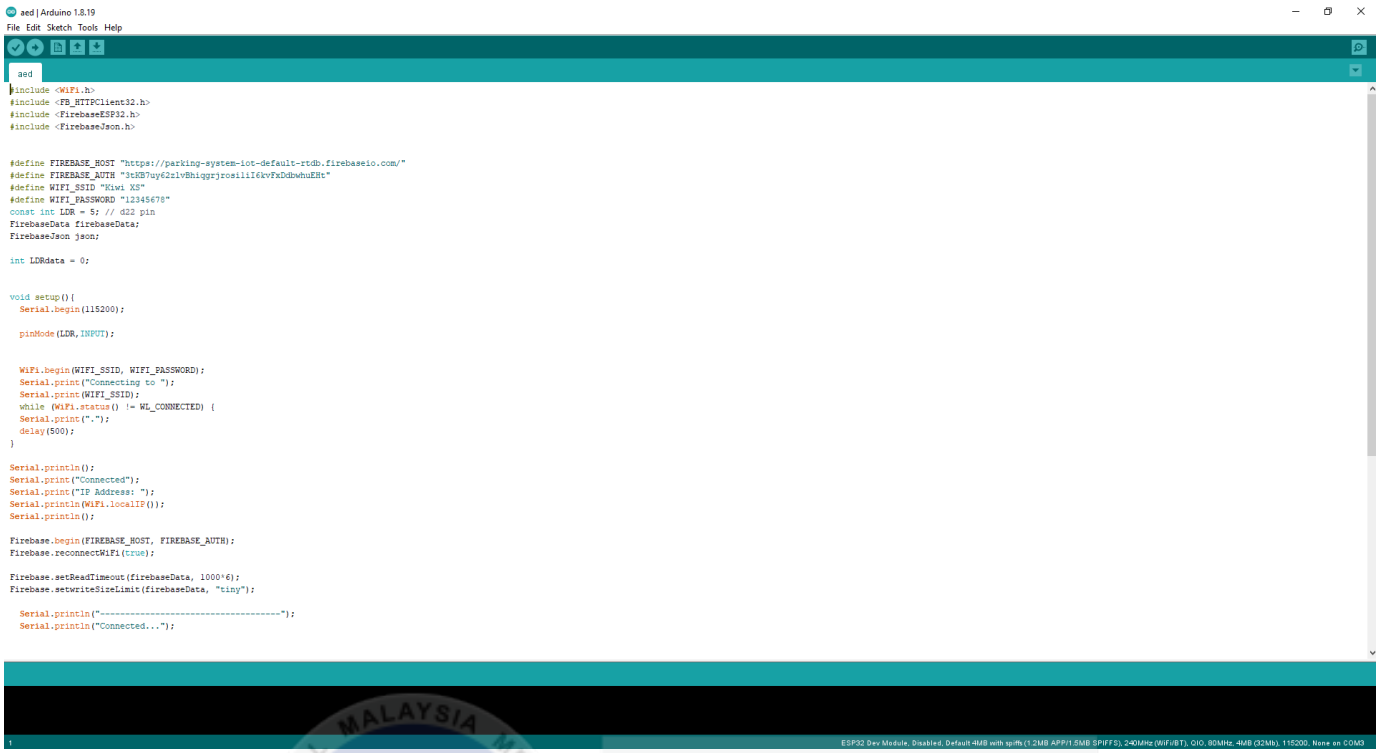


Figure 3.9 Arduino IDE User Interface

3.8.3 FIREBASE

Firebase is a Google-backed platform that allows developers to connect with hardware board such as ESP 32 to send realtime database to its platform. Firebase also provies tools for storing database with certain pricing available and 1GB free of real time database storage for starters. Firebase which acts as a cloud -hosted database also support android,Ios,Web platforms and Unity platforms. Firebase is user friendly and easy to learn. Users need to create a google account to use the platform.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

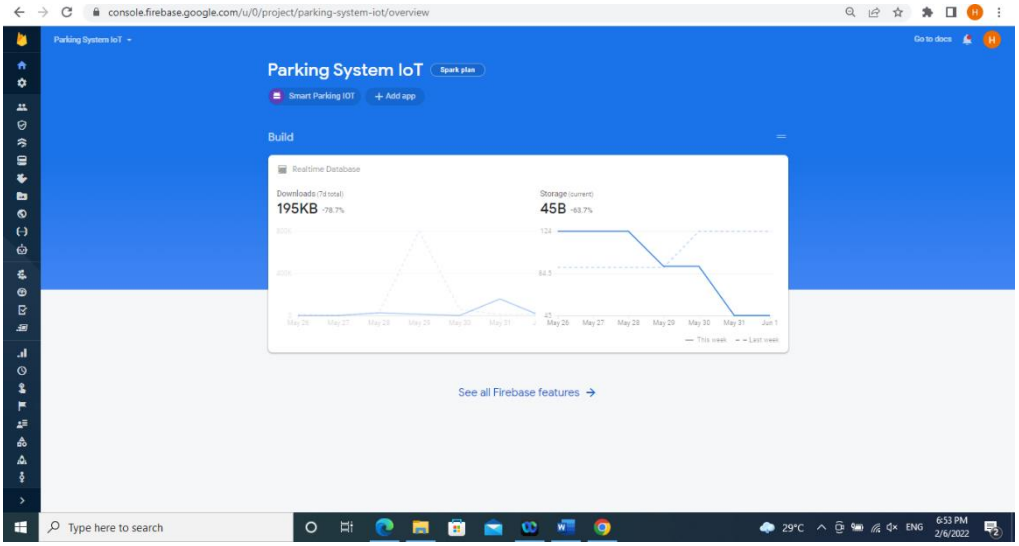


Figure 3.1.0 Firebase webpage

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 4

RESULTS AND ANALYSIS

4.0 INTRODUCTION

In this chapter, the results and analysis will be discussed. The data, operating circumstances, and data analysis are all included in the project test results . The final outcomes of these reviews and evaluations serve as a benchmark for determining if the project's goal has been met.

4.1 HARDWARE DEVELOPMENT ON ESP-32

ESP-32 The WiFi module and IR sensor are connected by pins and a jumper to accept sensor reading data that will be sent to the Firebase Database in real time. The microcontroller is directly connected to the power supply. The VCC pin is connected to the 3v3 pin, the GND pin is connected to the GND pin on the IR sensor, and the OUT pin is connected to any accessible input ports. If the connection is successful, the IR sensor will illuminate and be ready to receive data.

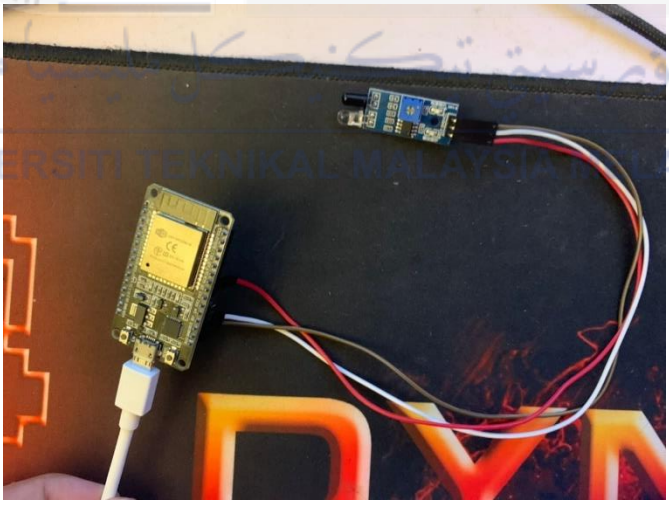


Figure 4.0 Hardware connection between ESP32 and IR sensor

To test whether the hardware connection is successful, obstacle must be placed directly onto the sensor. When sensor detected motion or obstacle, the green indicator will light up and if otherwise, only one static indicator will light up.

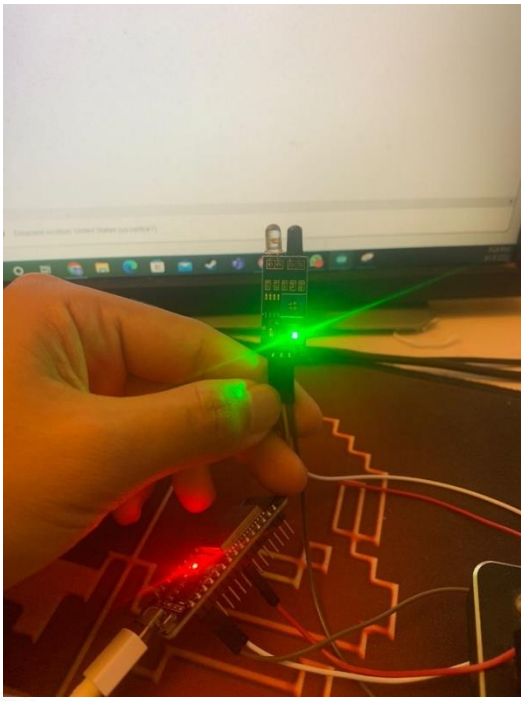


Figure 4.1 IR sensor when no motion is detected

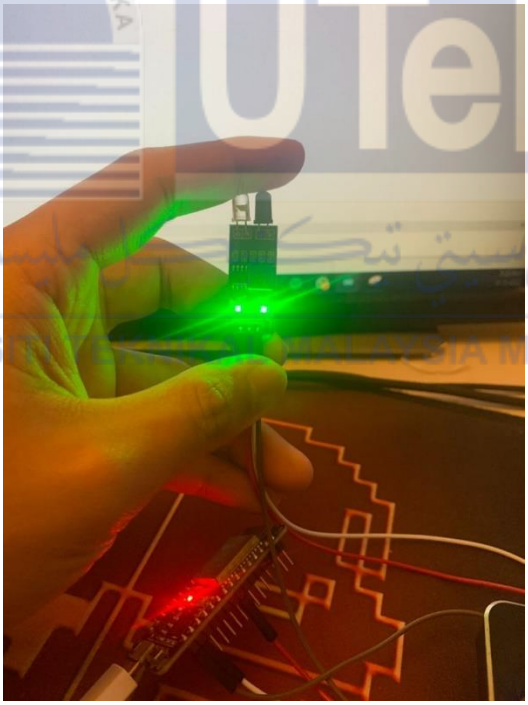


Figure 4.2 IR sensor when motion is detected, both green indicator will light up

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

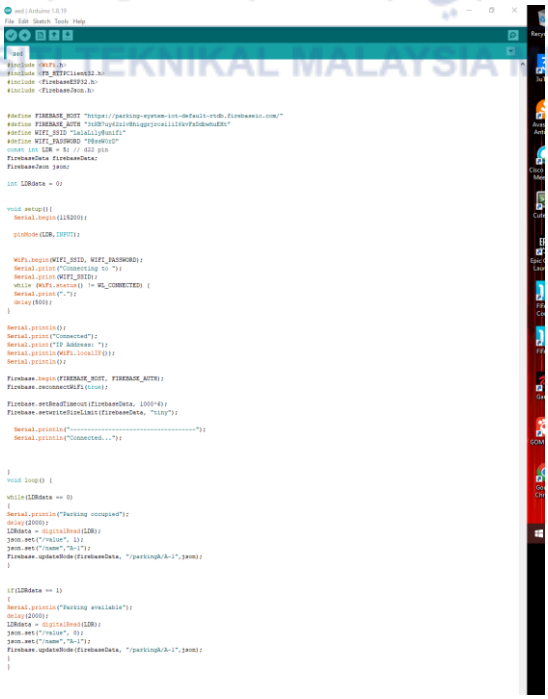
4.2 SOFTWARE DEVELOPMENT ON ESP-32

Firebase real time database is used to receive real time data that is transmitted from the IR sensor into the ESP32. Firebase shows variable change in real time when IR sensor detects motion or not. This data can be shown by using android application that is developed and connected with the Firebase. By referring to figure 4.3 , the firebase host and authentication key can be obtained from the project settings that already made.

```
#define FIREBASE_HOST "https://parking-system-iot-default-rtdb.firebaseio.com/"
#define FIREBASE_AUTH "3tKB7uy62zlvBhiqgrjrosiliI6kvFxDdbwhuEHt"
#define WIFI_SSID "LalaLily@unifi"
#define WIFI_PASSWORD "P@ssW0rD"
```

Figure 4.3 Firebase Host And Authentication

To make sure that the ESP is connected to the wifi, we need to define the WIFI SSID and WIFI password and also need to declare the right header so that connection between WIFI and ESP32 is succesful. This is to ensure that ESP32 can trasmit data from IR sensor into the Firebase host. When coding is sucessfully compiled, the code need to be uploaded into the ESP32 so that the right instruction can be send can read by the microcontroller and to achieve the objective of the project.



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Figure 4.4 Snapshot of the code.

By referring to figure 4.5, serial monitor will show parking available when there is no motion detected at the IR sensor and firebase also will show 0 value indicates that there is no variable change and this result is determined on the code that is sketched and uploaded into the microcontroller.

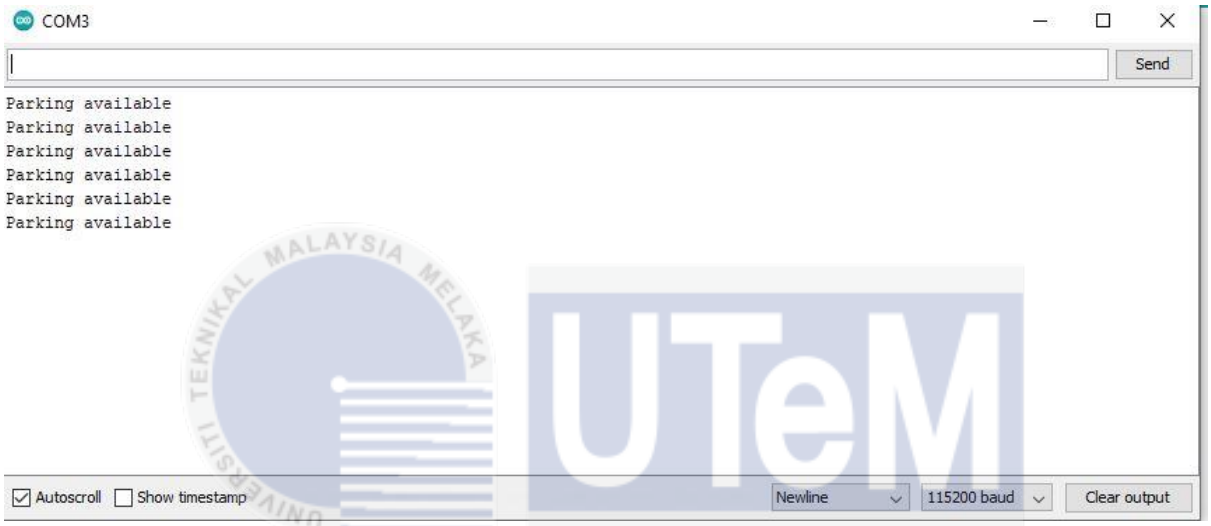


Figure 4.5 Serial Monitor showing "Parking Available"

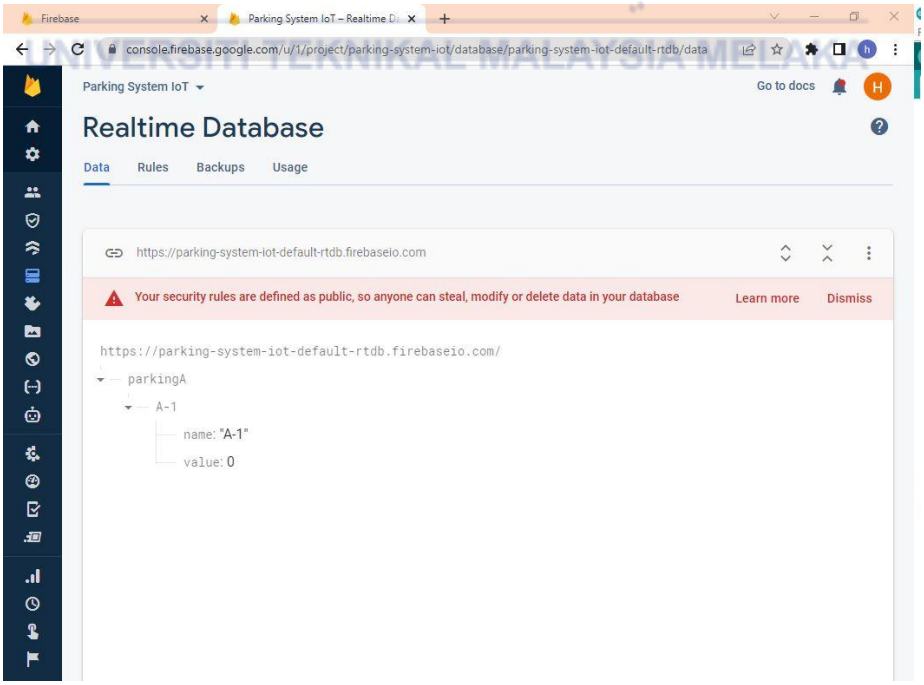


Figure 4.6 Firebase value is 0

According to figure 4.7 , serial monitor will change to parking occupied when there is motion detected at the IR sensor and it will send value ‘1’ to firebase . There will be a real time variable change from 1 to 0 and this result indicate that data transfer between the microcontroller and the firebase is successful.

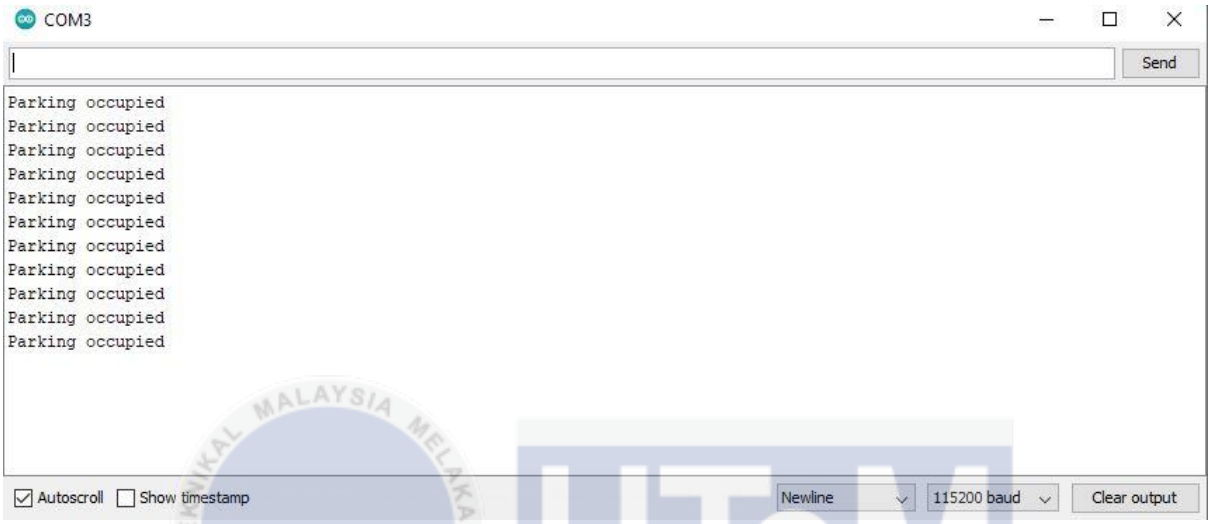


Figure 4.7 Serial Monitor showing “Parking Occupied”

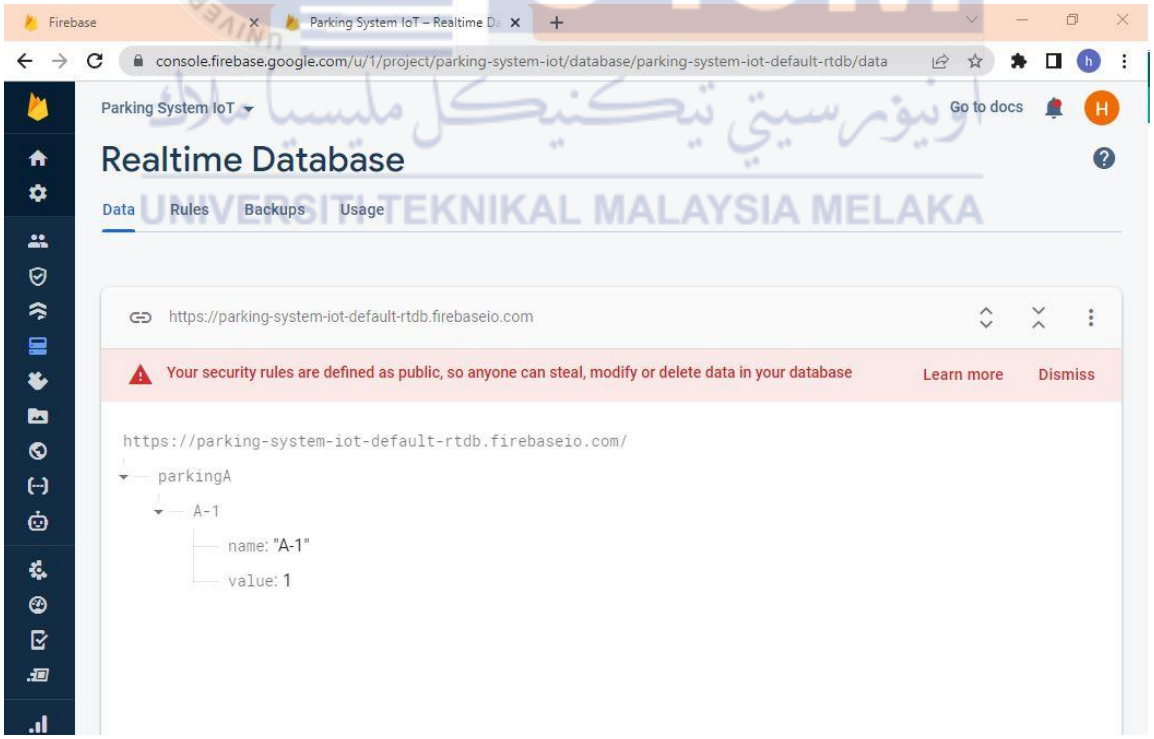


Figure 4.8 Firebase value changed from 0 to

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

4.3 HARDWARE DEVELOPMENT ON ARDUINO UNO

Arduino Uno is used with two servo motor tu replicate a gate that available at most parking lot. This arduino uno is directly connected to power source or battery. Brown wire on servo motor that represents negative supply is connected to GND while red wire to 5V or 3V and orange wire or PWM that acts as output is connected to digital pins on arduino uno. IR Sensor also used with the servo motor so that the barrier will spin 180 degrees or 90 degrees when an obstacle go through.

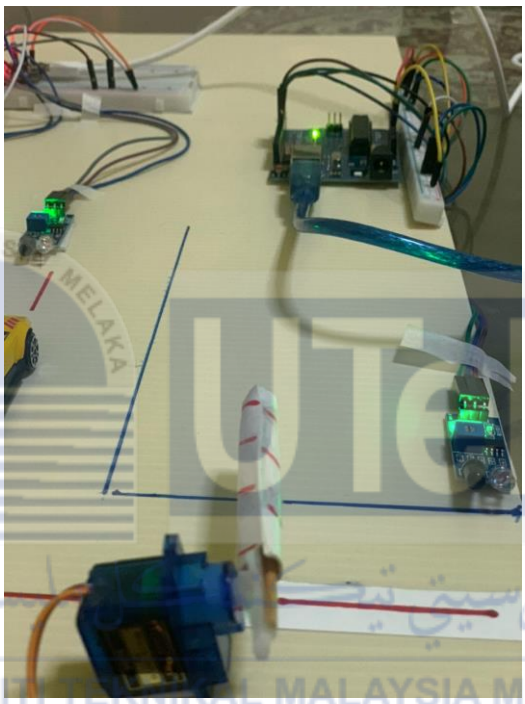


Figure 4.9 Connection between the IR

4.4 SOFTWARE DEVELOPMENT ON ARDUINO UNO

To make sure that when obstacle is detected on the IR sensor and servo motor will turn 90 degree to indicate the gate is open and 180 degrees as it default, a successful code is required for the successful connection. The servo pin and sensor pin must be declared at the code and instructions is given which is when sensor is reading 1 value the gate will always be 180 degree and when the sensor reading is 0 the gate motor will change to 90 degree.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

```
void setup(){
  Serial.begin(115200);
  pinMode(sensor_pin,INPUT);
  tap_servo.attach(tap_servo_pin);
  tap_servo2.attach(tap_servo_pin2);

}

void loop(){
  val = digitalRead(sensor_pin);
  val2 = digitalRead(sensor_pin2);


  if (val==1)
  {tap_servo.write(180);
   Serial.println("Gate Close");
     delay(500);
  }
  if (val==0)
  {tap_servo.write(90);
   Serial.println("Gate Open");
     delay(500);
    }

     if (val2==1)
  {tap_servo2.write(180);
   Serial.println("Gate Close 2");
     delay(500);
```

Figure 4.10 Snapshot of the code

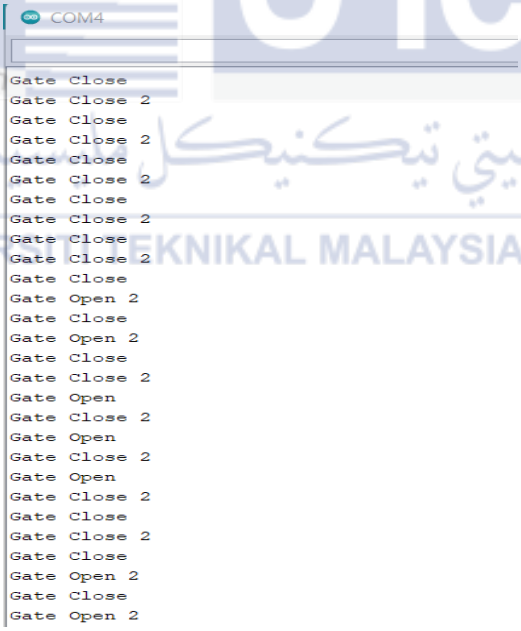


Figure 4.11 Serial monitor for arduino uno

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

4.5 PROTOTYPE DEVELOPMENT

After all the connections is established, a prototype is developed to replicate the parking lot situation in real life. In the final prototype, a total of 10 IR sensor is used alongside 2 servo motor, 1 ESP-32 and 1 arduino uno.

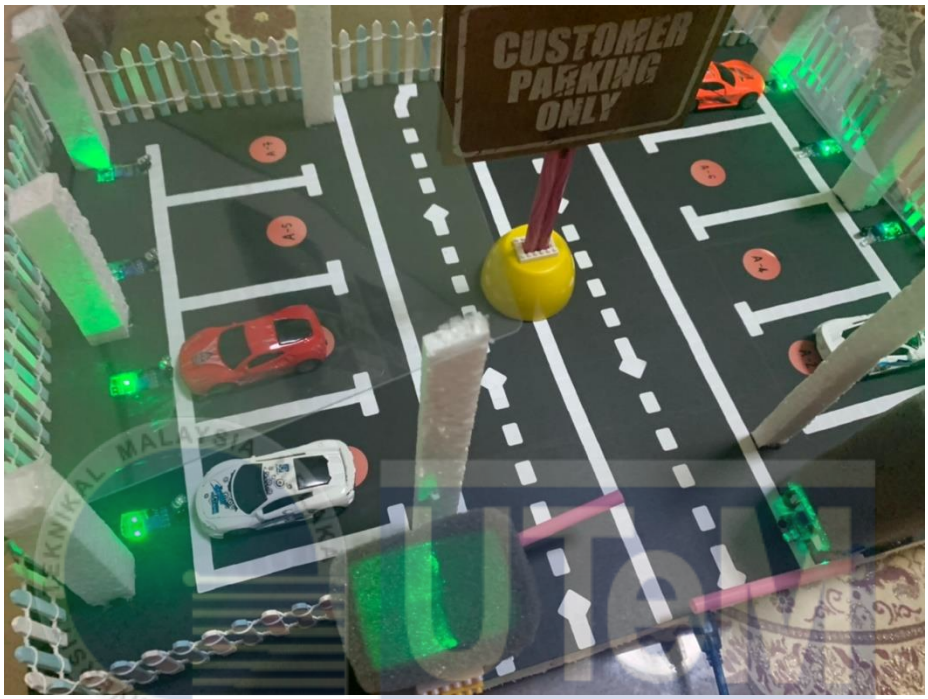


Figure 4.12 Parking System Prototype

اونيۏرسيتي تيكنيكل مليسيا ملاك
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

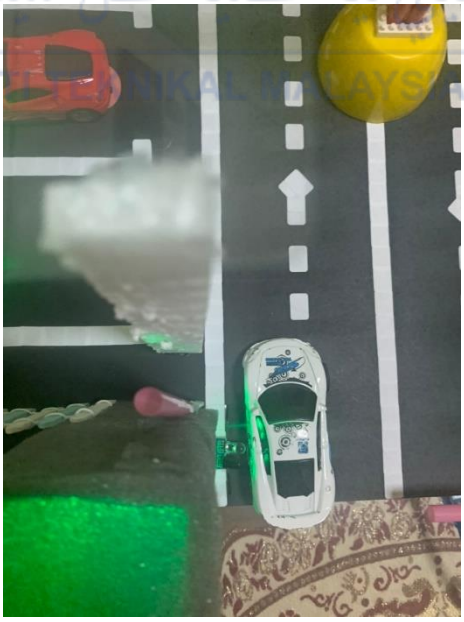


Figure 4.13 Servo motor rotated when car is present

According to figure 4.13, the servo motor at default is at 180 degree indicate the gate is closed. When IR sensor detects a motion of car, it will send instructions to servo motor to change to 90 degrees angle indicating the gate is open.

Figure 4.14 Car present at parking slots

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
UTeM
اونيۏرسيتي تيکنيکل مليسيا ملاک

According to figure 4.14 when the sensor detects the car, both of the light on the ir sensor will light up and if there is no obstacle present, only power indicator will light up. When both light is up, firebase will receive instructions to change the value in real -time connection. To achieve this the microcontroller must be connected to the internet at all time.

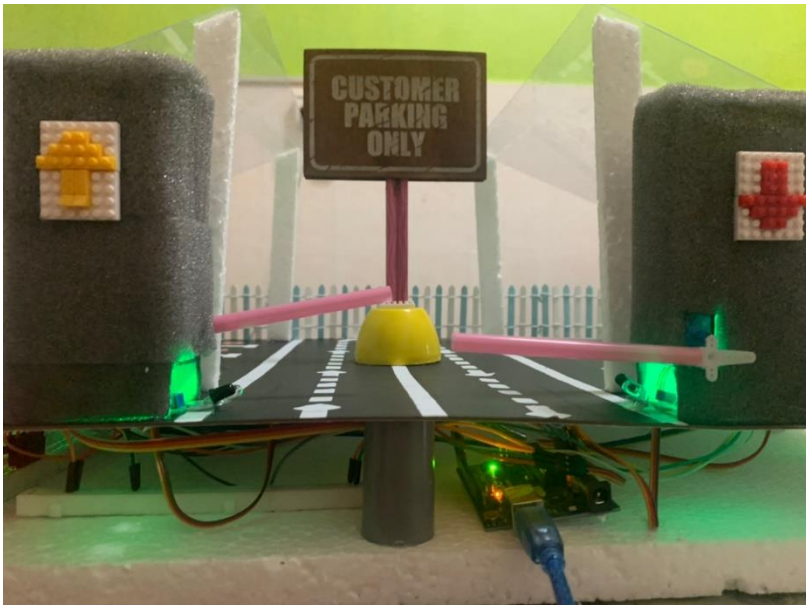


Figure 4.15 Both servo motor at 180 degrees angle

Figure 4.16 ESP32 and Arduino Uno connection is kept below the parking slot

4.6 ANDROID APPLICATION DEVELOPMENT

To achieve our goal, an android application must be made to fulfill the needs of our parking user. This android application will show the real parking slot according to the place. Firebase must be connected to the android studio so that data can be sent from firebase to android applications. According to figure 4.17, an android icon will appear at firebase console when the connection between the firebase and android studio is successful.

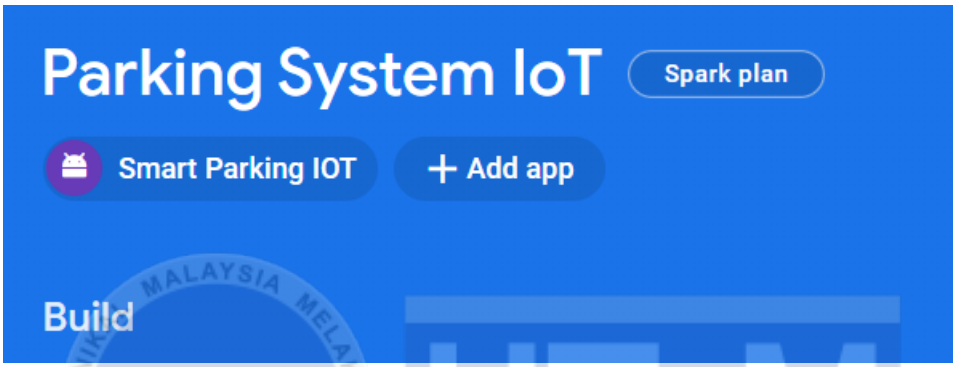


Figure 4.17 Succesful connection between android and firebase

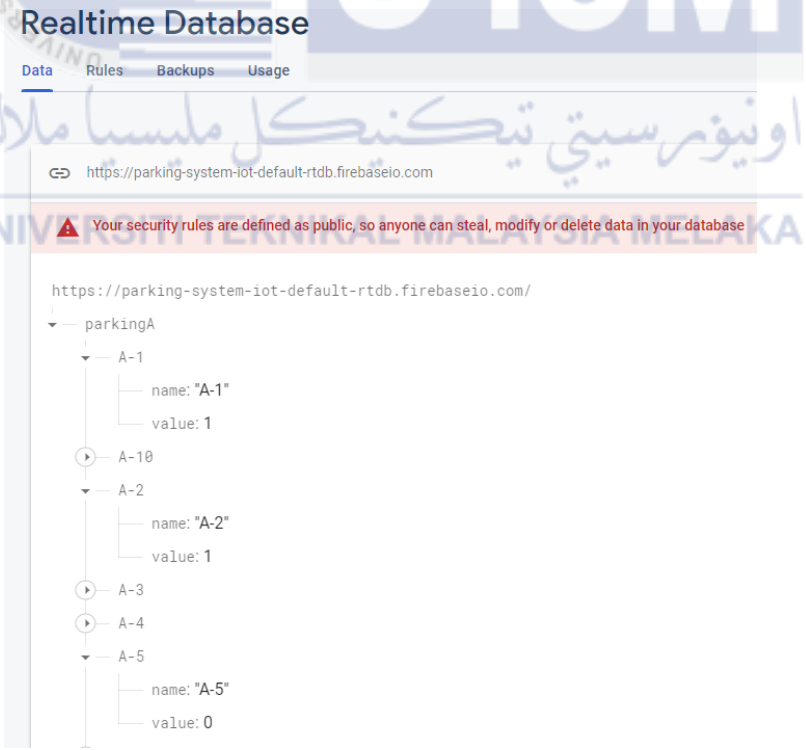


Figure 4.18 Data send from ESP-32 to Firebase

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Figure 4.19 Front page of the application

According to figure 4.19, this is the front page of the application. First,user need to select the parking lot that available. If user click at the desired parking lot, it brings user to homepage of the parking system application apps. At the homepage user can click onto the parking location box and it will bring the user to google maps of the parking location. If user click at the helpline button, it will show a number that can be called.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Figure 4.20 Homepage of the application

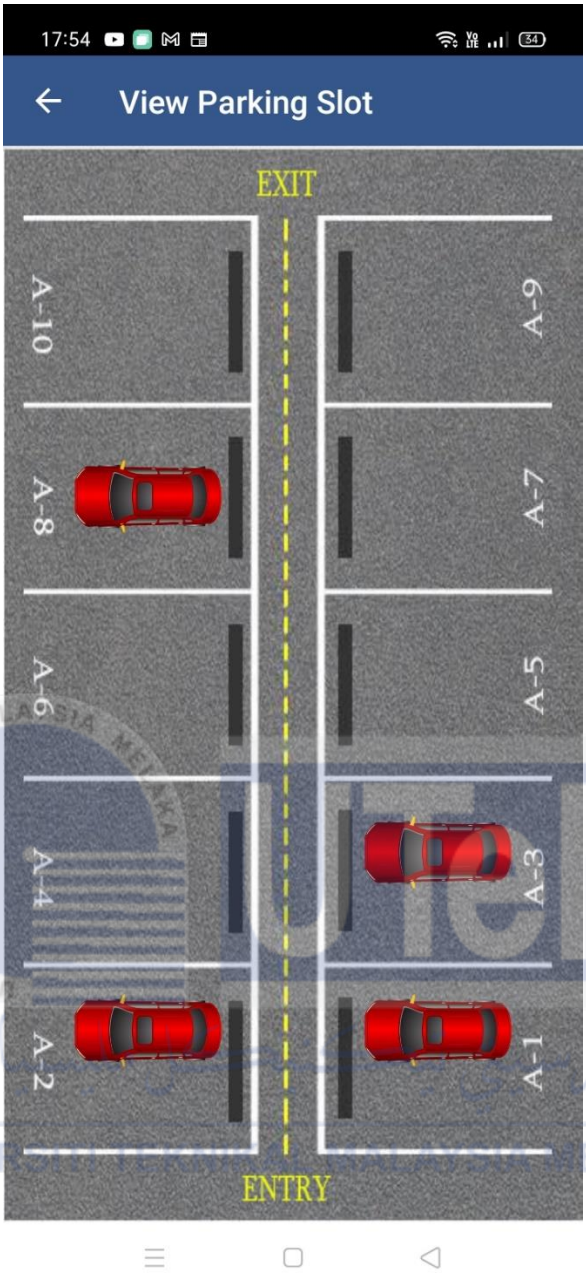


Figure 4.21 View Parking Slot

According to figure 4.21 , when user click at the parking slot button, it will show this page that shows which slot available and which slot is not. This page is connected to the firebase console and firebase console received the data from ESP-32. When the value at firebase is 0 no car is present at the slot and if the value is changed to 1, a car will appear at the slot indicating that the slot is occupied. The coding of this page will include instructions to receive firebase data.

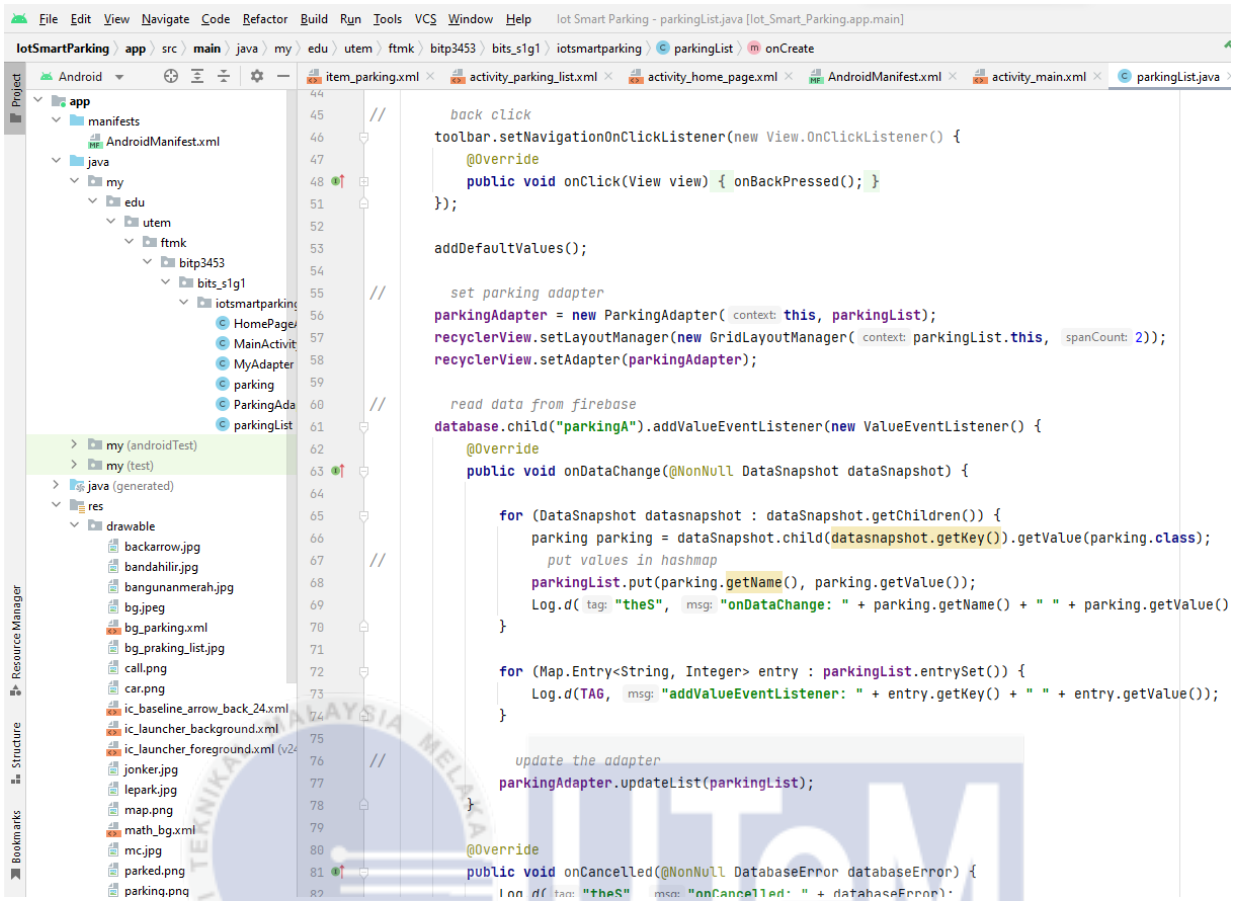


Figure 4.22 Snapshot of the code that include firebase instructions

This chapter explains one of the final outcomes from the project. The result of Smart Parking System is included. Moreover , the results of the compiled coding also have been included to prove the connection between hardware and software is a success without any error or a need to troubleshoot.

CHAPTER 5
CONCLUSION & RECOMMENDATIONS

5.0 INTRODUCTION

The overall project implementation is concluded, and future recommendation are suggested in this chapter.

5.1 CONCLUSIONS

The Iot Smart Parking System provided certain benefits to its intended population. First and foremost, with the introduction of the parking application, users will be able to choose which lot they will be able to park in, as well as simply track the parking location and its availability. This project also met all the objective that is required. The prototype is able to successfully guide multiple cars on searching empty parking spot with the use of android application.

Futhermore, the developed project able to make connections between microcontroller,firebase and android applications. The data that shown onto android application that received from firebase in realtime will assist user in quest to search for empty parking spaces. User also being able to plan ahead on where to park and user can choose variety of parking lots within the states. This will save a lot of user time because if the parking lot if fully occupied,user does not need to wander or circling in search of parking slot. The android application also has a map button if user doesn't know the location of parking lot.

Lastly, this system benefits will go well beyond avoinding the needless circling of parking lot. It also reduce gas emissions and reduce time wastage. The smart parking system is beneficial for car park operators,patrons as well as in enviroment conservation. For operators,the information shown from android application can be used in decision making on whether to closed the parking lot for a moment by showing parking full sign.

5.2 RECOMMENDATIONS

There are a number of improvement that can be made to develop more on this project. Amount of parking slot left can be added and user can register and login to look onto parking history or searches. This project also may add reserve and payment for parking slots and real-time direction to the slots. By adding more module to the project,admin be able to update or delete the data and usage of database such as oracle may be beneficial for this project. Last but not least, this project will made changes to the quality of life to user and admin. This project is to be hoped that users will be able to find this system helpful in the future

5.3 PROJECT POTENTIAL

This project aim to use for parking contractors, mainly parking spaces that were handled by municipal council such as MBMB. This council already has a system which user can pay but there is no features where user can see empty slots. Thus integrating this system with existing system will help user and thus can also increase the income for the council.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

REFERENCES

[1] "Anthony Lim , 2019 Vehicle Registration in Malaysia" https://paultan.org/2020/04/02/vehicles-registrations-in-malaysia-31-2-mil-as-of-2019/

[2] M.Y.I. Idris, Y.Y. Leng, E.M. Tamil, N.M. Noor and Z. Razak, 2009. Car Park System: A Review of Smart Parking System and its Technology. Information Technology Journal, 8: 101-113.

[3] Shah, Ahmed & Shah, Dev & Satpute, Ajit & S., Mihir & Shinde, Sunil. (2021). Literature Review on Parking System. International Journal of Engineering and Technical Research. 10. 100. 10.17577/IJERTV10IS100061.

[4] "Shubhankar Gautamon March 4, 2020 Get My Parking" https://blog.getmyparking.com/2020/03/04/people-in-kuala-lumpur-waste-25-minutes- every-day-looking -for-parking/#:~:text=Due%20to%20the%20lack%20of,through%20the%20tiniest%20of%20space

[5] "BCG Unlocking Cities, The Impact Of Ride Sharing Apps in Malaysia" https://web-assets.bcg.com/img-src/BCG-unlocking-cities-2017_tcm93-178660.PDF

[6] Ali, Abdul & Hassan, Sitti. (2020). Parking Characteristics in Malaysia Public Hospitals. IOP Conference Series: Materials Science and Engineering. 884. 012047. 10.1088/1757-899X/884/1/012047.

[7] "Joschka Muller Oct 19 2021, Car Ownership among Malaysian Respondents" https://www.statista.com/statistics/1029277/malaysia-car-ownership-among-consumers/#:~:text=Car%20ownership%20among%20Malaysian%20respondents%20in%202019&text=According%20to%20the%20survey%20conducted,higher%20than%20its%20neighboring%20countries.

[8] "Manuel Silverio Dec 30 2019 What is Smart Device?" https://towardsdatascience.com/what-is-a-smart-device-the-key-concept-of-the-

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

[9] Tahsien, Syeda & Karimipour, Hadis & Spachos, P.. (2020). Machine learning based solutions for security of Internet of Things (IoT): A survey. Journal of Network and Computer Applications. 161. 102630. 10.1016/j.jnca.2020.102630.

[10] Sfar AR, Zied C, Challal Y. A systematic and cognitive vision for IoT security: a case study of military live simulation and security challenges. In: Proc. 2017 international conference on smart, monitored and controlled cities (SM2C), Sfax, Tunisia, 17–19 Feb. 2017. https://doi.org/10.1109/sm2c.2017.8071828.

[11] "Jason Cockerham , What is Sensor?" https://managerplus.iofficecorp.com/blog/sensors-actuators

[12] "April 9, 2020 Heidi Huff Iot Explained" https://www.sealevel.com/2020/04/09/iot-explained-part-ii-the-four-stages-of-data-collection-conversion-and-transfer/

[13] "Mark Andrew March 2014 Computing Strategy Data" https://www.redhat.com/en/topics/edge-computing/iot-edge-computing-need-to-work-together#:~:text=Edge%20computing%2C%20a%20strategy%20for,analyze%20data%20in%20real%2Dtime.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

[14] Rahman, Atiqur & Li, Yun. (2020). Automated smart car parking system using raspberry Pi 4 and iOS application. International Journal of Reconfigurable and Embedded Systems (IJRES). 9. 229. 10.11591/ijres.v9.i3.pp229-234.

[15] Mendiratta, Sarthak, Debopam Dey and Deepika Rani Sona. "Automatic car parking system with visual indicator along with IoT." *2017 International conference on Microelectronic Devices, Circuits and Systems (ICMDCS)* (2017): 1-3.

[16] Anusooya, G. & Jackson, Christy & Sathyarajasekaran, K. & Kannan, K.. (2017). RFID based smart car parking system. International Journal of Applied Engineering Research. 12. 6559-6563.

[17] Van Casteren, Wilfred. (2017). The Waterfall Model and the Agile Methodologies : A comparison by project characteristics. 10.13140/RG.2.2.36825.72805.

[18] “Ravi Teja Febraury 2021, Getting Started With ESP32” https://www.electronicshub.org/getting-started-with-esp32/

[19] “Jeremy S Cook May 2020 , Understanding Active and Passive IR” https://www.arrow.com/en/research-and-events/articles/understanding-active-and-passive-infrared-sensors

[20] Narmatha, M., and S. Venkata KrishnaKumar. "Study on Android operating system and its versions." International Journal of Scientific Engineering and Applied Science 2.2 (2016): 439-444.

[21] “Ismail Sarwar October 2016 Pros and Cons of Arduino IDE” https://engineerexperiences.com/advantages-and-disadvatages.html

[22] “Amir Iman May 2016 Thingsboard and Firebase” https://www.saashub.com/compare-thingsboard-vs-firebase

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

APPENDIX

ESP 32 Code

```
#include <WiFi.h>
#include <FB_HTTPClient32.h>
#include <FirebaseESP32.h>
#include <FirebaseJson.h>



#define FIREBASE_HOST "https://parking-system-iot-default-rtdb.firebaseio.com/"
#define FIREBASE_AUTH "3tKB7uy62zlvBhiqgrjrosi1iI6kvFxDdbwhuEHt"
#define WIFI_SSID "Kiwi XS"
#define WIFI_PASSWORD "12345678"
const int LDR = 5; // d22 pin
FirebaseData firebaseData;
FirebaseJson json;

int LDRdata = 0;

void setup(){
  Serial.begin(115200);

  pinMode(LDR,INPUT);

  WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
  Serial.print("Connecting to ");
  Serial.print(WIFI_SSID);
  while (WiFi.status() != WL_CONNECTED) {
  Serial.print(".");
  delay(500);
}
```

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

```
Serial.println();
Serial.print("Connected");
Serial.print("IP Address: ");
Serial.println(WiFi.localIP());
Serial.println();

Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);
Firebase.reconnectWiFi(true);

Firebase.setReadTimeout(firebaseData, 1000*6);
Firebase.setwriteSizeLimit(firebaseData, "tiny");

  Serial.println("------------------------------------");
  Serial.println("Connected...");



}
void loop() {
// put your main code here, to run repeatedly:



//trap loop
while(LDRdata == 0)
{
Serial.println("Parking occupied");
delay(2000);
LDRdata = digitalRead(LDR);
json.set("/value", 1);
```

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

```
Firebase.updateNode(firebaseData, "/parkingA/A-1",json);
}


if(LDRdata == 1)
{
Serial.println("Parking available");
delay(2000);
LDRdata = digitalRead(LDR);
json.set("/value", 0);
json.set("/name","A-1");
Firebase.updateNode(firebaseData, "/parkingA/A-1",json);
}
}
```

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
اونيۏرسيتي تيکنيکل مليسيا ملاك
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Android To Firebase Code

```
package my.edu.utem.ftmk.bitp3453.bits_s1g1.iotsmartparking;

import androidx.annotation.NonNull;
import androidx.appcompat.app.AppCompatActivity;
import androidx.appcompat.widget.Toolbar;
import androidx.recyclerview.widget.GridLayoutManager;
import androidx.recyclerview.widget.LinearLayoutManager;
import androidx.recyclerview.widget.RecyclerView;

import android.os.Bundle;
import android.util.Log;
import android.view.View;
import android.widget.TextView;

import com.google.firebase.database.DataSnapshot;
import com.google.firebase.database.DatabaseError;
import com.google.firebase.database.DatabaseReference;
import com.google.firebase.database.FirebaseDatabase;
import com.google.firebase.database.ValueEventListener;

import java.util.ArrayList;
import java.util.HashMap;
import java.util.Map;

public class parkingList extends AppCompatActivity {

    RecyclerView recyclerView;
    DatabaseReference database;
    ParkingAdapter parkingAdapter;
    HashMap<String, Integer> parkingList;
    String TAG = "theH";

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_parking_list);

        recyclerView = findViewById(R.id.parkinglist);
        Toolbar toolbar = findViewById(R.id.ViewToolbar);

        setSupportActionBar(toolbar);
        database = FirebaseDatabase.getInstance().getReference();
        recyclerView.setHasFixedSize(true);

//        back click
        toolbar.setNavigationOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View view) {
                onBackPressed();
            }
        });

        addDefaultValues();

//        set parking adapter
        parkingAdapter = new ParkingAdapter(this, parkingList);
        recyclerView.setLayoutManager(new
```

```
GridLayoutManager(parkingList.this, 2));
        recyclerView.setAdapter(parkingAdapter);

//        read data from firebase
        database.child("parkingA").addValueEventListener(new
ValueEventListener() {
            @Override
            public void onDataChange(@NonNull DataSnapshot dataSnapshot) {

                for (DataSnapshot datasnapshot : dataSnapshot.getChildren())
{
                    parking parking =
dataSnapshot.child(datasnapshot.getKey()).getValue(parking.class);
//                    put values in hashmap
                    parkingList.put(parking.getName(), parking.getValue());
                    Log.d("theS", "onDataChange: " + parking.getName() + " "
+ parking.getValue());
                }

                for (Map.Entry<String, Integer> entry :
parkingList.entrySet()) {
                    Log.d(TAG, "addValueEventListener: " + entry.getKey() +
" " + entry.getValue());
                }

//                update the adapter
                parkingAdapter.updateList(parkingList);
            }

            @Override
            public void onCancelled(@NonNull DatabaseError databaseError) {
                Log.d("theS", "onCancelled: " + databaseError);
            }
        });
    }


    public void addDefaultValues() {
//        put default value in hashmap
        parkingList = new HashMap<>();
        parkingList.put("A-1", 0);
        parkingList.put("A-2", 0);
        parkingList.put("A-3", 0);
        parkingList.put("A-4", 0);
        parkingList.put("A-5", 0);
        parkingList.put("A-6", 0);
        parkingList.put("A-7", 0);
        parkingList.put("A-8", 0);
        parkingList.put("A-9", 0);
        parkingList.put("A-10", 0);
        for (Map.Entry<String, Integer> entry : parkingList.entrySet()) {
            Log.d(TAG, "addDefaultValues: " + entry.getKey() + " " +
entry.getValue());
        }
    }
}
```

UNIVERSITI TEKNIKAL MALAYSIA MELAKA