DESIGN OF AN AUTOMATIC TAXI PARKING SYSTEM USING RASPBERRY PI

(Case Study: Park Enkadde, Kampala)

Final year project report submitted to Kampala international university in partial fulfillment of the requirement for the award

Of

Bachelor of Science in telecommunications engineering

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DECLARATION

I hereby declare that this project is my own work, original and has not been submitted for any academic award by any student to any other university.

BINSEEGA DERICK

Signature: …………………………………

Date: ……………………………………….

APPROVAL

This is to certify that BINSEEGA DERICK is presenting a final year project entitled the "design and implementation of an Automatic Taxi Parking System Using Raspberry Pi" under the Supervision of:

PROJECT COORDINATOR
MR. ADABARA IBRAHIM

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DEDICATION

I dedicate this report to the Glory of GOD, my guardians who have supported and sponsored me in everything I have done; their advice is highly appreciated as well. I also would like to dedicate it to all my beloved friends who have given me advice throughout my academic struggle.

ACKNOWLEDGEMENT

Primarily I would like to express my thanks to the Almighty God whom without any of this would have been impossible.

More thanks go to our Project Coordinator Mr. Ibrahim Adabara for his useful comments, criticisms, and suggestions on the original manuscript of this project report. Also to our lecturers who gave me ideas, technical support and spared their time to ensure my success in coming up with this project.

We recognize the effort of my parents in their endeavor to support me financially. Their prayers, support, guidance, and sacrifices are highly appreciated.

Appreciation goes to my fellow students who helped me in the research process.

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ABSTRACT

Despite the scattered taxi stages around Kampala city, taxis are supposed to only stage or park in the main taxi park to reduce the congestion. However, other congestion factors come into play like improper parking methodologies which calls for a lot of human labor, poor or no slot monitoring system and drunk driving which even leads to accidents in and out the taxi parking yards. Therefore, a system has been implemented to reduce the congestion in Kampala city which normally begins from the taxi parks. The system uses RFID technology to only grant access to the known taxi drivers that are stored in the database, it also includes empty slot detection and automatic parking mechanism which will help in reduction of the congestion inside the taxi parking yards. Alcohol detectors are also installed on the exit gate to only allow sober taxi drivers to drive passengers out which is anticipated to reduce accidents caused by drunk drivers on the roads. The system is controlled by raspberry pi 3 B+ interfaced with the Arduino technology for precision.

LIST OF ABBREVIATIONS

LED	Light Emitting Diode
LCD	Liquid Crystal Display
ADC	Analogue to Digital Converter
IR	Infra-red
RFID	Radio-frequency identification

CHAPTER ONE
INTRODUCTION

1.0 INTRODUCTION

This chapter gives a brief introduction to the project, as well as discussing the problem statement in detail. Also, the main and specific objectives, significance and scope of the project are presented.

1.1 BACKGROUND

On a busy working day, Kampala city is painted in all white and blue, this is the sight of the white Toyota minibusses with blue square stripes. This is most cases is accompanied by a sharp chaotic noise of hooting, tire screeching and different loud voices hailing passengers to board the popular Matatus. At first sight, one may think it's a crazy market day.

Kamunye, as they are commonly referred to, is the most used means of public transport in Kampala and East Africa at large. However on the east African scope, these are known as Matatus. The 14 seater minibusses have made quite a name in Uganda with research showing that Uganda is among the top importers of this Japanese Toyota van.

Since the early 60s, taxis have been at the helm of Kampala's public transport and today the city harbors over 16, 000 taxis. This has largely contributed to the increasing city traffic congestion which according to First African Bicycle Information Organization (FABIO) costs the economy over 50 million shillings a day.

Taxis are used by almost everyone in Kampala, young or old, rich or poor due it their flexibility. Most commuters to work and school are found every dawn and dusk at stages battling for the taxis. Commuters think this is the most effective means of transport due to its flexibility and the fact that taxis are cheap hence most fit to be used in Uganda's deteriorating economy.

"I have used taxis all my life; they are cheap and pretty accessible. A taxi can fetch me from wherever I am which wouldn't be the case for buses or trains" said Joy Gertrude, a Commuter working at Luwum street. She also thinks taxis are a better option to using a personal car since one might use 'just' Shs 2,000 for a Journey on which he would have put fuel of Shs 10,000.

Just like Joy, many Ugandans have opted to the taxis because of such convenience and cost-effectiveness. Taxis have no fixed stops and can, therefore, drop you anywhere or pick you at any point. As much as the commuters think this is to their advantage, traffic police think it's a major cause of confusion in the city and causes accidents at the end of the day.

"The indiscipline on the road, whereby these taxis stop anywhere, is the major cause of congestion and accidents on the roads. Drivers should be patient on the road and learn to park only in gazetted areas" said Israel Wambesyo, the Deputy Traffic Commander Kampala Metropolitan.

Despite the scattered taxi stages around the city, taxis are supposed to only stage in the main taxi parks. These include the Old Taxi Park which is along Ben Kiwanuka Street and the New Taxi Park which is downtown adjacent to Nakivubo. More, smaller taxi parks, however, have been created especially outside the city center. These include Owino taxi park, Usafi Taxi Park and so on. People, however, have always complained of how difficult it is to trek from the city center to some of these parks, so they end up waiting in the city for the illegal taxis on non-gazetted stages.

However, it should also be noted that most of the congestion begins from the main taxi parks like the old taxi park. Where improper parking becomes the order of the day which makes it difficult for the filled taxis to even access exit gates and as a result wastes a lot of time and brings about confusion. There are many lanes for taxi parking, so to park a car one has to look through all lanes. Moreover, there is a lot of human labor involved in this process.

Conventionally, Ugandan taxi parking systems do not have any intelligent monitoring system. Parking lots are monitored by human beings. All vehicles enter into the parking and waste time searching for parking slots. The condition becomes worse when there are multiple parking lanes and each lane has multiple parking slots.

At times the congestion is not only brought about by improper parking but also caused by drunk drivers on duty who normally cause accidents on road where a lot of people lose their lives. This is mainly based in taxi parks where vehicles stage and drivers get time to move out for beers and smoke yet the existing local conducting taxi park systems do not monitor driver's status before vehicles are allowed to get out of the parking yard which becomes dangerous towards the innocent passengers.

The Kampala old taxi park is also faced by the problem of drivers violating the set loading order. This implies that some drivers tend to load the vehicles in rounds that are not theirs which brings about a lot of confusion and even at times cause fights.

With the above-elaborated challenges in Kampala taxi parks, a system is proposed to automate the taxi parking business in the sense that the system indicate the status of parking yard before the entrance of any vehicle, in case empty slots are available, each car is directed where to park in order to reduce on congestion and here infrared transmitter and receiver will be used. To improve on the order of parking and loading only authorized vehicles will be allowed to load according to the first come first serve threshold. All the drivers and other taxi operator's information in detail will be stored in a database that will be used to also eliminate theft.

The proposed system will also be able to eliminate drunk drivers through the alcohol detection mechanism that will be in a position to immediately report and alcohol detection in the driver's seat before any taxi crosses the exit gate of the taxi park. This is as well anticipated to reduce reckless drivers and accidents on roads.

1.2 PROBLEM STATEMENT.

Taxis are used by almost everyone in Kampala, young or old, rich or poor due to their flexibility. Commuters think this is the most effective means of transport due to its flexibility and the fact that taxis are cheap hence most fit to be used in Uganda's deteriorating economy. They are cheap and pretty accessible. However, the uncontrolled number of taxis makes it an annoying business at some point whereby on busy days a lot of confusion and congestion are mostly caused by taxis. Due to the research carried out, the extreme congestion and reckless driving begin from the taxi parks where improper parking, dodging load orders, drunk driving and theft are on their peak.

To eliminate the above-mentioned challenges, an automatic congestion-free taxi parking system is proposed. The system will be able to automatically detect incoming vehicles on the entrance of the taxi park gate through the use of IR sensors, opens the gate by the use of motors in case there are empty slots left for the vehicles to park, in case there are no empty slots, information will be displayed on LCD on the entrance with directions to the next taxi parking yard with empty slots. Only authorized drivers with valid RFID tags will be allowed to load vehicles during their turn, in case the information of RFID tag doesn't match with information in the database at that time, load will be denied to eliminate dodging of load orders. Using MQ-2 alcohol detection sensor drunk drivers will be detected and the system notifies the control panel.

1.3 OBJECTIVES OF THE STUDY.

1.3.1 MAIN OBJECTIVE.

To design and implementation of an automatic congestion-free taxi parking system.

1.3.2 SPECIFIC OBJECTIVES.

- To examine the existing system
- To develop an automatic car parking and empty slot detection mechanism.
- To develop a database that stores detailed information about taxi operators that will only allow authorized drivers to load vehicles.
- To develop an alcohol detector that will be used to eliminate drunk drivers in taxi parks.
- To test/validate the developed system

1.4 RESEARCH QUESTIONS.

- How to examine the existing system
- How to develop an automatic car parking and empty slot detection mechanism.
- How to develop a database that stores detailed information about taxi operators that will only allow authorized drivers to load vehicles.
- How to develop an alcohol detector that will be used to eliminate drunk drivers in taxi parks.
- How to test/validate the developed system

1.5 SCOPE OF THE STUDY.

1.5.1 GEOGRAPHICAL SCOPE.

The system is designed for the need to eliminate the extreme congestion and reckless driving in taxi parks in Kampala where improper parking, dodging load orders, drunk driving and theft are on their peak.

1.5.2 CONTENT SCOPE.

The system will be able to automatically detect incoming vehicles on the entrance of the taxi park gate through the use of IR sensors, opens the gate by the use of motors in case there are empty slots left for the vehicles to park, in case there are no empty slots, information will be displayed on LCD on the entrance with directions to the next taxi parking yard with empty slots. Only authorized drivers with valid RFID tags will be allowed to load vehicles during their turn, in case the information of the RFID tag doesn't match with information in the database at that time, the load will be denied to eliminate dodging of load orders. Using MQ-2 alcohol detection sensor drunk drivers will be detected and the system notifies the control panel.

1.5.3 TIME SCOPE.

The whole process of design and implementation of a car parking system using Atmega328p has taken four months.

1.6 SIGNIFICANCE OF THE PROJECT.

The Project is cost-effective, efficient, pollution-free and environment-friendly since its operations do not involve release of any waste product.

In the long run, the maintenance cost is very less when compared to the present systems.

CHAPTER TWO
LITERATURE REVIEW

2.0 INTRODUCTION.

This chapter will discuss more all of the information related to the project. It discusses the previous relevant and present work about the project. We all look at existing systems, their weaknesses, and solutions. The literature review in this chapter is based on the Internet, journals, books, and articles.

2.1 THEORETICAL REVIEW.

EXISTING SYSTEMS.

In 2019, Asghar Ali Shah et al. presented a Video Stitching with Localized 360^{o} Model for Intelligent Car Parking Monitoring and Assistance System which monitors and assists car parking by stitching multiple videos and creating a 360 degree localized view. A complete model was proposed and steps were defined for each module including video acquisition, stitching, and 360 degrees localized view. A single view was created from all individual cameras. When a car enters a parking area, the driver was to be guided towards free slot by proposed monitoring and assistance system. (Shah, Mustafa, Ali, & Anees, 2019)

In 2019, Md Mamunur Rashid et al. proposed an Autonomous 4WD Smart Car Parallel Self-Parking System by Using Fuzzy Logic Controller. An Automatic car parking obtains information about available parking space, processes it and then places the car at certain position. It is inevitable for the people to update with the growing technology and generally people are facing problems with parking vehicles in parking slots in a city. The Automatic car parking which enables the user to find the nearest parking area and gives availability of parking slots in that respective parking area with the help of LCD display and it mainly focus on reducing the time in finding the parking slots and also it avoids the unnecessary traveling through filled parking slots in a parking area. (Rashid, 2019)

In 2015, Abu Asaduzzaman et al. proposed A Time and Energy Efficient Parking System Using ZigBee Communication Protocol. The proposed system is suitable for multi-floor buildings and able to send a message to vehicles about the status of parking spaces. The parking monitoring system continuously collects the data from parking slot detectors and then it intimates the vehicle section. We simulate the proposed system using ZigBee and two other popular wireless technologies: Bluetooth and Wi-Fi. Experimental results show that ZigBee provides transition time and power advantages over Bluetooth and Wi-Fi. (Asaduzzaman, Chidella, & Mridha, 2015)

In 2013, R.Ranjini et al. School of Computing, SASTRA University, presented A Comparative Review on Car Parking Technologies which discussed some of the commonly used techniques in parking management and identified the problems present in their methodologies. Keywords: Parking management system, Parking techniques, WSN, RFID, Zigbee. (Ranjini & Manivannan, 2013)

In 2008, Ananth Nallamuthu et al. Department of ECE, Clemson University presented a Vision-Based Parking Space Classification. The problem of Vacant Parking space detection from static images using computer vision-based algorithms such as color histogram classification, car feature point detection has been recently proposed by a few researchers. In this project some of the suggested approaches are implemented and also use additional techniques such as background subtraction and some improvised methods to classify the state of a parking space. (Nallamuthu & Lokala, n.d.)

In 2008, Chulhoon Jang et al. proposed a semantic segmentation-based parking space detection with a standalone around view monitoring system. To accomplish collision-free parking, precise and robust parking space detection is required. However, harsh conditions such as varied illumination in outdoor parking lots and high reflection in indoor parking lots degrade the reliability of parking space detection. In this paper, we propose a unified structure for parking space detection to detect parking slot markings and static obstacles. A fully convolutional network for semantic segmentation can immediately identify free spaces, slot markings, vehicles, and other objects without using a range sensor or 3D reconstruction algorithm. Furthermore, a vertical grid encoding method can simultaneously detect unoccupied slots identified by parking slot markings and empty spaces created by surrounding static objects without sensor fusion. Experimental results show the robustness of the proposed method in various different parking scenarios. Even in challenging conditions such as dark shaded or high-glare areas, the detection performance maintains a precision rate of 96.81% and recall rate of 97.80%. (Jang & Sunwoo, 2018)

In 2000 Jin Xu, Guang Chen et al. School of Mechanical & Production Engineering, Nanyang Technological University presented a Vision-Guided Automatic Parking for Smart Car that relies on vision to estimate free parking slots. All problems involved in implementing automatic parking behavior are discussed. Solutions are given together with experimental results obtained from real data. (Xu, Chen, & Xie, n.d.)

2.2 WEAKNESSES OF THE EXISTING SYSTEMS.

From the review of the above literature, there are many advantages with the existing systems because it maintains a particular order for parking all vehicles but also has some disadvantages that with this system we can't know where exactly the vehicle has been parked. We also cannot able to identify which slot is empty and which slot has been filed. So through this project we want to create a system that gives information about slots and their occupancy. We use IR sensors for detecting which slots are filled and which slots are not filled.

2.3 CONCEPTUAL FRAMEWORK

The design and implementation of an automatic congestion-free taxi parking system using raspberry pi detects a vehicle and also the RFID of the driver in order to open the entrance. The gate is opened only if the is an empty slot for parking inside the park. At the exit of the park, the vehicle is only allowed to leave after testing the alcohol levels of the driver to reduce the accidents.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION.

This chapter explains in detail the methodology and components that will be used in the project. In this chapter also explains the technical plan, analysis and also the specifications.

3.2 DATA COLLECTION

The experimental data collection method was used in this project. It is data produced by a measurement, test method, experimental design or quasi-experimental design. Also, it is data produced as a result of a clinical trial. Experimental data may be qualitative or quantitative, each being appropriate for different investigations. The data therein used in this project is both qualitative and quantitative where qualitative data is considered more descriptive and can be subjective in comparison to having a continuous measurement scale that produces numbers normally experimentally repeatable. Qualitative information is usually more closely related to phenomenal meaning and is, therefore, subject to interpretation by our observations as it will be shown in the experiments and block diagrams in this and the next chapters.

3.3 SYSTEM DESIGN.

The system is designed with the use of a combination of tools. These tools are categorized as hardware tools and software tools as elaborated below:

3.3.1 HARDWARE SYSTEM COMPONENTS

- Voltage Regulator LM7805.
- LCD JHD16X2A.
- The power supply section contains a transformer, rectifier, filter, regulator which ensures a constant +5V.
- Buzzer.
- IR Sensor
- Capacitors.
- Resistors.
- Prototyping board (breadboard) and jumper wires.
- The implementation circuit board (copper board)
- MQ-2 Alcohol Sensor
- RFID

- Servo Motor

3.3.2 SOFTWARE

- Proteus
- SQLite software

3.4 INSTRUMENTATION/ MAJOR COMPONENTS USED.

Raspberry Pi

The Raspberry pi is a single computer board with credit card size, that can be used for many tasks that your computer does

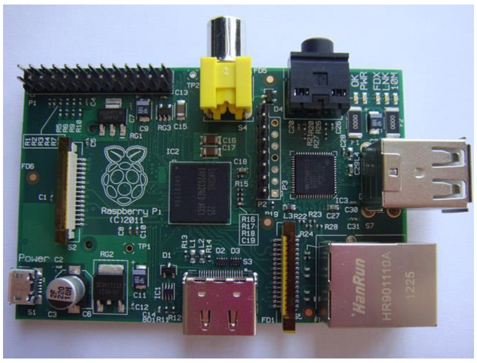


Figure 1 Raspberry pi

The Servo Motor:

The servo engine is a motor that comes with a Gear gearbox and a Shaft transmission that gives motion greater torque and greater precision. This engine can rotate 180 degrees and in some types 360 degrees. The servomotor is internally made up of a "mostly microcontroller" control circuit. When the engine gives pulses at a certain time constant, the engine rotates to the angle according to that time constant.

Figure 2 Servo motor

LCD JHD162a.

A liquid crystal display is a flat panel, an electronic visual display that uses the light modulating properties of liquid crystals. Liquid crystal does not emit light directly. The working of LCD depends on two sheets of polarizing material with a liquid crystal solution in between them. When an electric current is passed through the liquid, it causes the crystals to align so that it blocks out light and does not allow it to pass. Each crystal behaves like a shutter; it either allows light to pass through or blocks the light.

It can function properly in the temperature range of -10°C to 60°C and has an operating lifetime of longer than 50000 hours (at room temperature without direct irradiation of sunlight).

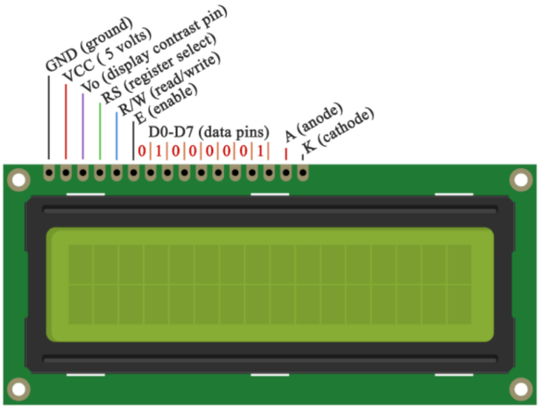


Figure 3 Liquid Crystal Display

Buzzer system.

The buzzer is used for alerting purposes. It converts electrical energy into sound energy by using transistor and capacitor. It produces high frequency for hearing purpose.

The MQ-2 sensor will sense the alcohol, the raspberry pi takes quick action and the relay driver gets activated by sending a signal to it. The relay driver sends the signal in terms of voltage and buzzer will start beeping.

Figure 4 Buzzer

IR Sensor

The principle of an IR sensor working as an Object Detection Sensor can be explained using the figure below. An IR sensor consists of an IR LED and an IR Photodiode; together they are called Photo coupler or Opto Coupler. When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined. It consists of an IR LED, a photodiode, a potentiometer, an IC Operational amplifier, and an LED. IR LED emits infrared light. The Photodiode detects the infrared light. An Op-amp is used as a voltage comparator. The potentiometer is used to calibrate the output of the sensor according to the requirement

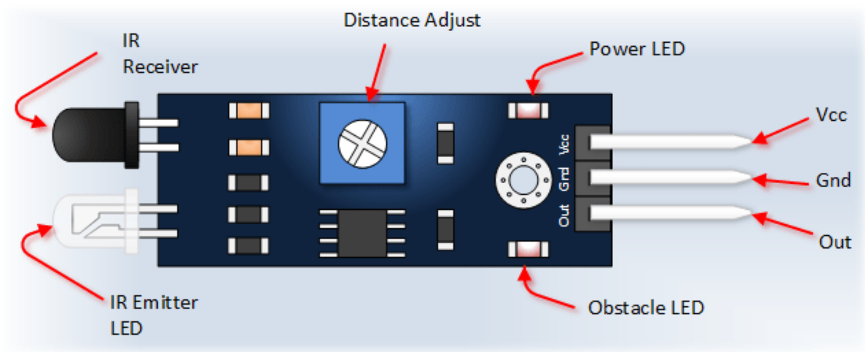


Figure 5 Infrared Sensor

Alcohol sensor (mq2)

Alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. The sensor provides an analog resistive output based on alcohol concentration. The drive circuit is very simple; all it needs is one resistor. Alcohol Sensor (MQ2) module is suitable for detecting H2, LPG, CH4, CO, Alcohol, Smoke or Propane. The sensitivity of the sensor can be adjusted by potentiometer. Alcohol sensor is used to prevent the accidents caused due to drunken drivers. In order for the vehicle to leave the taxi park, the driver must take the breathe test, which calculates the amount of alcohol present in his body. The units of the output of alcohol sensor are also ppm. So we set the threshold of the alcohol sensor to 450ppm, above which indicates the driver has consumed alcohol. If the value is within the threshold limit, then the driver can start the vehicle to leave the park. If it exceeds the threshold then he won’t be able to start the vehicle.

Figure 6 MQ-2 Sensor

Radio-frequency identification (RFID)

RFID uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information.

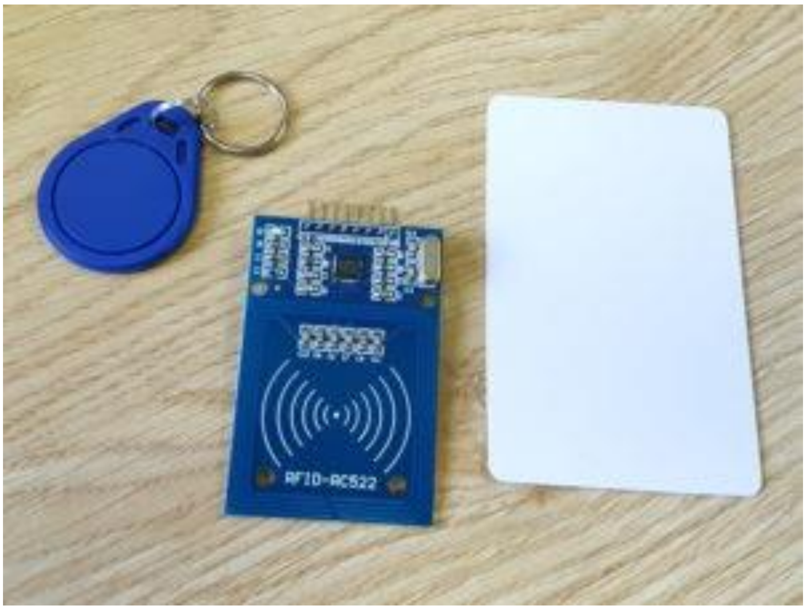


Figure 7 RFID

3.5 CONCEPTUAL DESIGN/FRAMEWORK.

The block diagram consists of the drivers to display unit which is the JHD16X2. They are represented as the following block diagrams.

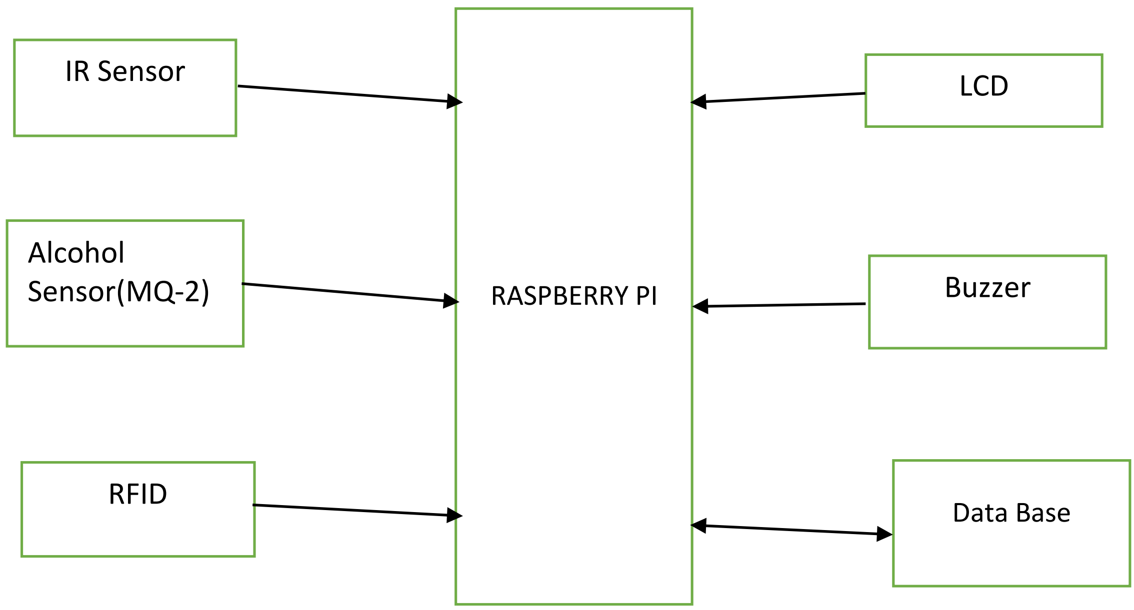


Figure 8: block diagram

3.6 WORKING PRINCIPLE OF THE PROJECT.

The system works on the principle of motion sensing and IR rays obstruction. The system is able to automatically detect incoming vehicles on the entrance of the taxi park gate through the use of IR sensors, opens the gate by the use of motors in case there are empty slots left for the vehicles to park, where there are no empty slots, information is displayed on LCD on the entrance with directions to the next taxi parking yard with empty slots. Only authorized

drivers with valid RFID tags are allowed to load vehicles during their turn, MQ-2 alcohol detection sensor is used at the exit gate to detect drunk drivers and the system turns on the buzzer that notifies the control panel.

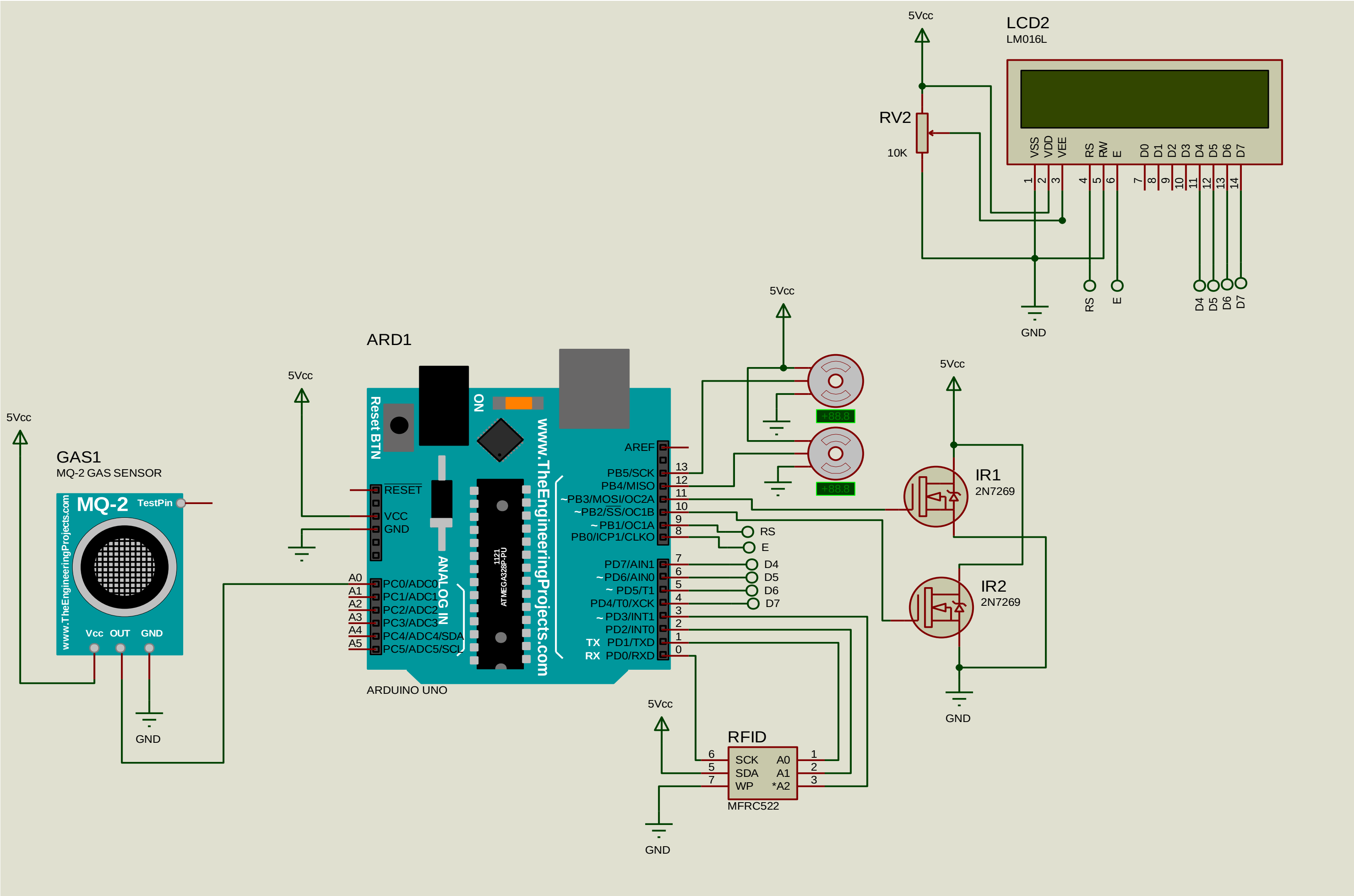


Figure 9 Circuit Diagram

FLOW CHART

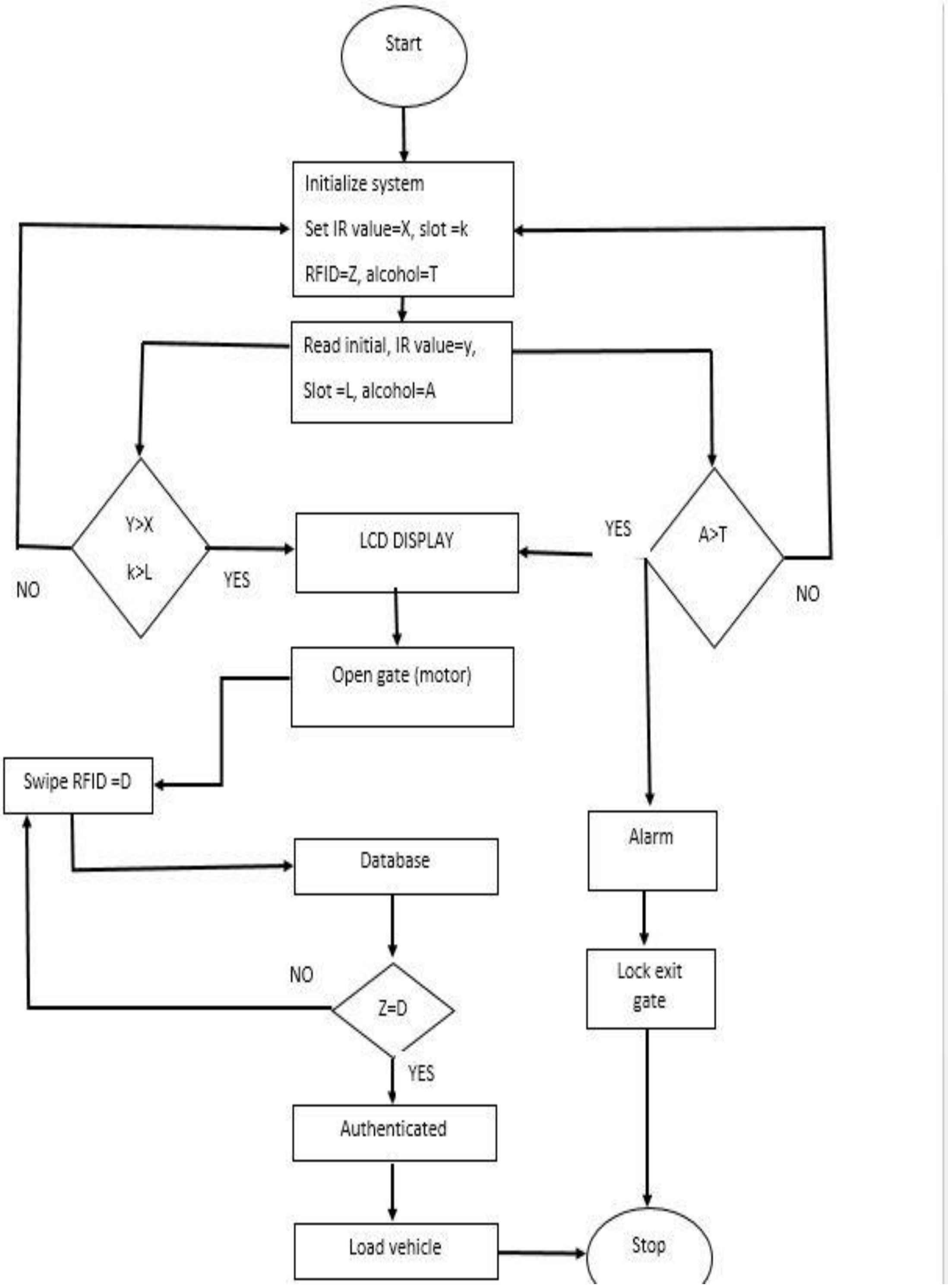


Figure 10: Flow chart

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 INTRODUCTION

As stated in the above chapters, this system works on mainly three sensors that are IR sensors, RFID, and MQ-2 alcohol sensor which trigger the action of other components as programmed and also the database records the information on whether there is an empty slot or not by increasing or decreasing on the count. The raspberry pi is fed with a code to control components being used in the system. In this chapter, the results and discussion of the project are discussed.

4.1 BREADBOARD COMPONENTS ASSEMBLING.

Here, all components are first assembled on the breadboard, and the concept of the project operation tested before finally transferring the components to a printed circuit board (PCB).

4.2 BREADBOARD RESULTS

The results were positive as all components performed their tasks as expected, right from the +5v power source tapped from the step-down transformer, through the board to all other components.

4.3 SOFTWARE PROGRAMMING

Here, after having positive feedback from breadboard circuit outline, it is important to come up with suitable source code as per the project-specific goals, hence the transmitter and receiver source codes are as seen below

4.4 SOLDERING ON PRINTED CIRCUIT BOARD (PCB).

This involved, placing components on a PCB and soldering them on with the aid of a soldering gun and lead. This marked a strong continuous outline of the circuit whereby all components were connected from point to point, from Vcc to ground and microcontroller connections.

4.5 CONTINUITY TESTING

After soldering was done, the continuity test was crucial for testing whether a line was continuous from one point to another and also to ensure there are no short circuits as a result of continuity between Vcc and ground.

4.6 RESULTS ON PCB

A successful continuity test gave a go-ahead to power the circuit and hence all components successfully performed as anticipated and the figure below shows the results after soldering on PCB and powering the system.

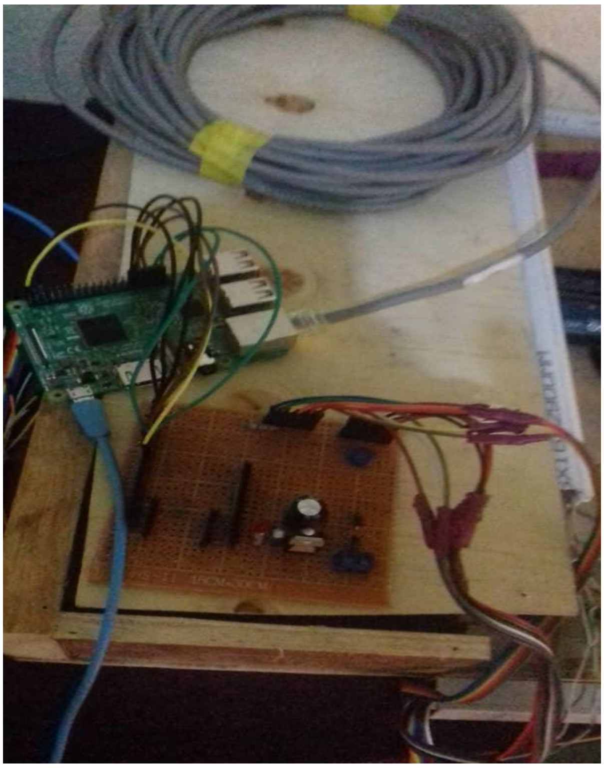


Figure 11 Result on a PCB

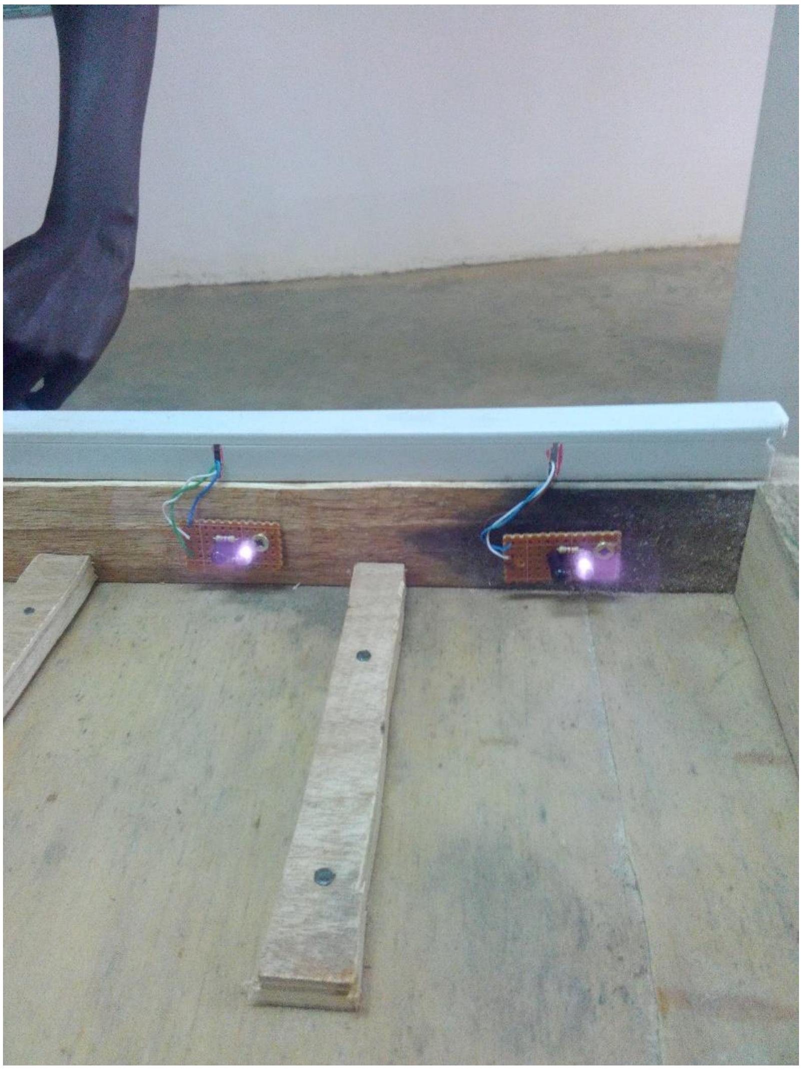
CHAPTER FIVE

RECOMMENDATIONS, CONCLUSION AND FUTURE SCOPE OF WORK

5.1 CONCLUSIONS

Automatic car parking and empty slot detection.

Slot detection is carried out by the IR sensors that are installed in front of every slot where occupied slots are detected when vehicles act as obstacles to reflect infrared rays that as a result send an input signal to the microcontroller. When all the slots are occupied in the parking yard, access is denied for more cars to enter and an indication message is displayed on the LCD that even advice drivers to try the next free parking yard. On the other hand, access is granted to drivers with valid tags that contain all the required information and stored in the database. This is when there are empty slots in the yard. Once a valid card is swiped, authorized access is displayed on the LCD and the gate automatically opens.

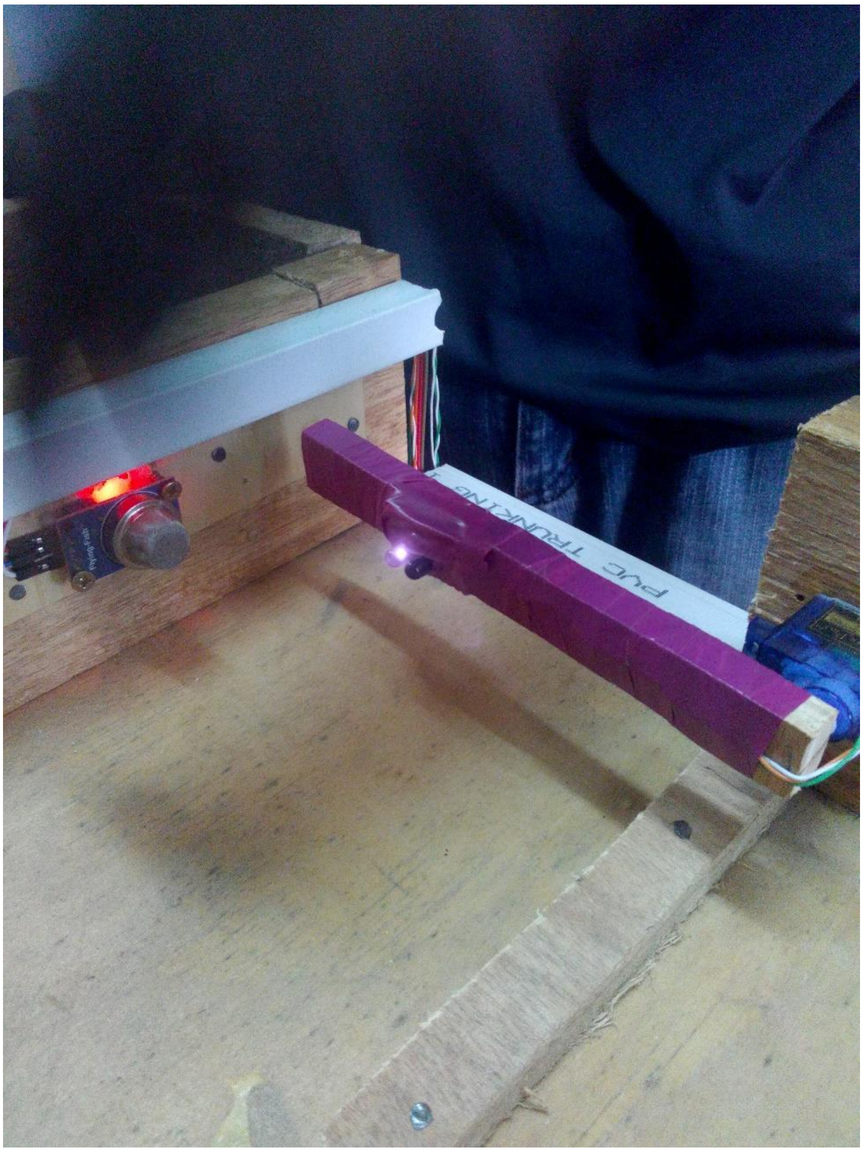


A database that stores detailed information about taxi operators.

The SQLite software library was chosen to be the database engine, SQLite is a serverless, self-contained software library that fits perfectly with the Raspberry Pi. It contains tables that in this case used to store data like the driver's name, permit number and the RFID tag number. Whenever an RFID tag is swiped, data is fetched from the Arduino to the database on the raspberry in real-time which is latter compared with the initially stored data and access is therefore granted to the driver whose RFID card was registered by the taxi park authorities.

Alcohol detection.

An alcohol detector is installed on the exit door of the taxi park whereby each driver's alcohol level is analyzed before he's allowed to drive passengers out of the parking yard. This has been implemented to reduce the accidents which are normally caused by drunk drivers from taxi parks. Alcohol detection is carried by the MQ-2 sensor that generates an analog signal which is then converted into digital by the built-in Arduino ADC functionality. In case the alcohol levels of a certain driver exceed the maximum set limit, the exit gate does not open up to allow him drive out and such information is also kept in the database for future investigations on that driver. On the other hand, sober drivers are freely allowed to park and exit the taxi park normally.



5.2 RECOMMENDATIONS.

I recommend a more efficient system that will ensure at least 95% automation and also in case of forgotten property in the vehicle, the passenger will be able to trace by knowing which vehicle left at that particular time.

5.3 FUTURE SCOPE.

The following features can be added to this project design in the future.

- The ability of the system to automatically alert the responsible person when there is free parking space by sending them messages.
- The ability of the system to record the arrival time and departure time of the vehicles from the park in order to improve on the security of passengers

CHAPTER SIX

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APPENDICES

SOURCE CODE

```
#include <SPI.h>
#include <MFRC522.h>
#include <LiquidCrystal.h> //LCD Library
#include <Servo.h>
#define SS_PIN 10
#define RST_PIN 9
MFRC522 mfrc522(SS_PIN, RST_PIN);
int servoPx = 8;
// Declare the Servo pin
int servoPin = 1;
// Create a servo object
Servo Servo1;
const int input=14;
const int slot_1=15;
const int slot_2=16;
// Create a servo object
Servo Servo2;
LiquidCrystal lcd(2,3,4,5,6,7);
int baz[]={255,255,255,255,255,255,255,255,255,255,255,255,255,255,255,255};
void setup()
{

  SPI.begin();      // Initiate  SPI bus
  mfrc522.PCD_Init();   // Initiate MFRC522
  Servo2.attach(servoPx);
  Servo1.attach(servoPin);
  Servo2.write(0);
  Servo1.write(180);
   pinMode(input,INPUT);
   pinMode(slot_1,INPUT);
   pinMode(slot_2,INPUT);
        Servo2.write(0);
        delay(10);
        lcd.begin(16, 2);
        lcd.setCursor(0,0);
        lcd.print("Automatic taxi");
        lcd.setCursor(0,2);
        lcd.print("parking system");
        delay(3000);
        lcd.clear();
/*
       int k,x;
       for(k=0;k<=15;k++)
       {
        for(x=0;x<=100;x++)
```

```
        {
          lcd.setCursor(0,0);
        lcd.print("Checking slots......");
        lcd.print(x);
         lcd.print("%");

        lcd.setCursor(k,1);
        lcd.print((char)baz[k]);
        delay(10);

        }
       }*/
      delay(1000);
      lcd.clear();

}
void loop()
{

   if((digitalRead(slot_1)==HIGH)&&(digitalRead(slot_2)==HIGH))
   {

          if(digitalRead(input)==HIGH)
 {
    lcd.setCursor(0,0);
    lcd.print("Opening exit");
    delay(1000);
    lcd.clear();
    int i;
  for(i=180;i>=90;i--)
  {
   delay(50);
  Servo1.write(i);
   delay(10);
  }
      lcd.setCursor(0,0);
    lcd.print("Closing exit");
    delay(3000);
    lcd.clear();
  for(i=90;i<=180;i++)
  {
   delay(50);
  Servo1.write(i);
   delay(10);
  }
 }
 else
 {
     lcd.setCursor(0,0);
    lcd.print("Parking full!!");
```

```
   lcd.setCursor(0,1);
   lcd.print("try next parking");
   Servo1.write(180);
   delay(1000);
   lcd.clear();
 }
  }
  if((digitalRead(slot_1)==LOW)&&(digitalRead(slot_2)==LOW))
  {

       open_entrance();
             if(digitalRead(input)==HIGH)
        {
          lcd.setCursor(0,0);
          lcd.print("Opening exit");
          delay(1000);
          lcd.clear();
          int i;
        for(i=180;i>=90;i--)
         {
          delay(50);
        Servo1.write(i);
          delay(10);
         }
           lcd.setCursor(0,0);
          lcd.print("Closing exit");
          delay(3000);
          lcd.clear();
        for(i=90;i<=180;i++)
         {
          delay(50);
        Servo1.write(i);
          delay(10);
         }
        }
        else
        {
             Servo1.write(180);
             lcd.setCursor(0,0);
             lcd.print("Welcome to the ");
             lcd.setCursor(0,1);
             lcd.print("Old taxi park");
             delay(2000);
             lcd.clear();
             lcd.setCursor(0,0);
             lcd.print("    ALL Slots     ");
             lcd.setCursor(0,1);
             lcd.print("currently free");
              delay(2000);
             lcd.clear();
```

```
      }
}

 if((digitalRead(slot_1)==HIGH)&&(digitalRead(slot_2)==LOW))
{


       open_entrance();
       if(digitalRead(input)==HIGH)
        {
          lcd.setCursor(0,0);
          lcd.print("Opening exit");
          delay(1000);
          lcd.clear();
          int i;
        for(i=180;i>=90;i--)
         {
          delay(50);
         Servo1.write(i);
          delay(10);
         }
            lcd.setCursor(0,0);
          lcd.print("Closing exit");
          delay(3000);
          lcd.clear();
        for(i=90;i<=180;i++)
         {
          delay(50);
         Servo1.write(i);
          delay(10);
         }
        }
        else
        {
                 Servo1.write(180);
                 lcd.setCursor(0,0);
                 lcd.print("slot_1 occupied");
                 lcd.setCursor(0,1);
                 lcd.print("slot_2 free");
                 delay(2000);
                 lcd.clear();

        }
}

 if((digitalRead(slot_1)==LOW)&&(digitalRead(slot_2)==HIGH))
{

       open_entrance();
```

```
if(digitalRead(input)==HIGH)
{
  lcd.setCursor(0,0);
  lcd.print("Opening exit");
  delay(1000);
  lcd.clear();
  int i;
 for(i=180;i>=90;i--)
 {
  delay(50);
 Servo1.write(i);
  delay(10);
 }
    lcd.setCursor(0,0);
  lcd.print("Closing exit");
  delay(3000);
  lcd.clear();
 for(i=90;i<=180;i++)
 {
  delay(50);
 Servo1.write(i);
  delay(10);
 }
}
else
{
        Servo1.write(180);
        lcd.setCursor(0,0);
        lcd.print("slot_1 free");
        lcd.setCursor(0,1);
        lcd.print("slot_2 occupied");
        delay(1000);
        lcd.clear();

}
}
/*
    lcd.setCursor(0,0);
    lcd.print("Welcome to the ");
    lcd.setCursor(0,1);
    lcd.print("Old taxi park");
    delay(2000);
    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("Swipe card");
    lcd.setCursor(0,1);
    lcd.print("to enter");
    delay(2000);
    lcd.clear();
```

```
        open_entrance();
        exit_gate();
        */

           }
void exit_gate()
{
 if(digitalRead(input)==HIGH)
 {
   lcd.setCursor(0,0);
   lcd.print("Opening exit");
   delay(1000);
   lcd.clear();
   int i;
  for(i=180;i>=90;i--)
  {
   delay(50);
  Servo1.write(i);
   delay(10);
  }
     lcd.setCursor(0,0);
   lcd.print("Closing exit");
   delay(3000);
   lcd.clear();
  for(i=90;i<=180;i++)
  {
   delay(50);
  Servo1.write(i);
   delay(10);
  }
 }
 else
 {
   Servo1.write(180);
   lcd.setCursor(0,0);
   lcd.print(" Exit closed");
   delay(3000);
   lcd.clear();

 }

        }


 void open_entrance()
 {
  // Look for new cards
        if ( ! mfrc522.PICC_IsNewCardPresent())
        {
          return;
```

```
}
// Select one of the cards
if ( ! mfrc522.PICC_ReadCardSerial())
{
  return;
}

String content= "";
byte letter;
for (byte i = 0; i < mfrc522.uid.size; i++)
{

   content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " "));
   content.concat(String(mfrc522.uid.uidByte[i], HEX));
}
content.toUpperCase();
if (content.substring(1) == "13 E9 1B 21")
{

      lcd.setCursor(0,0);
      lcd.print("Authorized access");
      lcd.setCursor(0,1);
      lcd.print("Opening gate");
      delay(2000);
      lcd.clear();
 int i;
 for(i=0;i<=90;i++)
 {
       delay(30);
       Servo2.write(i);
       delay(10);
 }


      lcd.setCursor(0,0);
      lcd.print("Closing gate");
      delay(3000);
      lcd.clear();
    for(i=90;i>=0;i--)
 {
     delay(30);
     Servo2.write(i);
     delay(10);
 }
      Servo2.write(0);
      lcd.setCursor(0,0);
      lcd.print("Gate closed");

      delay(3000);
       lcd.clear();
```

```
 }
else   {
     lcd.setCursor(0,0);
      lcd.print("Access denied");

      Servo2.write(0);
      delay(3000);
      lcd.clear();

     }
}
```

GANTT CHART

	NUMBER OF WEEKS							
ACTIVITIES	**WEEK 1**	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEEK 7**	**WEEK 8**
DATA COLLECTION								
DATA PROCESSING								
DATA ANALYSIS								
PURCHASING OF COMPONENTS								
PROGRAMMING THE RASPBERRY PI								
DESIGN AND IMPLEMENTATION								
TESTING AND ERROR RECTIFICATION								
REPORTING AND DISSEMINATION								

BILL OF QUANTITY

S/N	COMPONENTS	QUANTITY	RATE	AMOUNT
01	Raspberry Pi	01	400000	400000
02	Buzzer	01	5000	5000
03	LCD	01	47000	47000
04	IR sensor	05	10000	50000
05	Transformer	01	30000	30000
06	Voltage regulator	01	10000	10000
07	Crystal Oscillator	01	8000	8000
08	LED	05	1000	5000
09	Resistors	10	1000	10000
10	Capacitors	01	2000	6000
11	MQ-2 Alcohol Sensor	01	30000	30000
12	Terminal block	01	3000	3000
13	RFID	01	30000	30000
14	Servo Motor	02	40000	80000
	TOTAL			714000