Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF PET ENTRANCE SYSTEM USING RFID

NUR ALIZA BINTI MD ZAM

Bachelor of Electronics Engineering Technology with Honours

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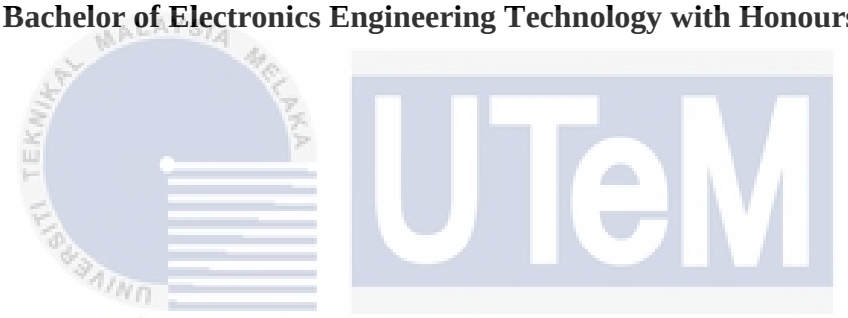
A project report submitted
in partial fulfilment of the requirements for the degree of
Bachelor of Electronics Engineering Technology with Honours



Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this project report entitled “Development of pet entrance system using RFID” 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 : NUR ALIZA BINTI MD ZAM

Date : 28 / 1 / 2023

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronic Engineering Technology with Honours.

Signature : 

Supervisor Name : TS. SAIFULLAH BIN SALAM

Date : 24/2/2023

Signature :

Co-Supervisor :

Name (if any) EN. AMAR FAIZ BIN ZAINAL ABIDIN

Date :

DEDICATION

I would like to dedicate this project to my supervisor, Mr Ts. Saifullah Bin Salam and Mr Amar Faiz bin Zainal Abidin whom had guided me this project. I would like to thank my beloved parents, Md Zam bin Giman and Ramlah binti Hj Hassan for encouraging me to finish my final year project. Thank you for the support and prayer. I would like to thank my sibling,. friends, lecturer and and my favourite person whom had helped and supported me.

ABSTRACT

Nowadays, the advancement of quickly increasing technical facilities has substantially aided in improving the quality of living in human daily existence. Simultaneously, this raises the demand for technologies that can assist pet owners in monitoring their pets while they are away from home. Since pet owners are preoccupied with their daily routines, they do not have time to allow their pets out of the house and keep them healthy. The goal of this project is to design a pet entry system which uses RFID technology to allow pets to pass through doors without human assistance. This invention is using RFID technology to allow access to the pet through the door.

ABSTRAK

Pada masa kini, kemajuan kemudahan teknikal yang meningkat dengan pesat telah banyak membantu dalam meningkatkan kualiti hidup dalam kehidupan seharian manusia. Pada masa yang sama, ini meningkatkan permintaan untuk teknologi yang boleh membantu pemilik haiwan peliharaan memantau haiwan peliharaan mereka semasa mereka berada jauh dari rumah. Oleh kerana pemilik haiwan peliharaan sibuk dengan rutin harian mereka, mereka tidak mempunyai masa untuk membenarkan haiwan peliharaan mereka keluar dari rumah dan memastikan mereka sihat. Matlamat projek ini adalah untuk mereka bentuk sistem kemasukan haiwan peliharaan yang menggunakan teknologi RFID untuk membolehkan haiwan peliharaan melalui pintu tanpa bantuan manusia. Ciptaan ini menggunakan teknologi RFID untuk membenarkan akses kepada haiwan peliharaan melalui pintu.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, Mr. Saifullah bin Salam and co-supervisor, Mr. Amar Faiz bin Zainal Abidin for their precious guidance, words of wisdom and patient throughout this project.

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My highest appreciation goes to my parentsand family members for their love and prayer during the period of my study. An honourable mention also goes to my parent Mr. Md Zam bin Giman and Mrs. Ramlah binti Hj Hassan for all the motivation and understanding. And to Khairulamirin Amir bin Mazlan, thanks for support and always be there for me through up and down in my life.

Finally, I would like to thank all the staffs at the Universiti Teknikal Malaysia Melaka, fellow colleagues and classmates, the Faculty members, as well as other individuals who are not listed here for being co-operative and helpful.

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LIST OF ABREVIATION

RFID	-	Radio Frequency Identification
LCD	-	Liquid Crystal Display
PWM	-	Pulse Width Modulation
DC	-	Direct Current

CHAPTER 1

INTRODUCTION

1.0 Overview

Chapter 1 provides information about the introduction of the project including research background, problem statement, objective and scope explained in detail to give best overview of the project.

1.1 Background

Radio frequency identification (RFID) refers to a form of wireless communication system that comprised of two components which are tags and reader. The RFID technology use radio waves to transfer data from an electronic tag for the purpose of identification and tracking object. The RFID chips contain a radio transmitter that emit coded identification number to read by the reader when prompted. This RFID technology consists of three part which are an antenna, a transceiver and a transponder. The RFID reader consist of an antenna and transceiver while RFID tag consist of transponder.

By using this RFID technology, the result is a prototype of development of pet entrance system to help make it easier for pet owner to monitor their pet. This project allows pet to enter without the help of the pet owner to open the door and at the same time this door only allow pet which have access to enter to avoid unwanted pet in the house. The RFID reader will be put

at the door entrance will the RFID tags will be worn on the pet as a collar. The RFID tag on the pet collar have the dentification of each pet such as name.

This system allows a time to be released and a return time to be set. Moreover, this system using RTC Clock IC to keep track on current time to enable the setting of time for this project. This project is design with servo motor to control the opening and closing of the door which this servo motor can control its rotation. An Arduino will be used as a microcontroller to be the main processor for the input and output. The keypad 4X4 will be used an input for setting the time.

1.2 Problem Statement

According to statistics, an estimated total of 85 million families own some kind of pets. Moreover, statistics show that dogs are the most popular pet of about 471 million followed by cat of about 370 million kept as pet worldwide [5]. The pet owner usually let their pets out about 1 -2 hours a day to let this pet stay healthy and stress-free. Due to this activity, the pet owner must monitor their pet which causes the owner to spend more time and energy in finding the pet.

By purposing this project development of pet entrance system using RFID can help the pet owner life easier. This project is ideal for cat and pet owners. The goal of this project is to monitor the whereabouts of pets. This project is to track whether a pet has returned home at the time set by the user. In addition, the project will display which pet did not return on time. For safety, the door controls the entry of the animals in and only pets with access that are allowed to enter. This is for safety precautions to avoid the unwanted pets in the house. Furthermore, this project is using RFID technology to ensure the project can run successfully.

1.3 Project Objective

There are three main objectives to be focus on to make sure this project is build successfully.

The objective is stated as below:

- To study the RFID technology on the pet entrance system.
- To develop a safety system using Arduino to prevent unwanted pet to pass through the door.
- To evaluate id system of pet that can be read by the system for data collection.

1.4 Scope

The scope if this project are as follows:

a) Implementing a low-cost prototype that can make the life of pet owner become easier.
b) The technology of Radio Frequency Identification (RFID) that will be used as a tag and reader to allow the opening and closing the door without help from the human.
c) Analyse on the functionality of the sensor to detect the tag and control the opening and closing the door.
d)

CHAPTER 2

LITERATURE REVIEW

2.0 Overview

Chapter 2 will explain the background of the study that contain the literature review of the study regarding this project. This literature review based on articles previous and current project.

2.1 Project Research

2.2 The study And Applications of the IoT in Pet Systems.

This article is to study the ability of computational, communication, and control technologies to enhance interactions between human and pets based on the Internet of Things (IoT) technology [5]. It is an improvement of the pet monitoring systems that involve IoT and also enhances the pet appliances with the location awareness capabilities that help the lives of pet owners become easier [5]. This project uses IoT system instead of using infrared detector or recognition that has been used in most pet care system. The disadvantages of using infrared detector and recognition is that it is easily influenced by various factors and can result in the detection not recognizing correctly [5].

This project focuses on pet doors and pet feeding system. To achieve the target, the project uses IoT technology. IoT can be referred as “connected together” and its function are for identification, localization, tracing and management. RFID technology act as “speaking technology” for IoT systems consisting of RFID tags, readers and applications [4]. The RFID

tags can uniquely mark the objects because there is agreement from the preserved code data. It is also must be supported with battery to avoid serious vulnerabilities that could result in short communication distance of the passive HF RFID tags. Therefore, sensor network tags were used to extend the communication distance for this study.

The IoT can be divided into three parts [5]. The first part is hardware device or sensing layer that uses less space and makes it easier to connect to anything, anywhere and anytime. In addition, it uses wireless sensor network (WSN) technology that can obtain object environment information and distinguish each object accurately [5]. The second part is the infrastructure or sensing layer where it consists of all types of communication network and the internet form a concentrated network. It is an IoT management centre and information centre that have the network operational capabilities and enhance information operational capabilities. The third part is the application layer where it consists of applications and services that use the large quantity of information created by IoT. This layer is to provide information services and it consist mainly of three part namely IoT client part, data storage module and data inquiry module.

The first project of pet monitor system was a smart pet door [5]. These pet doors are designed to allow pets to pass through the door easily without human assistance. The pet door consists of one control door, one smart pet door, several environment nodes and the tags on collars. This WSN-based project and its purpose is to control the activity of their pets. The sensing tag on the collar will broadcast the pet's identification for every 20 seconds continuously [5].

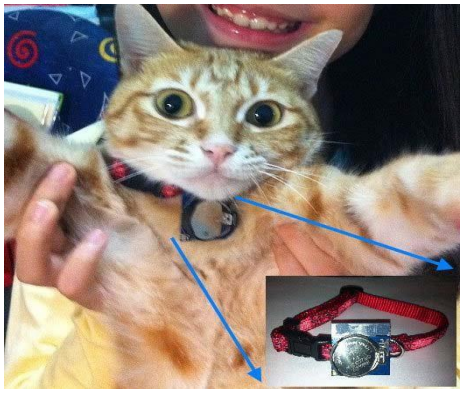

Figure 2.1 pet wears collar with the sensor tag identification [5]

Then, pet door will detect the location of the pet and it will request the pet activity list from the server. After the pet door receive the activity list from the pet tag, the device will measure the estimated distance by the RSSI (Received Signal Strength Indicator) [5]. This designated collar allows the pet tags to broadcast the pet ID for every 20 seconds continuously. The sensing range that can be achieve is about 1m to 2m due to the node of WSN which is an active tag. The door will be unlocked when the activity is permitted. The WSN module is installed on the upper right of the pet door that act as the control and communication centre. It is responsible for receiving and control the motors. Moreover, this project is using tow motors that are used to unlock the pet door which its control the direction of the flap [5]. There is also light motion sensor that implemented on the top panel of the door to detect the flap swing direction. The LED will be triggered based on the data collected of the flap swing direction. this will inform the pet owner the location of the pets either indoor or outdoor. The led will turn green to indicates the pet are at outdoor.

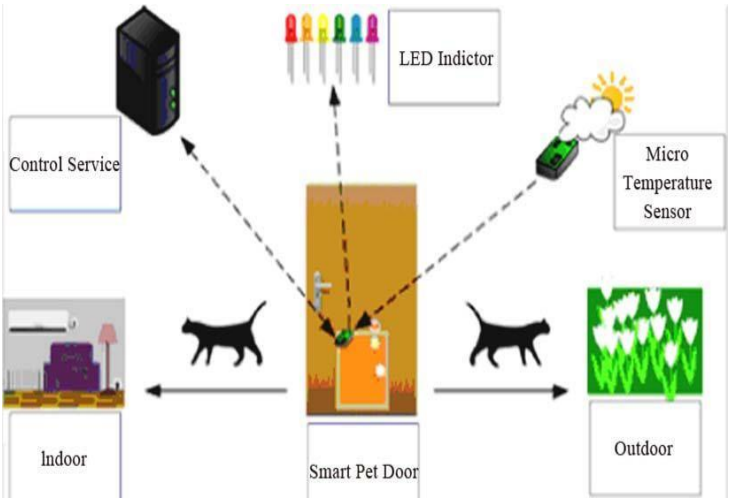

Figure 2.2 interior design of pet door [5]

This pet system also associated with smart pet feeder. It helps the pet owner to feed the pet automatically without worrying when they are outside the home. Moreover, the pet food hygiene is guarantee because it helps to avoid contamination of the food because of insects. This objective can be achieved because the implementation of the pet feeder which it has a bowl cover that opens and closes automatically with the help of infrared proximity sensor and battery-operated electric motor. The infrared proximity sensor is responsible to detects the presence of the pet to allow the opening of the bowl cover to give an access to the food. Then, the bowl cover will close when there is no presence of the pet. This pet system consists of one control server, one smart pet feeder and a tag on the collar. This project using WSN module which it is operates to drive the rotation gear to remove the bowl cover, receiving the signal pet id and responsible for checking the RSSI value, controlling the voice greeting and trigger the bowl cover to open and close [5]. However, this implementation project is higher cost and use larger power supply due to WSN module. This smart pet feeder is different with other pet feeder in the market because it supported pet identity recognition, and does not require tags for the identification [5].

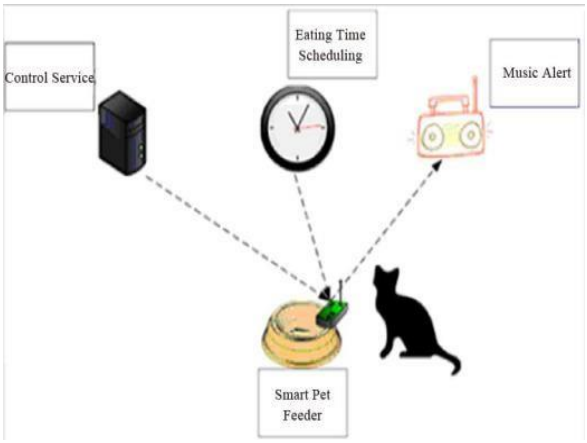

Figure 2.3 interior design of pet feeder system

2.3 Radio frequency Identification (RFID) based attendance system with automatic door unit.

This article is about an attendance system with automatic door unit using Radio Frequency Identification (RFID) [2]. It is a technology that uses radio wave to transfer data from an electronic tag for identify and tracking object. Based on this study, this technology is used to produce time-attendance management system that consist of two part which are hardware and software [2]. The hardware part consists of motor unit and RFID reader. For the RFID reader it using low frequency at 125 kHz and it is connected to serial to USB converter cable. This project is developed by using visual basic net. Moreover, this project can be function on displaying live Id transaction, registering ID, deleting ID and recording attendance. Based on this article, it is comparing the techniques that are used to record the time attendance system [2].

The first one is based on manual process where the manual process is has to sign at the office table. However, this type of attendance system has disadvantages where it will become

problem when it has to handle a large number of workers [2]. At the same time, this type of system allows employees to bribe the officers. This will affect the productivity and management of the company. The second type of system barcode attendance system [2]. This system is to measure and tracking employee's time and also provide high levels of accuracy and reliability in tracking of employee attendance. The implementation of the barcode is easy and its using UPC (Universal Product Code) which 12 digits number is assigned to retail merchandise that identifies a product and the vendor [2]. The first 6 digit is for vendor unique identification numbers. The next 5 digits is for product's identity and the last 5 digits as check digit.

Figure 2.4 Picture of barcode [2]

The third type if system is biometric attendance system which it is to study of measurable biological characteristics [2]. This biometric refer to authentication techniques that rely on measurable physical characteristics. The are several types of biometric identification which are face fingerprints, retina, hand geometry, vein, voice and etc [2]. By using biometric system, the time and attendance software is installed along with time clock to enable the use of biometrics for tracking purposes. The advantages of this system is the whole process is easy and fast and also it can eliminate the cost for ongoing expenses related to damage, misplacement, and cards

theft as well as the ongoing need for restoration and maintenance that has gone through system barcode and magnetic stripe.

The main system that will be used in this application of attendance system with automatic door unit is by using RFID (Radio frequency identification). This system offers the organization an efficiency and convenience system associated with RFID technology at a low cost [2]. The RFID devices and software must be supported by a sophisticated software architecture that enable the data collection and distribution of location based on information. Based on this RFID attendance system, the RFID tag and readers are combined with access to global standardized data base to ensuring the up-to-date of real time access on the card [2]. The RFID card consist a unique identification called an electronic product code (EPC) [2]. Moreover, the RFID system can be read from a distance compared to barcode system which it is rely on user to make contact to the reader because the barcode system cannot be read from the distance.

Next, this RFID system allows multiple read at one time compared to barcode system which allow one card to be read at one time [2]. Furthermore, the RFID system allow the embedded information updated which it is allowing the repeated over-writing for each card. At the same time, this RFID system can have increase technology while the barcode system does not allow for the increase technology. This articles also explain the uses of different frequency for the RFID system can be used for different application.

Frequency band	Description	Operating range	Application	benefits	Drawbacks
125KHz to 134KHz	Low frequency	Less than 0.5m to 1.5ft	Access control, animal tracking point of sale application, product authentication, vehicle immobilizer etc	Works well around water and metal products	Short read range and slower read rate
13.56MHz	High frequency	Less than 1m to 3ft	Smartcards library books, airline baggage etc	Low cost of tag	High read rate when compared to low frequency
860MHz To 930MHz	Ultra high frequency (UHF)	3m to 9ft	Parking lot access, electronic toll collection etc	EPC standard built around this frequency	Does not work well with high water or metal content
2.4GHz	microwave	1m to 3ft	Airline baggage, electronic toll collection	Most expensive	Fastest read rate

Figure 2.5 RFID frequency table [2].

Figure 2.6 RFID card and reader [2].

2.4 Smart Doggy Door

Based on this article, the objective of this smart doggy door to allows a dog to enter and exit the home without the need of the owner at the house [3]. This project needs the permission from the pet owner to open the dog door. Moreover, the information regarding dog's activities will be sent to the pet owner so that the pet owner can monitor the dog's activities.

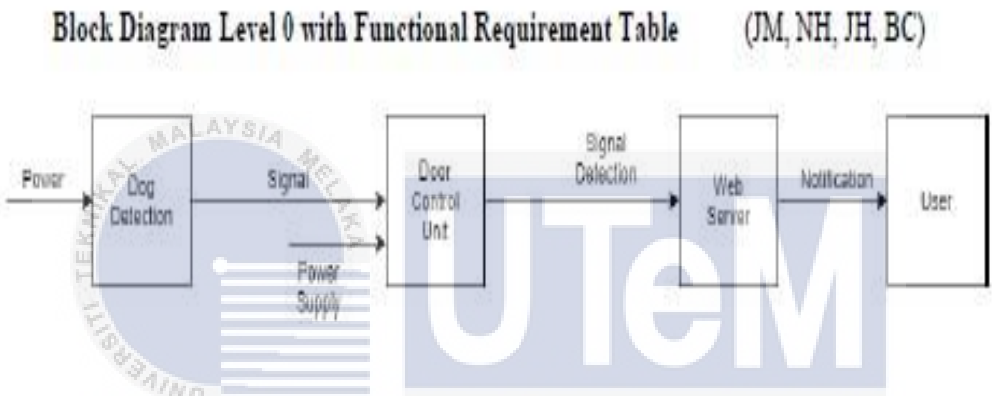

Figure 2.7 the block diagram of Smart Doggy Door system [3].

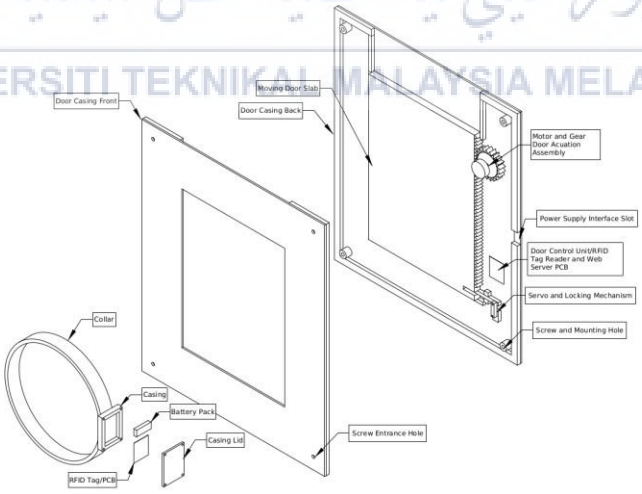

Figure 2.8 the mechanical sketch of Smart Doggy Door [3].

This Smart Doggy Door system are implemented at the door where the door is modified to enable the dog to enter and exit the house easily when the door senses the dog with an active RFID chip that attached to the collar [3]. The idea is when the pet is within the range of the pet door, the signal will be detected by the pet door from the active tag. After signal confirmation, the door will open and close automatically or it will send an email or SMS to the pet owner to allow the pet owner to decide whether to open or close the door. At the same time the pet must be in the area within the range to enable the signal to be detected. This Smart Doggy door also has an additional feature where it can collect the data of pet's activities such as the number of times pet pass through the door or the amount of time the pet spending time out door. The pet's activities will be sent to the pet owner and this communication between the base station to the collar and the owner will be across two techniques which are RFID and Wi-Fi.

Furthermore, when the microprocessor received the signal from the RFID, it will process to determine whether to let the pet in and it will send the signal out that will control the speed of the motor. For this Smart doggy door, the motor that are used is stepper motor which the direction and speed of the stepper motor can be accomplished by a single microprocessor [3]. The stepping motor has higher efficiency and high torque. This stepper motor does not have a feedback loop and are good at generating and holding torque.

2.5 PetCare : A Smart PeT care IoT Mobile Application.

Based on this article, the objective of the project is to design a project of a smart pet care assistant in mobile application through implement the Internet of Things that can develop an embedded system of house pet that able to monitor and care [4]. On this project, it includes eating time remote schedule, camera service monitoring, room temperature and light sensing, smart pet door control, defecation pad cleaning, remote music and voice commands activation at home while the pet owner are away from home [4]. For this project, it uses Raspberry P model B+ as a microcontroller where it become the centre of the brain for all the sensor that has been used in this project and also as a medium to the internet for mobile application [4]. The development of this project is using Cayenne and Xamarin for platform services. The "Cayenne" is used to enable the communication with the application programming interface of Raspberry Pi and to deliver the sensor data when the device is receiving from the sensor. The "Xamarin" is used as a cross platform library where the developer can create one application to several platform such as Android, iOS and Windows platform.

From the articles, this project are consist of seven modules [4]. The first one is an automated feeding system where this module control the consumption of food for the pet [4]. It is assisted with time schedules and the right amount of food to be serve. This system can be controlled through mobile application where both feeding system and mobile apps are connected to the internet. The second module is defecation module where on this module the defecation pad will automatically clean up the faeces of the pet. This defecation pad can be monitor by the pet owner to monitor their pet whether their pet has used the it or not. The third one is pet-parent method where this system allow the pet owner to have a video chat with their pet. The forth module is remote music activation which this system is an option to allow the pet to enjoy their stay at home by listening to the music. Next, is the room temperature system which this system

is responsible to check the temperature. The smart door scheme is also one of the modules in this project where the system gives an access to the pet to enter and exit the house. The sensor is attached at the collar of the pet and the door. This sensor will sense the presence of the pet nearby. At the same time, the pet owner can control the opening and closing of the door through mobile application. The last module is surveillance system where it has an access to web camera at home to monitor the behaviour the pet when the pet owner is away from home. All this module is using mobile application to allow the pet owner to make decisions.

Figure 2.9 the food dispenser design [4].

The microcontroller for this project is Raspberry Pi Model B+ with a RPi T-Cobbler and a full-size breadboard to extend the pins of the Raspberry Pi. The mobile app will send the data to tis module and it will transfer to the designated hardware or sensor. Furthermore, DC gear motor is used in this project [4]. The specification is 6V 77RPm-SGM-25-370 is used for this project where the motor is the low powered motor and it can run at ^V and the lower power is until 3V [4]. This motor is used for rotation of the dispenser fin of the automated food with time schedules and conveyor belt for the automated defecation pad. Next is plastic water solenoid valve 12V – 1/2" is used to control the flow of the water for the automated feeder [4]. The automated feeder comes with solid food and also water to keep the pet hydrated. This component is used because this system requires low water pressure and the flow is in one direction. FS90 micro servo is used for door locking system which it is acts as the rotating lock for the smart pet door. It is also connected with the proximity sensor to detect the pet collar and another proximity sensor will causing the servo motor to unlock the pet door the enable the pet to pass through it. The 10Cm-80Cm sharp IR infrared GP2Y0A21YK0F is use as a distance sensor to detect the presence of the pet nearby. The pressure/temperature/altitude sensor BMP180 is used to detect the temperature. Lastly, the camera is used surveillance camera to monitor the pet activities in the house.

Figure 2.10 the main menu on the mobile application [4].

2.6 A Multiple-Privilege Access E-Door system based on Passive RFID Technology (MPAES)

This technical article about an embedded system called multiple-privileges access E-Door system which it enables the administrator to set multiple access rules to the users [6]. This will allow a single e-door can be access by a single person or multiple people identification based on Radio Frequency Identification (RFID). At the same time, the administrator could control and monitor the access of the events. The main aim of designing an automated door lock is the security features. Based on this MPAES consist of three module which are a computing, storage, and control unit (CSCU), a passive RFID reader Unit (PRRU), and a door lock and Alarm unit (DLAU) [6]. Moreover, the administrator is responsible on setup the time period for opening the lock. The authorization period is very important to ensure the tag recognition is within the time period to avoid unwanted functionality.

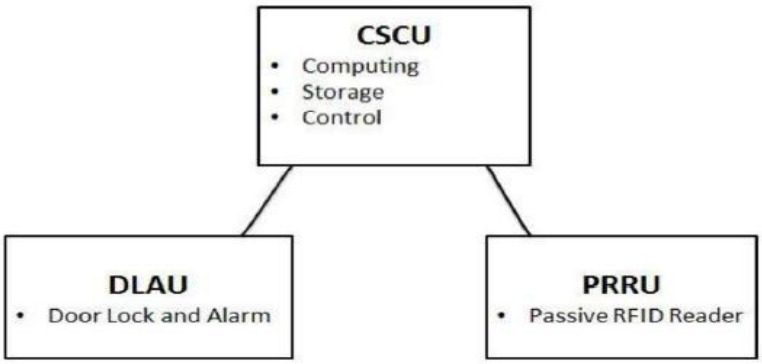

Figure 2.11 the MPAES block diagram [6].

The implementation of this system consists of two part which is hardware components and software components [6]. For the hardware implementation, Raspberry Pi 3, GPIO interface sockets, an automatic door-lock and its interface circuit, a micro switch which is a simple sensor sense whether the door is opened or closed and passive RFID reader and tags[6]. The software component implementation consists of Raspbian Linux operating system for the Raspberry Pi 3 and derby database.

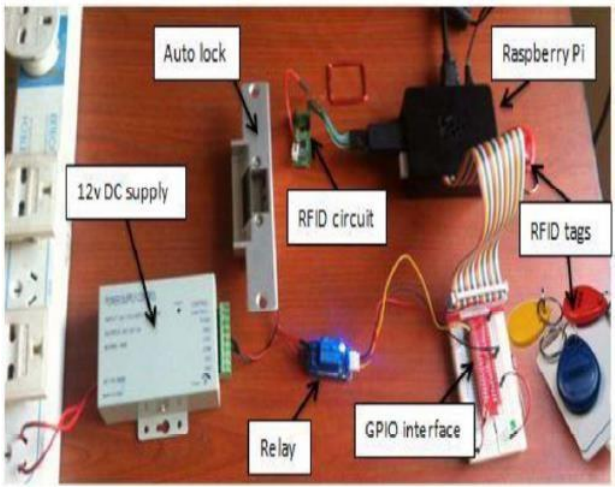

Figure 2.11 the MPAES prototype[6].

2.7 A low cost IoT smart home system.

This article is about a highly-effective and low-cost smart home by using the Internet of Things Technology that are suitable for people with visual disabilities or hearing disabilities or pet owners [7]. This project consists of several features which are effective temperature and humidity monitoring by using sensors, high security by using RFIDs, health monitoring by using pulse sensors, and home life safety by using smoke sensors [7].

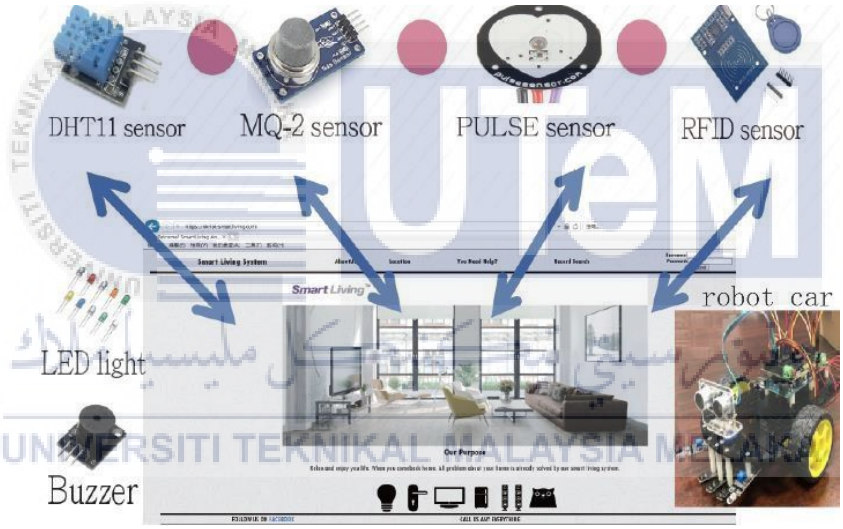

Figure 2.13 shows an IoT smart Home concept [7].

The hardware implementation of this project consists of DHT11 temperature sensor, an Arduino temperature Control Fan, an RFID security door (via NFC), a pulse sensor and a robot car. DHT11 is digital temperature and humidity sensor are selected of its basic, low cost digital temperature and humidity sensor [7]. Moreover, this sensor has a resistive sense of wet and NTC temperature measurement devices which connected with a high performance 8-bit

microcontroller. This component uses a capacitive humidity and a thermistor to measure the surrounding air. RFID door security (via NFC) is used for a security guard system. This component is selected compared to barcode scanning because the security of the RFID is higher compared to bar code scanning. Furthermore, the visibility of RFID recognition is high and it can penetrate the contact is also high.

2.8 Arduino Mega based pet feeding Automation

Based on this article, the project is about pet feeder that has the additional feature of providing food to pets via web access using Ethernet [1]. In other word, the project is an automated pet feeder that can control pet's diet through app or web access. Based on this project, the pet feeder is automatically serving food for the pet at the set of time. the component that are used in this project are LCD 16X2, DS3231 RTC Module, servo motor, keypad 4X4 and Arduino [1]. The LCD 16X2 is used to display the time using DS3231 RTC module. The servo motor is for rotation of the containers that provide the food which rotation angle and container opening ca be control by the pet owner. Keypad 4X4 is used to manually set the time while DS3231 RTC module is used to set time and date to provide the food to the pet according to the pet's eating schedule. The Arduino Ethernet Shield allows Arduino to be able to connect to the internet which it allows the sending and receiving data. In other word, it is responsible for the connection between mobile and Arduino mega board.

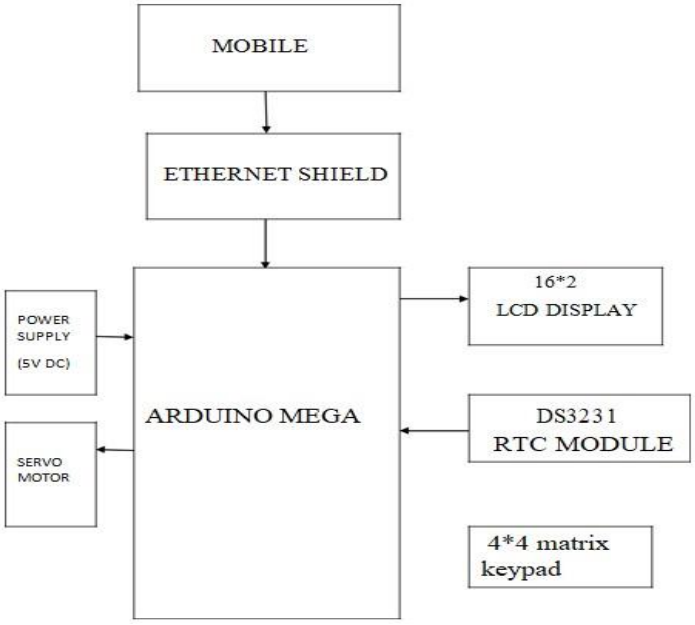

Figure 2.14 Block Diagram of the proposed system. [1]

2.9 Summary and Discussion of the Review

No.	Title	Structure	Advantages	Disadvantages
1.	The study And Applications of the IoT in Pet Systems	• RFID reader and tags • WSN module • Micro temperature sensor • Led indicator • IR proximity sensor	• Identity recognition • Owner can set eating time schedule for pet on web page remotely	Higher cost and larger power supply due to WSN module.
2.	Radio frequency Identification (RFID) based attendance system with automatic door unit.	• RFID reader and tag • Microcontroller • Graphical user interface (GUI)	• The system is user friendly • Provide a convenient method of attendance compared to traditional method • Low cost	This system do not have a reminder alert to show which person that have been absent for many time in a row.

3.	Smart Doggy Door	• RFID reader and tag • Wi-Fi • Microprocessor • Motor	This system allows the pet owner to decide whether to open or close the door	This system does not have reminder or display that can show which pet did not return at the set of time.
4.	PetCare : A Smart PeT care IoT Mobile Application	• Raspberry Pi • DC gear motor • Plastic water solenoid valve • FS90 micro servo • Proximity sensor • BMP180 • Camera	This system is using mobile application through implement the IoT to monitor and care pet.	It is not accountable to train the pets on using it.
5.	A Multiple Privilege Access E-Door system based on Passive RFID Technology (MPAES)	• Raspberry Pi 3 • GPIO interface sockets • Automatic door lock and its interference circuit • A micro switch • Passive RFID reader and tags	The administrator to set multiple access rules to the users	The entering keys is not in sequence

6.	A low cost IoT smart home system.	• Arduino software • Visual Micro • Gas sensor (MQ2-smoke sensor module • DHT11 sensor • LED light • Buzzer • RFID door security (via NFC) • SEN-11574 pulse sensor	• Simple and low cost appliances • Can measure human heartbeat	This system does not have a set of time to allow people in and out easily. Moreover, this system does not have LCD screen to the identification information of the RFID tags.
7.	Arduino Mega based pet feeding Automation	• LCD 16X2 • Arduino • DS3231 RTC module Keypad 4X4 • Ethernet • Servo motor	Keep the pet food fresh without contamination. Can set time for feeding the pet.	Do not have identification tag to enable which pet have eaten the food or which pet have not.

Table 2.1 Summary and Discussion of the Review.

CHAPTER 3

METHODOLOGY

3.0 Overview

Chapter 3 defines in specifies the research method regarding this project to obtain and achieve the main objective of this project. This chapter will cover introducing of methodology and project structure which it will explain on detail the components that will be used in this project.

3.1 Introduction

The methodology is a specific procedures or techniques that used to identify, select, process and analyse the information regarding the research topic. In other word, methodology is the details on how the research was conducted by showing the chosen method and techniques that are best to achieve the objectives and provide valid and reliable results.

3.2 System flow

The aim of the project flowchart is to show the project development of pet entrance system and it summarizes each step that taken to achieve the objective of this project based on Figure 3.1. The first step is to understand the problem related to this project. This step including problem on how pets can have an access to the door, how to control the opening and closing of the door. Moreover, how technology of RFID can be used as the identification of the pets.

After going through the first step, the next step is the phase of doing research to obtain data and information regarding all the question related to this project. In this step is important to collect data and it is as reference that can be used for this project. This can be completed by conducting a literature review based on journal, articles, books, internet and technical report as a source of information to gain knowledge and better understanding related to the project.

The next step is to write a program and design the circuit simulation. For this step, the Arduino Software IDE is used to execute all the program relate to pet entrance system in including the identification of pet. The circuit simulation can be design by using Proteus software and it also can run the simulation of the designated circuit. After completed the program and simulation, it is necessary to go through the troubleshooting phase to ensure all the program can be executed and the circuit simulation can run successfully before moving on to the next step.

After completing the program and the circuit simulation can run successfully without errors, the nest step is hardware implementation. In this step, the hardware can be determined by referring to the literature review can have been done on previous chapter to choose what component that are suitable and best option to be used in this project. Lastly, all the result from the input data and output data will be recorded and analyse.

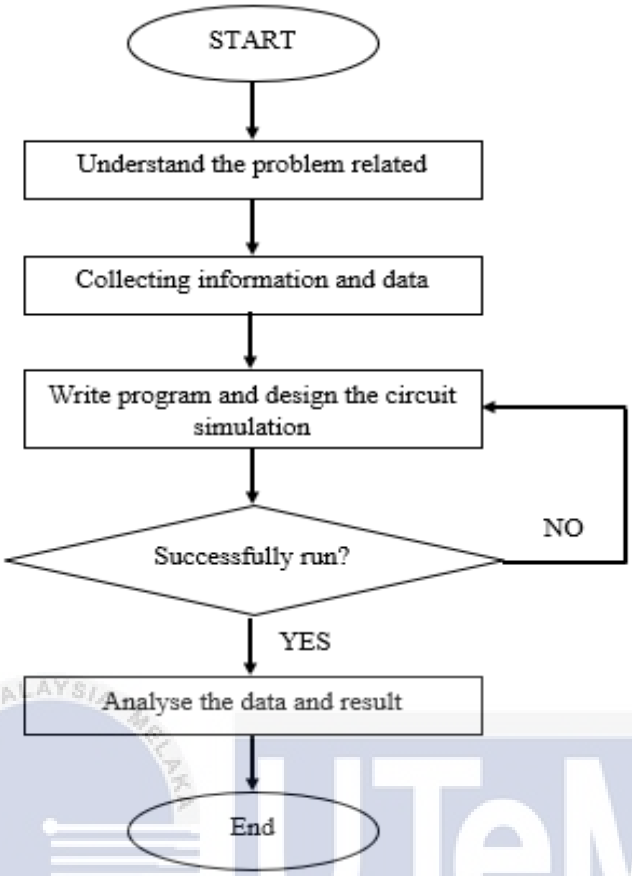

Figure 3.1 Project methodology flowcharts

Figure 3.2 illustrate the flowchart of development of pet entrance system using RFID. Firstly, the LCD will display current time, date and days. Then, the user has to set the time for the alarm which indicate the time for the pet to need to return. Next, the user will push the button to let the pet outside. The LCD will display pet is outside. When the pet has entered within the time given, the RFID will detect the tag. The servo motor will rotate 90 degree to allow the pet to enter. Then, IR sensor will detect whether the pet has been inside or not. Next, when the IR sensor has detected the pet is inside, the LCD will display the pet identification is inside. If the pet does not enter within the time given, the buzzer will turn on for 1 minute. The LCD will display the identification of the pet is outside.

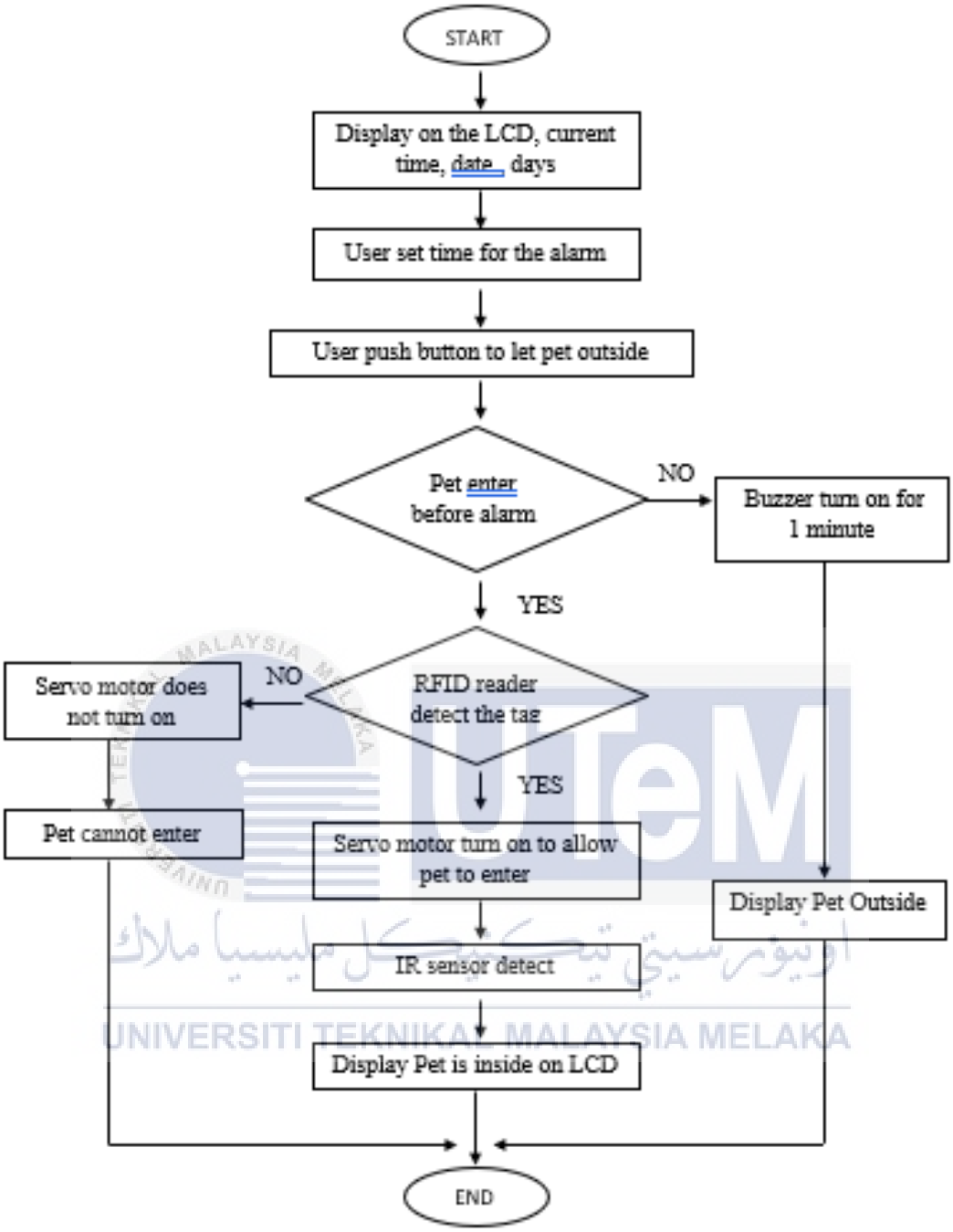

Figure 3.2 Flowchart of the system.

3.3 Project Structure

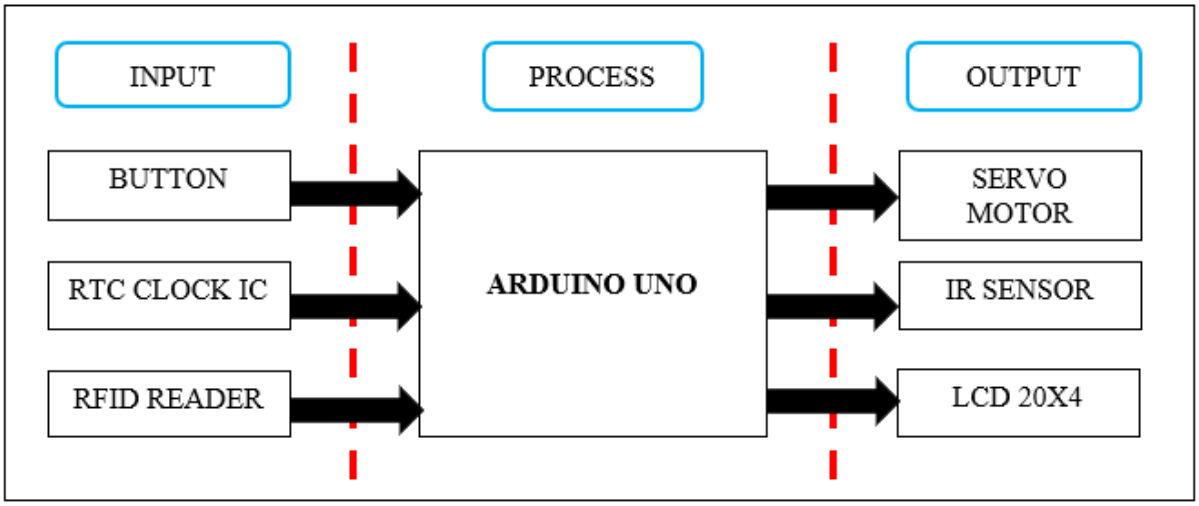

Figure 3.3 Project Structure block Diagram

Based on diagram show in Figure 3.3, this is the project structure block diagram which explain briefly on project flow that consist of input (button, RTC clock IC, RFID reader) , process (Arduino Uno) and output (servo, IR sensor, LCD).

3.4 Keypad 4X4

Keypad 4X4 will be used as an input to this project. It is used to enter the data such as setting the time to start releasing the pet and time to stop which the pet is needed to enter the house. Based on literature review that have been done, this component is suitable for entering data such as setting the time. A microcontroller can scan these lines for a button-pressed state [20]. The specification of this keypad as below:

Figure 3.4 Keypad 4X4 [20]

Table 3.1 Specification of Keypad 4X4 [20].

Maximum rating	24 VDC ,30mA
MRconnect hole	8 – PIN
Dimension Keypad	2.7 x 3.0 in (6.9 x 7.6 cm)
Operating Temperature	0°C to 50°C (32 to 122°F)

3.5 RTC clock IC

This RTC real time clock module DS1307 will be used in this project as an input. This RTC Real Time clock Module uses DS1307 to keep track of the current year, month, day and also current time [19]. Since this project require current time to facilitate the set time for pet release and closure time for pet to return. Moreover, this RTC comes with a rechargeable

Lithium coin battery that responsible to run the RTC without an external 5V power supply for about 1 year [22]. It is also come with 24C32 32K 12C EEPROM for more stable way to write and read. This DS1307 can be access via the 12C protocol. The specification for this RTC Real Time Clock as below:

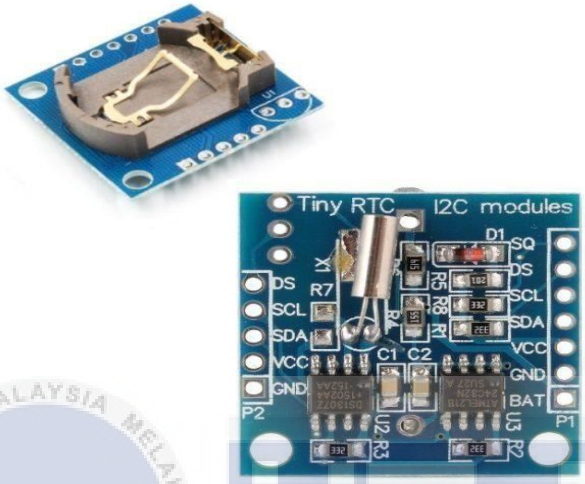

Figure 3.5 RTC Real Time Clock Module DS1307 [22]

Table 3.2 Specification of RTC (Real Time Clock Module DS1307) [22].

DC input voltage	3.0V – 5.5V
Interface	12C interface
Temperature Range	-55℃ to +125℃
Accuracy	±0.5℃ from -10℃ to +85℃
Dimension	28X25X8.4mm
Weigh	6.3g

3.6 RFID reader

This project uses RFID technology as an input which RFID stands for Radio Frequency Identification. RFID is a form of wireless communication that uses of electromagnetic or electrostatic coupling in the radio frequency spectrum to uniquely identify an object, animal or person [23]. This RFID systems consist of three component which are a scanning antenna, a transceiver, and a transponder[24]. RFID reader is combining of the scanning antenna and transceiver. The RFID tag consist of transponder. The RFID reader will be put on the door while the RFID tag will be placed on the pet as a collar to make it easier for the RFID tag to be read by the RFID reader. Moreover, the RFID reader is a network-connected device that can be portable or permanently attached and to activate the signal it uses radio waves to transmit the signals. After the RFID have been activated, the antenna will translate it to the data when the tag is sending a wave back to the antenna. From the research that have been done on previous chapter, this RFID technology is suitable for this project application. The specification of the RFID reader as below:

Figure 3.6 RFID Reader [25]

Table 3.3 specification of RFID reader [25]

RFID module	based on MFR522 chip
Operating Voltage	2.5V to 3.5V
Operating frequency	13.56MHz
Current (Working)	13 – 26 mA
Power down mode consumption	10uA (min)
Communication	SPI , 12c protocol, UART
Maximum data rate	10 Mbps
Read Range	5 cm
Weight	22 g

3.7 Arduino Mega

This Arduino will be used in this project as a microcontroller to process a program and execute all command. Based on the research that have been completed, this Arduino mega is selected as a process compared to Arduino Uno because due to the storage of the memory where for the Arduino Mega has flash memory of 256kB while for the Arduino Uno is 32kB [20]. Moreover, this Arduino Mega is design for a complex project where it comes with 54 digital I/O pins (which 15 provide PWM output) and 16 pins [17]. For this Arduino Mega specification as below:

Figure 3.7 Arduino Mega 2560 (CH340) [17]

Table 3.7 Specification of Arduino Mega 2560 [20]

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage(recommended)	7V – 12V
Input Voltage (limit)	6V – 20V
Digital I/O pins	54 (15 pins provide PWM output)
Analog Input Pins	16
Dc Current per I/O Pin	20mA
DC Current for 3.3V Pin	50mA
Flash Memory	256KB
EEPROM	4KB
Clock Speed	16 MHz

3.8 Servo

This servo motor will be used in this project after considering all the research that have done. It is suitable for this project as an output. The advantage of this servo motor is it has the ability to control its rotation angle. This servo motor is tiny and lightweight with a high output power [26]. In addition, this servo motor can rotate approximately 0º to 180º [26]. This servo motor is used in this project due to it has a better torque and has a great precision. Moreover, it can be set for both clockwise or counter-clockwise which it is suitable for setting the opening and closing of the pet door. Servo are controlled by sending an electrical pulse of variable width, or pulse width modulation (PWM). The specification of this servo motor as below:

Figure 3.8 Servo motor SG90 [26]

Table 3.5 Specification of servo Motor [26]

Operating Voltage	4.8V – 5V DC
Speed at 4.80V (no load)	0.1 s/60˚
Torque at 4.80V	2.5kg/cm
Rotation angle	0º - 180º
Weight	9.0g

3.9 LCD

After completing literature review, this LCD 20X4 is suitable to display the time set for releasing pet and time for pets to return. Moreover, it can display the identification of the pet such as name of each pet. This LCD (Liquid Crystal Display) screen is an electronic display module where there are four rows in display and it can display 16 characters per line[13]. For this LCD, it uses HDD44780 which is a controller used to display monochrome text displays) parallel interfacing [13].

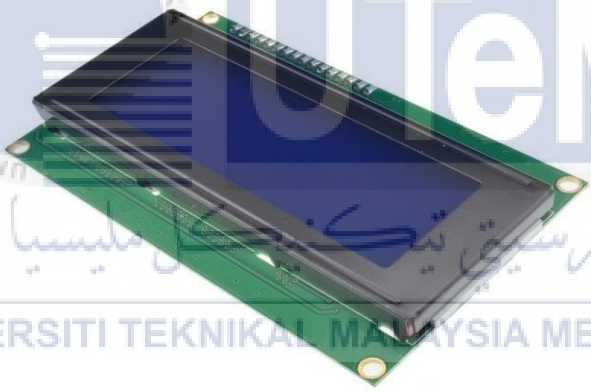

Figure 3.9 LCD 20X4 [13]

3.10 Bluetooth Module

This HC-05 Bluetooth module is design for a wireless communication which it is allows all serial enable device to communicate with each other using Bluetooth. This component can be used in a master or slave configuration. This serial port Bluetooth module is fully qualified Bluetooth V2.0 +EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. The specification of Bluetooth HC-05 module as below:

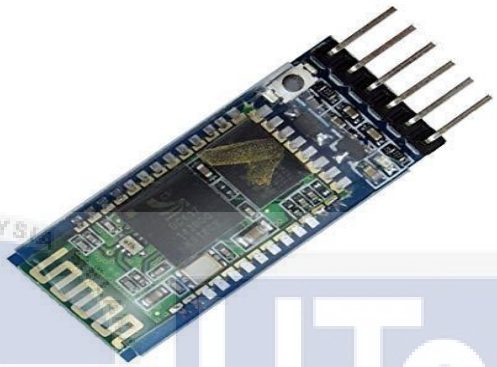

Figure 3.10 HC-05 Bluetooth Module

Bluetooth	Bluetooth v2.0 +EDR
ISM band frequency	2.4GHz
Sensitivity	Typical -80 dBm
RF transmit power	Up to +4dBm
Power supply	3.6V to 6V DC
Antenna	Built-in
Dimension	38mm X 15mm X 2.35mm
Control	PIO control

Table 3.6 Specifications of Bluetooth Module

3.11 Arduino Uno

Arduino Uno acts as a microcontroller for the system which the microcontroller board are based on ATmega328p [29]. This Arduino consist of 14 digital I/O pins which 6 of it is for PWM outputs, 6 pins for analog inputs and a 16 MHz ceramic senator, a USB connection, a power jack, an ICSP header and a reset button [29]. The ATmega328P are easily to be replaced due to it is not required to soldered to the board. This Arduino has features of 1kb of EEPROM that the memory is not can be erased when the powered is off [29]. The battery connector for this Arduino Uno is featured with a barrel plug connector that can works with standard 9V battery,

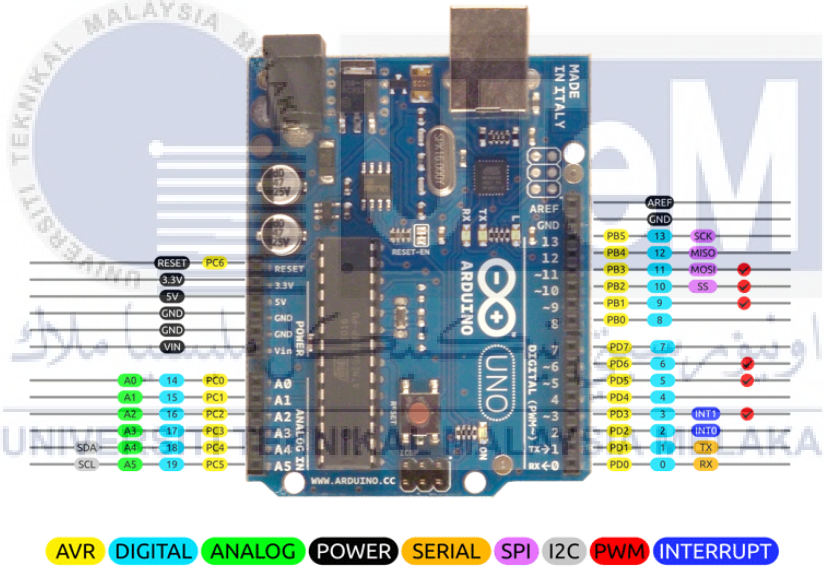

Figure 3.11 Arduino Uno [29]

Table 3.7 Specification of Arduino Uno [29].

Board	Arduino Uno R3
Microcontroller	ATmega328P
Built-in LED Pin	13
Digital I/O Pins	14
Analog input Pins	6
PWM Pins	6
I/O Voltage	5V
Input Voltage (nominal)	7 – 12V
DC Current per I/O Pin	20mA
Main processor	ATmega328P 16 MHz
Memory ATmega328P	2KB SRAM, 32KB FLASH, 1KB EEPROM

3.12 Buzzer

Buzzer is an audio signalling device like a beeper or buzzer that produces sound [28]. This buzzer may be mechanical, electromechanical or piezoelectric [28]. Its main function is to convert the signal from audio to sound. The buzzer is powered by DC voltage and used in timers, alarm devices, printers, alarms, computers, etc [28]. In this project, this buzzer is used for alarm purposes to indicate the time is up for the pet to enter. The buzzer pin configuration include of two pins which is positive and negative terminal. The positive terminal is connected with 6Volts while negative terminal is connected to the GND terminal.

Figure 3.12 Buzzer [28]

Table 3.8 Specification of Buzzer [28]

Colour	Black
Frequency range	3,300 Hz
Operating Temperature Range	-20℃ to +60℃
Operating Voltage Range	3V to 24V DC
Sound Pressure level	85dBA or 10 cm
Supply current	Below 15mA

3.13 IR sensor module

A radiation -sensitive optoelectronic component is called an infrared sensor (IR sensor) has a spectral sensitivity in the infrared wavelength range of 780 nm to 50µm [27]. The IR sensor is used in this project is to detect the motion of the pet whether has enter the house or not. This sensor can be used to detect the heat of the target and its motion. The IR sensor consist of two parts which is known as emitter and receiver (transmitter and receiver) that are joint as optocoupler or a photo-coupler [27]. The IR LED act as emitter while the IR photodiode act as a receiver.

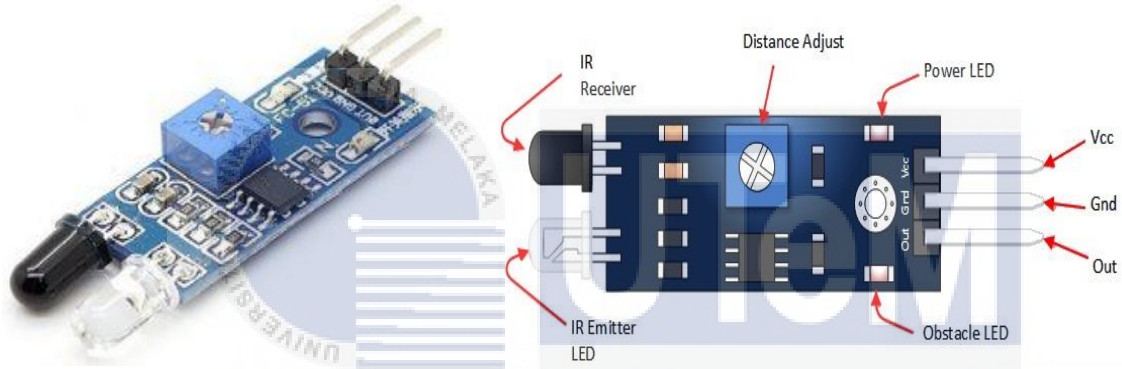

Figure 3.13 IR sensor module [27]

Table 3.9 Specification of IR sensor [27]

Operating Voltage	5V DC
I/O Pins	3.3V – 5V
Supply Current	20 mA
Sensing Range	Adjustable
Main Chip	LM393
Distance Measuring Range	2 – 30 cm
Weight	15 grams

CHAPTER 4

RESULTS AND DISCUSSION

4.0 Overview

Chapter 4 will cover on the project development function, analysis and discussion of the result obtained from project testing. In this chapter will discuss on the outcome of the project and analyse the data.

4.1 Expectation Result

This project is expected to be able to detect the RFID tag, turn on the servo motor and display the identification of the pet. The result is taken to measure the detection of the RFID reader to the tag to allow the pet entrance to open and close.

4.2 Hardware Configuration

Figure below show the hardware implementation on the pet entrance door.

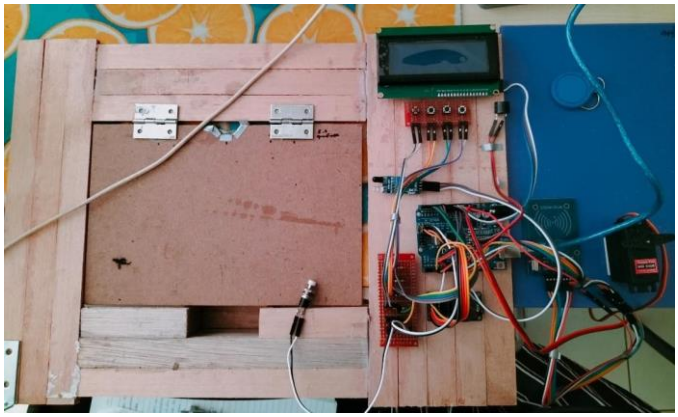

Figure 4.1 hardware implementation.

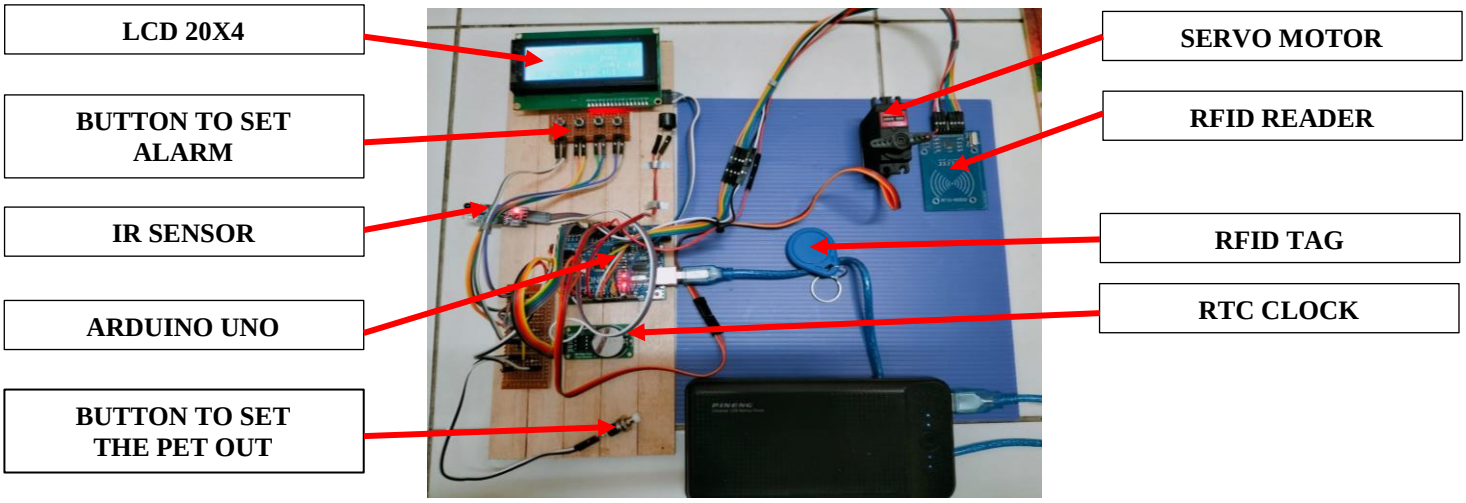

Figure 4.2 Hardware Prototype.

From the figure above, it is shows that the hardware prototype configuration of the Development of pet entrance system using RFID. The components that are used in this project is Arduino Uno, RFID tag and reader, LCD 20X4, button, buzzer, IR sensor and servo MG946. The RTC real time clock module DS1307 is used in this project as an input. This RTC Real Time clock Module uses DS1307 to keep track of the current year, month, day and also current time. Since this project require current time to facilitate the set time for pet to enter the door. The LCD 20X4 is used in this project as out where it will display the current time, date, days and status of the pet whether inside or outside the cage. This LCD has 4 lines display. The first line will display the current time. The second line will display date. The third line will display the status of the pet either inside or outside. At first, set the alarm to let the pet out of the cage. Then, after the alarm has been set, push the button to set the pet is out. When the pet wants to enter the cage before the alarm, the RFID tag will be read by the RFID reader. Then, the Servo MG946 will rotate to allow the opening of the door to let the pet to pass through the door. Next, when the IR sensor detect the present of the pet inside the cage, the servo will automatically on and LCD will display the status of the pet is inside. The function buzzer is to turn on when the time is up. The Arduino Uno is microcontroller for this project and directly connected with power source by using 5V cabling.

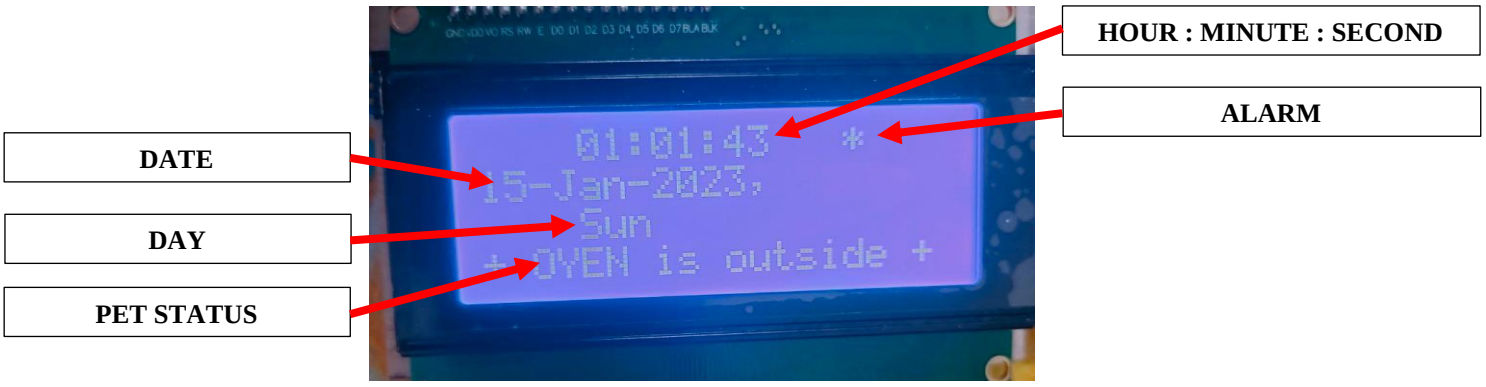

Figure 4.3 Display on LCD 20X4

From the figure 4.3, the type of LCD that is used in this project is LCD 20X4. This is because there four line that will be used for this project. The first line on the LCD display is for display current hour, minute and second. The second line is to display the date while the third line is to display the day. On the fourth line is to display the pet identification and status of the pet whether is inside or is outside.

Figure 4.4 Display LCD 20X4 Alarm enable.

Figure 4.5 Set alarm hour.

Figure 4.6 Set alarm minute.

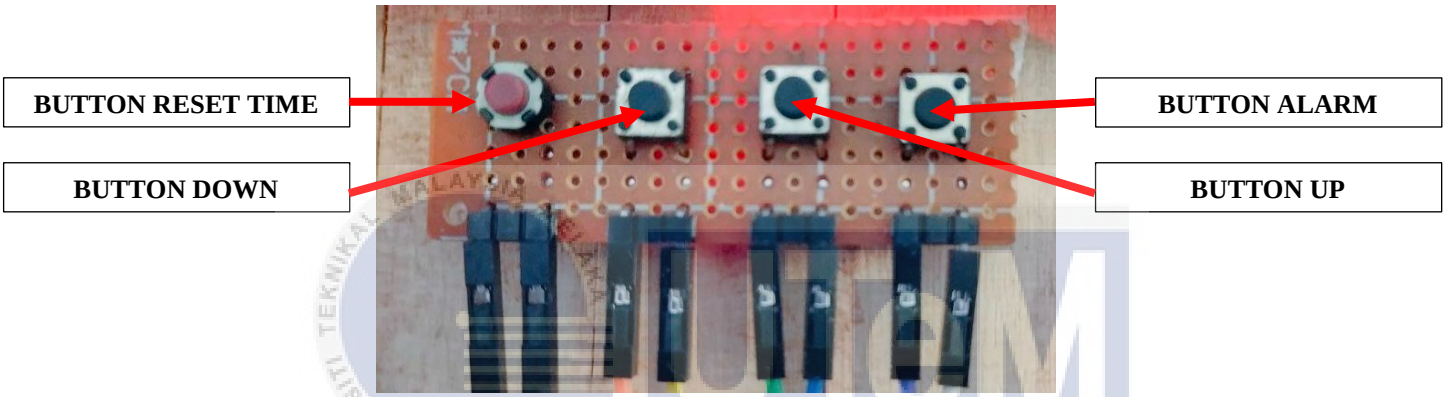

Figure 4.7 Set of buttons.

From the figure 4.4 until figure 4.6 is the display of the LCD regarding the alarm setting. The alarm is set by a set of buttons that works setting the alarm. The button alarm is used to set the alarm. The button up and button down is to set the hours and minute. The red button is for reset the time.

4.4 Analysis Data

In this project, the analysis is done as the requirement for this project. This is to monitor the functionality of this project whether it can function well according to the flowchart. At the same time, the analysis is done to determine the project has achieve the objectives. The first analysis is to determine the efficiency of the technology of the RFID due to the hours in a day. The analysis takes two days to measure the efficiency of the technology of RFID to detect the RFID tag. The analysis is done every hour in a day. The second analysis is to measure the time taken for the opening of the servo motor. It is to measure the time taken for the servo motor to open to allow the door to open so that the pet can pass through the door. Third analysis is regarding the distance of the IR sensor to detect the present of the pet whether has enter the cage or not.

This will have explained about the finding based on the observation that have been done and discuss the finding. The analysis will have three data from different sensor which are RFID tag and reader, IR sensor and servo motor MG946.

4.4.1 Analysis of efficiency of the RFID tag respect to hours per day

The table 4.1 shows the functionality of the RFID tag to be read by RFID reader for every hours in a day.

Table 4.1 Efficiency of RFID tag

Hours	Yes	No
00.00 a.m.	/	
01.00 a.m.	/	
02.00 a.m.	/	
03.00 a.m.	/	
04.00 a.m.	/	
05.00 a.m.	/	
06.00 a.m.	/	
07.00 a.m.	/	
08.00 a.m.	/	
09.00 a.m.	/	
10.00 a.m.	/	
11.00 a.m.	/	
12.00 a.m.	/	
13.00 a.m.	/	
14.00 a.m.	/	
15.00 a.m.	/	
16.00 a.m.	/	
17.00 a.m.	/	
18.00 a.m.	/	
19.00 a.m.	/	
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21.00 a.m.	/	
22.00 a.m.	/	
23.00 a.m.	/	

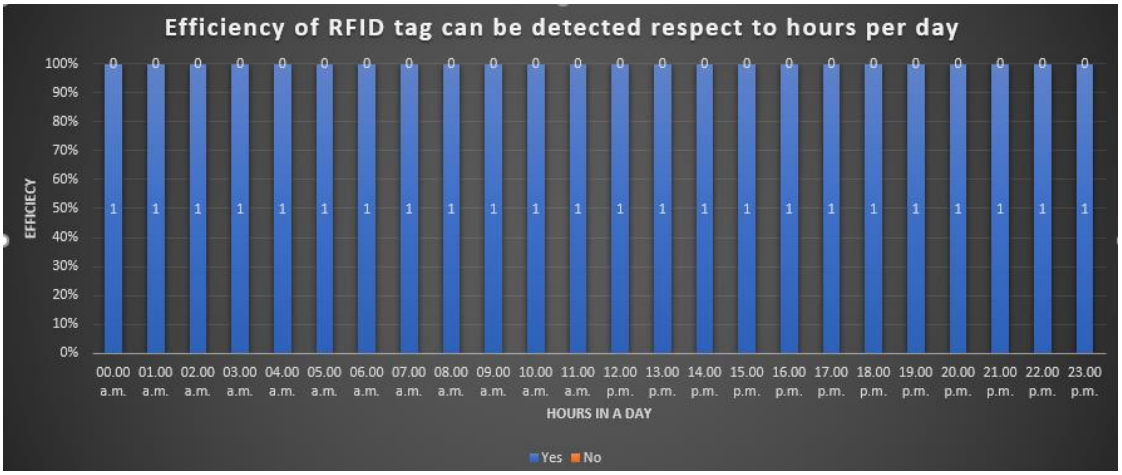

Figure 4.8 Graph of efficiency of RFID tag.

The analysis is done to measure the efficiency of the RFID technology of this project. For this analysis, every hour the RFID tag is touch to RFID reader to determine whether the RFID tag can be read or not. The analysis is taken every hour in a day to make sure every hour the functionality of the RFID technology is excellent. From the table above, the sample is taken from 00.00 a.m. until 23.00 a.m. after tabulate the data taken, we can see clearly the relationship of every hour's data respect to functionality of the RFID technology is 100% function. This can be proved by based on the figure 4.4.1 show the graph of the efficiency of the RFID technology every hour. The objective of this project is achieved based on this analysis.

4.4.2 Analysis to measure the time taken for the servo to open

The table 4.2 shows the number of reading taken varies time in minute for the servo to open to allow the pet to enter the door.

Table 4.2 Time taken for the servo to open.

Number of reading taken	Time / minute
1.	1
2.	3
3.	6
4.	9
5.	12
6.	15
7.	18
8.	21
9.	24
10.	27
11.	30
12.	33
13.	36
14.	39
15.	42
16.	45
17.	48
18.	51
19.	54
20.	57

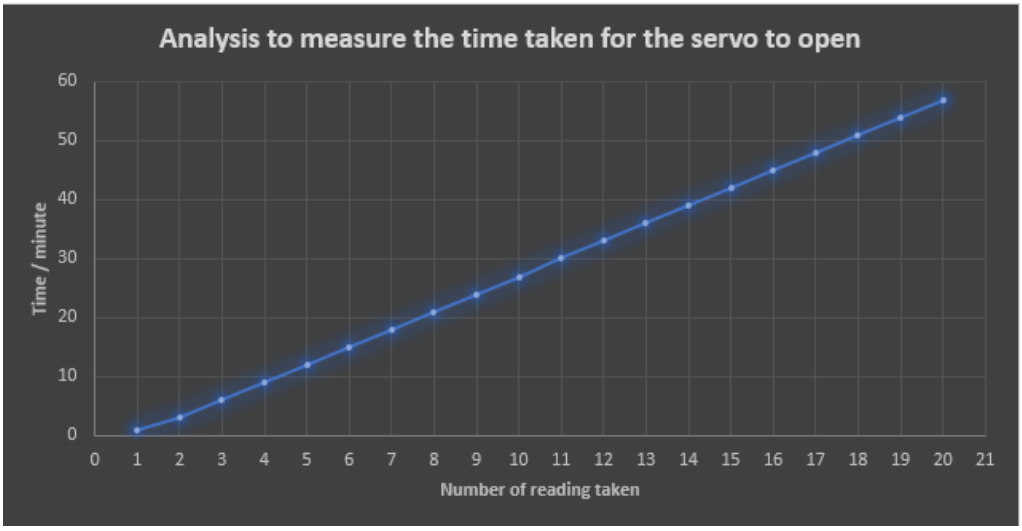

Figure 4.9 Graph for the time taken for the servo motor to open

This analysis is done to measure the time taken for the servo MG946 to open when the pet is passing through the door. This analysis is conducted on the servo MG946 of this project to measure how long the servo motor will open. The duration time taken that is measure is from 1 minutes until 57 minutes. From the table can see clearly the time taken is varies every 3 minutes of the time taken before. To prove this analysis, the number of reading is taken about 20 sample to investigate the effectiveness of the servo motor functionality. The graph is plot based on the tabulated data, the relationship shows the number of reading taken is directly proportional to the time taken for the servo to open. Thus, this proves that the servo motor functions well and can open for a long time to allow the pet to enter through the door.

4.4.3 Analysis to measure the distance of the IR sensor to detect.

The table 4.3 shows the number of sample taken varies distance in cm for the IR sensor to detect the present of the pet inside the cage.

Table 4.3 measure the distance of the IR sensor to detect.

Number of sample taken	Distance / cm
1.	0.5
2.	1.0
3.	1.5
4.	2.0
5.	2.5
6.	3.0
7.	3.5
8.	4.0
9.	4.5
10.	5.0
11.	5.5
12.	6.0
13.	6.5
14.	7.0
15.	7.5
16.	8.0
17.	8.5
18.	9.0
19.	9.5
20.	10.0
21.	10.5
22.	11.0
23.	11.5
24.	12.0
25.	12.5
26.	13.0
27.	13.5
28.	14.0
29.	14.5
30.	15.0

Table 4.3 measure the distance of the IR sensor to detect.

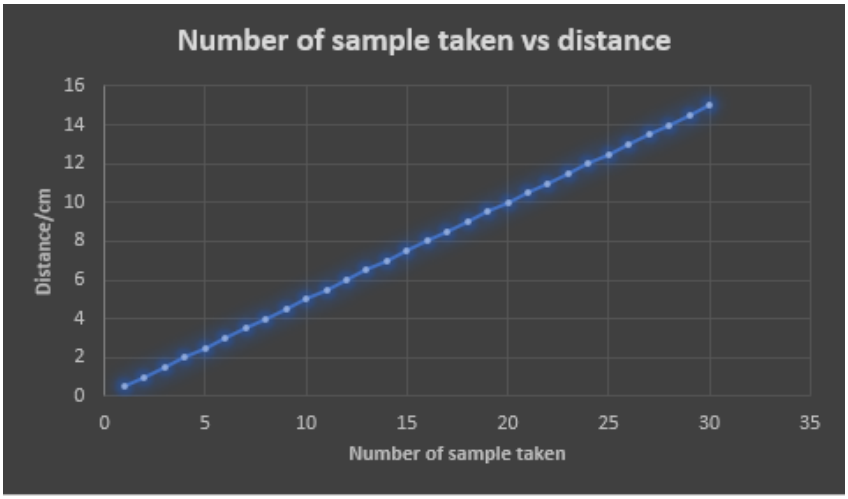

Figure 4.10 Graph for number of samples taken vs distance

This analysis is to determine the distance for the Infrared Sensor (IR sensor) can detect. Total of 30 data is taken and measured to discover the finding. From the table, the data that is obtained by measure the sensitivity of the IR sensor respect to the distance. In this analysis, the longest distance that can be detected by the IR sensor is 15.0 cm while the shorter distance for the IR sensor can detect is 0.5 cm. The distance measured is varies 0.5 cm from previous reading. From the graph, the relationship between the number of samples taken distance for the IR sensor can detect is directly proportional. Thus, this show that the IR sensor can detect the present of the pet is from 15 cm far. This show that the IR sensor are sensitive and suitable to detect the present of the pet inside the door.

4.5 Summary

This chapter is about discussion on results from the prototype testing measurement. This project. It utilizes microcontroller type Arduino as the main process of the controller so that the framework will be completely robotized. This chapter covers the hardware configuration, how the project work and the analysis of the project. This analysis is to determine how the project can function according to the flowchart.

CHAPTER 5

CONCLUSION AND FUTURE WORK

5.0 Conclusion

This thesis presents a method for

In this project, it can be seen that toward the end of this project the Development of Pet entrance system using RFID are successfully implemented and operate as the objective stated. In other word, the objective of this project is achieved. This project is using RFID technology which the RFID tag as the identification for the pet and will detected by the RFID Reader. The Arduino Uno acts as a microcontroller for this system. This project can be accomplished after doing many researches through books, webs, journals and articles. After all the research step, the next step is the component selection which it is important to determine what component that are suitable for this project. Next, circuit design and coding are implemented for this project before construct the hardware to make sure the coding is right. After the coding has successfully running, the coding will be implemented in the Arduino Uno. Next, the prototype installation for the project. The prototype is able to run smoothly according to the flowchart of the project.

This project makes it easier for the user to monitor the whereabout of their pet. Moreover, the user does not need to open and close the door manually to allow the pet enter to enter the cage. This project is using the technology of the RFID for the identification of the pet which this allow the only pet that has an access can enter the cage. For the safety purpose, the servo motor is function to open and close the door for the pet that has an access to pass through it. The RTC clock is used to display the current time and set time out for the pet. The LCD will

display the current time, date, day and identification of pet. The buzzer is used for the alarm purposes if the pet does not enter the cage at the set of given time. The IR sensor is used to detect the present of the pet whether has enter the cage or not and it will send signal to the servo to close. The advantage of this project is low cost and affordable.

5.1 Future Work

For the future work of the execution of this project, the project can be improved by using application that can be used to enter the identification of the pet compare to the current project implemented with the identification of the pet need to be set through coding. The application to set the pet identification use internet of things (IoT) for user friendly and affordable. At the same time the application can connect with this project to allow the user to set the time for letting the pet out through mobile phone.

Furthermore, this project can implement to Wi-Fi setting to Arduino so it would notify the user whether the pet has entered the house or not. Besides, by connecting the project with the Wi-Fi, this will let the user to monitor the pet by connect with the surveillance camera. This allow the user to monitor the pet anytime and anywhere. Next, the improvement that can be applied is by improving the sensor that can detect the pet whether has entered the house or not more efficiently.

5.2 Potential Commercial

Development of pet entrance system has a potential commercial that can provide a satisfaction to the consumer. The target user for this product is the persons who own pet and thinks their pet as part as their family which the well-being of the are taken care off. This product uses the RFID technology which basically everyone knows. It has the same features as the RFID sticker for tolls but in this project the RFID tag is used as an identification for the pet. This allows the opening of the door for the pet to pass through it. This pet entrance is affordable and easy to use. This can make the pet 's owners' life easier. Due to the owner's busy schedule, this project is suitable to help the owner life as it helps the owner in opening the door for the pet compare to usual pet entrance door that need the owner assist.

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APPENDICES

Gant Chart PSM 1

WEEKS / PROJECT ACTIVITIES	(BDP 1) SEM 2 2021/2022														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Selection of title								MID TERM BREAK							
Online title registration															
Article Research															
Preparation of Proposal															
Consultation															
Submition of Proposal															
Preparation of Chapter 1															
Preparation of Chapter 2															
Preparation of Chapter 3															
Report Submission															
PSM Presentation															

Gant Chart PSM 2

WEEKS / PROJECT ACTIVITIES	(BDP 2) SEM 2 2022/2023														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Article Research									MID TERM BREAK						
Circuit Design															
Circuit Simulation															
Hardware Construction															
Data Analysis															
Preparation of Chapter 4															
Preparation of Chapter 5															
Draft Report Submission															
Report Submission															
PSM Presentation															

CODING PROJECT

DECLARE

```
//#include <Wire.h>

int RQScount;
int countERROR;
int countPHONE;
int countOK;
int commaPosition;
int index = 0;


char command;
String string;
#include <SPI.h>
#include <RFID.h>

#define SS_PIN 10
#define RST_PIN 9

RFID rfid(SS_PIN,RST_PIN);


int serNum[5];

int acards[][5] = {
  {35, 55, 184, 29, 177}

};


bool access = false;

#define RTC_CLK 5 // clock
#define RTC_DAT 6 // data
#define RTC_RST 7 // enable

#define BTN_AL  A0
#define BTN_DN  A1
#define BTN_UP  A2
#define BTN_SET A3


int sw1=2;

int sw2=4;
int MODE=0;
```

```
#include <Servo.h>
Servo servoMain; // Define our Servo

#define AL_BUZZ 8
//#define out1 3
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

// Set the LCD address to 0x27 for a 16 chars and 2 line display
LiquidCrystal_I2C lcd(0x27, 16, 4);

unsigned long timeUpdate = 0;
unsigned long timeButton = 0;
unsigned long timeAlarm = 0;
bool buttonPress = false;
byte alarmOn = 0;
bool alarmSw = 1;
byte setMode = 0;
byte setAlarm = 0;

byte daysOfMonth[13] = {0, 31, 29, 31, 30, 31, 30, 31, 31, 30, 31, 30, 31};
const char* months[13] = {"---", "Jan", "Feb", "Mar", "Apr", "May", "Jun",
"Jul", "Aug", "Sep", "Oct", "Nov", "Dec"};
const char* wdays[8] = {"---", "Mon", "Tue", "Wed", "Thu", "Fri", "Sat", "Sun"};

byte hh, mm, ss; // hour, minute, second
byte dd, MM, yy; // day, month, year
byte dw; // day of the week
byte ae, ah, am; // alarm: enabled, hour, minute
```

RTC CODING (DISPLAY DATE, DAY , HOURS, MINUTE, SECOND)

```
switch (setMode) {
    case 1: // year
      lcd.setCursor(4, 0);
      lcd.print("Year");
      lcd.setCursor(6, 1);
      lcd.print(yy + 2000, DEC);
      break;
    case 2: // month
      rtc_write_reg(0x8C, bin2bcd(yy));

      lcd.setCursor(4, 0);
      lcd.print("Month");
      lcd.setCursor(6, 1);
      lcd.print(months[MM]);
      break;
```

```
    case 3: // day
      rtc_write_reg(0x88, bin2bcd(MM));

      lcd.setCursor(4, 0);
      lcd.print("Day");
      lcd.setCursor(6, 1);
      if (dd < 10) lcd.print('0');
      lcd.print(dd, DEC);
      break;
    case 4: // day of week
      rtc_write_reg(0x86, bin2bcd(dd));

      lcd.setCursor(4, 0);
      lcd.print("Weekday");
      lcd.setCursor(6, 1);
      lcd.print(wdays[dw]);
      break;
    case 5: // hour
      rtc_write_reg(0x8A, bin2bcd(dw));

      lcd.setCursor(4, 0);
      lcd.print("Hour");
      lcd.setCursor(6, 1);
      if (hh < 10) lcd.print('0');
      lcd.print(hh, DEC);
      break;
    case 6: // minutes
      rtc_write_reg(0x84, bin2bcd(hh));

      lcd.setCursor(4, 0);
      lcd.print("Minute");
      lcd.setCursor(6, 1);
      if (mm < 10) lcd.print('0');
      lcd.print(mm, DEC);
      break;
    case 7:
      rtc_write_reg(0x82, bin2bcd(mm));
       rtc_write_reg(0x80, 0x00); // make sure clock is not halted and reset
seconds
    default:
      setMode = 0;
      rtc_write_reg(0x8E, 0x80); // protect writes
      initTimeDisplay();
      updateDisplay();
  }
}
```

SET ALARM(ENABLE ALARM, SET ALARM HOUR, SET ALARM MINUTE)

```
  switch (setAlarm) {
    case 1: // enable
      ae = 1 - ae;
      ae ? lcd.print("Yes") : lcd.print("No ");
      break;
    case 2: // hour
      t = ah; t += a;
      if ((t >= 0) && (t < 24)) ah = t;
      if (ah < 10) lcd.print('0');
      lcd.print(ah, DEC);
      break;
    case 3: // minutes
      t = am; t += a;
      if ((t >= 0) && (t < 60)) am = t;
      if (am < 10) lcd.print('0');
      lcd.print(am, DEC);
      break;
  }
}

void setAlVariable() {
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Alarm");
  lcd.setCursor(0, 1);
  lcd.print("< >");

  rtc_write_reg(0x8E, 0x00);

  switch (setAlarm) {
    case 1: // alarm enabled
      lcd.setCursor(6, 0);
      lcd.print("Enabled");
      lcd.setCursor(6, 1);
      ae ? lcd.print("Yes") : lcd.print("No ");
      break;
    case 2: // alarm hour
      rtc_write_reg(0xC0, ae);
      if (ae == 0) { // is disabled, do not ask for ah and am
        setAlarm = 0;
        rtc_write_reg(0x8E, 0x80); // protect writes
        initTimeDisplay();
        updateDisplay();
        return;
      }
```

```
      lcd.setCursor(6, 0);
      lcd.print("Hour");
      lcd.setCursor(6, 1);
      if (ah < 10) lcd.print('0');
      lcd.print(ah, DEC);
      break;
    case 3: // alarm minute
      rtc_write_reg(0xC2, ah);

      lcd.setCursor(6, 0);
      lcd.print("Minute");
      lcd.setCursor(6, 1);
      if (am < 10) lcd.print('0');
      lcd.print(am, DEC);
      break;
    case 4:
      rtc_write_reg(0xC4, am);
    default:
      setAlarm = 0;
      rtc_write_reg(0x8E, 0x80); // protect writes
      initTimeDisplay();
      updateDisplay();
  }
}
```

OYEN IS OUTSIDE DISPLAY ON LCD

```
if (digitalRead(sw1)==0 ){

digitalWrite(AL_BUZZ, HIGH);
delay(200);
digitalWrite(AL_BUZZ, LOW);
   Serial.println("lepaskan kucing");

      lcd.setCursor(0, 3);
      lcd.print("+ OYEN is outside +");
    delay(200);

    MODE=1;

}
```

OYEN HAS ACCESS RFID (THE SERVO WILL OPEN)

```
       if(access){

        Serial.println("oyen dah scan");

      lcd.setCursor(10, 2);
      lcd.print("RFID");
digitalWrite(AL_BUZZ, HIGH);
delay(200);
digitalWrite(AL_BUZZ, LOW);
delay(1000);
  servoMain.write(90); // door unlock for oyen
            delay(1000);
```

OYEN IS INSIDE DISPLAY ON LCD

```
if (digitalRead(sw2)==0 ){


digitalWrite(AL_BUZZ, HIGH);
delay(200);
digitalWrite(AL_BUZZ, LOW);
   Serial.println("kucing masok dah");

      lcd.setCursor(10, 2);
      lcd.print("    ");
      lcd.setCursor(0, 3);
      lcd.print("+ OYEN is inside + ");

  servoMain.write(0); // door lock
    delay(200);

    MODE=0;

}


}




}
```