AUTOMATED PARKING SYSTEM

FINAL YEAR PROJECT UG 2020

By

Capt Ali Siddique Chohan (Leader)
Maj Qamar Gulzar
Maj Muhammad Fareed Hamid
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Project Supervisor

Asst Prof. Col (R) Dr. Imran Tauqeer

Submitted to the faculty of Department of Electrical Engineering, Military College of Signals, National University of Sciences and Technology, in partial fulfillment for the requirements of B.E Degree in Electrical Engineering

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CERTIFICATE OF CORRECTIONS & APPROVAL

Certified that work contained in this thesis titled **"Automated Parking System"** carried out by (1) Capt Ali Siddique Chohan (Leader) (2) Maj Muhammad Fareed Hamid (3) Maj Qamar Gulzar (4) Capt Muhammad Hamza Abbasi under the supervision of Asst Prof. Col (R) Dr. Imran Tauqeer for partial fulfillment of Degree of Bachelors of Electrical Engineering, in Military College of Signals, National University of Sciences and Technology, Islamabad during the academic year 2019-2020 is correct and approved. The material that has been used from other sources has been properly acknowledged / referred.

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Date: _____

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Abstract

With rising security concerns, we see more and more restricted entries to premises. This requires checking and scanning of vehicles at the entry point. The process is not only cumbersome for the security providers, but also a cause of disruption in the traffic flow to the point that sometimes it chokes the system. In this project, we will develop a system that will keep the flow of the traffic smooth. The initial idea is that the vehicles will be provided with the RFID tag and an RFID reader will be installed some distance prior to the entry gate. A signaling system will direct the authorized users to a fast lane and only those which are not recognized by the system will be directed to the checking lane. Along with RFID, face detection and number plate detection will also verify the legitimate car and person. After the unrecognized vehicles have been cleared by the security the two lanes can again be merged. Once inside the premises, the parking system will guide the user to a vacant parking slot. The major task in this part is to identify the empty parking slots and display them on the mobile application of the user and then direct them to the selected slot with an optimum route. In our project the image processing techniques will be adapted to find status and free slots in the parking area.

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Abbreviations

RFID ……. ……Radio Frequency Identification

RPI ….……..…..... Raspberry Pi

GPIO……..... General Purpose Input/output

CMOS……..…..…….Complementary Metal Oxide Semiconductor

UHF……...……Ultra High Frequency

CCTV…….……Closed Circuit Television

PWM……..…...Pulse Width Modulation

USB …….…….…..…Universal Serial Bus

DHCP……..……Dynamic Host Configuration Protocol

HDMI……...……High Definition Multimedia Interface

Chapter - 1

Introduction

This document includes the detailed description of “RFID based vehicle entry system for gated communities along with image processing-based parking system”. It covers the detailed information about all the phases of the project flow. This chapter will cover the brief introduction of project, its relevance with our courses, tools and methodology used to realize the project.

1.1 Objective

Vehicle Identification is an ongoing application that is becoming essential requirement in nearly all universities, institutes, hospitals, etc. Its substantial benefit is that it reduces the time wasted and the security is increased by letting entrance only to the approved users. In identifying the vehicle, the Radio Frequency Identification (RFID) technology is utilized to gather vehicle info in real time at parking lots by accepting the vehicle ID from RFID readers.

We have proposed to design, and implementation of RFID based Vehicle Entry System for gated communities along with image processing based parking system. This system will monitor all

vehicles that enter and depart to arrange the parking lots with the help of RFID readers installed in parking lots.

In this project, "RFID Based Vehicle Entry System for Gated Communities along with Image Processing Based Parking System" we demonstrated the Radio Frequency Identification based Vehicle Entry System. RFID based entry system is used for authorized vehicle in which RFID tag is mounted on the windscreen of the vehicle. RFID sensor detects that the vehicle is authorized or not. Authorized vehicles will carry on without any traffic interruption.

Once inside the premises, the parking system will guide the driver to a vacant parking slot. In today's high traffic world drivers take lot more time to decide and park the vehicle, thus disrupting flow. Our main objective is to get the information whether the vacant slot is available or not in the parking area. This information along with exact location of the vehicle in parking lot will be available to user on his mobile app.

Check-ins and check-outs without stopping vehicle will be done quickly, thus congested driving conditions issue will be abstained. Hence, we build up a parking management system for an organization to have mechanized stopping framework for making best utilization of room, diminishing the labor and

giving verification to the vehicles from staying away from the burglary.

1.2. Relevance to Course

Introduction to Computer Programming helped us to understand basics of programming language.

Signal and System helped us with MATLAB programming that was helpful in developing the tool for evaluating the video quality.

Report Writing Skills provided us with guidelines to write a formal thesis.

Project Planning and Management educated us how to plan and manage this project that would be very chaotic and unorganized without it.

1.3. Analysis

The existing system provides information about the empty slots availability but does not give information about the location of parking slot available in big area. This is time taking process for the driver to search for the empty slot which is a major drawback for the pre-existing methods. Our system displays the total parking slots available and shows the occupied and unoccupied slots on mobile App so that user can check the slots before entering the parking area and can park his car in that slot. The parking slots are continuously monitored, and the data is

continuously updated. The demo showed the ability of approach to reserve the parking lot, increase the entrance to the parking zone and remove the search hitches for empty parking lots.

1.4. Brief Introduction

The picamera is used in our project to detect vacant slot by mea ns of video image detection. The car must be parked in a particular area, initially the parking area must be recognized and after that parking slot must be recognized and check whether vacant space is available or not. The image processing technique that will undergo the image segmentation and edge detection would be applied in the area of interest.

Raspberry Pi 3 Model B is the processing and controlled unit here. Image of the parking lot is captured with the Pi camera. After that, image processing can be performed on the captured image as open CV with correct program is installed on raspberry pi. As raspberry pi is connected to the internet and also its data is received by mobile app over the server. So vacant slot status is accessible on the user's mobile application. Users can simply check the status of the parking slot available to park their vehicle from anywhere with the help of mobile application that we've made.

The application we are using is a cloud based multi-platform messaging application. The system responds to a

particular message by triggering a set of instructions that may include a reply back to the sender and a program that can also be used to control the raspberry pi's General-Purpose Input Output (GPIO) pins. The program can be used to either make the control signal via GPIO high or low depending upon the requirements. RPi is connected to a camera and a set of instructions can be triggered according to the utilization. In this way, pictures captured from the camera can be sent over to the end user.

Chapter 2

Literature Review

The first communication started with the evolvement of telegram in the year 1830 to 1840. Voice transmission over radio began in 1900 which provided the development grounds for Internet of things (IoT).

In this project, "RFID Based Vehicle Entry System for Gated Communities along with Image Processing based Parking System". We will demonstrate the idea of Radio Frequency Identification based Vehicle Entry System. RFID based entry system is used for authorized vehicle in which RFID tag is mounted on a windscreen of the vehicle. While it is passing through barrier, RFID reader detects that the vehicle is authorized or not. Those vehicles which are authorized will go to fast lane while the unauthorized vehicle will be directed towards checking lane. As a result, authorized vehicles will be free to carry on without any traffic interruption. Once inside the premises, the parking system will guide the driver to park a vehicle in vacant parking slot.
In a heavy traffic world, car parking is one of the drivers ' most challenging tasks.

Generally, in indoor parking, drivers take much longer to decide and to park the vehicle, thereby disrupting the traffic flow. The

main purpose of this system is to get in a parking area detail. On a mobile phone, this information will be available to the user easily. It gives the exact available slot for vehicle in the parking lot which is the main part in this parking system. Check-ins and check-outs without stopping the vehicle, the congested driving conditions will be taken care of quickly within these procedures, the issue will be abstained. Meanwhile there will be no holding up in check-ins and check-outs, the emanation of gas will be avoided due to such holding up. Hence, by this undertaking we build up a parking management system for an organization to have mechanized stopping framework for making best utilization of room, diminishing the labor and giving verification to the vehicles from staying away from the burglary.

2.1 RFID based Vehicle Entry System for gated communities:

RFID is a Radio Frequency Identification technique in which passive, active or battery-assisted passive RFID tags can be used. A tag has an on-board battery and transmits its ID signal on ordered basis. In the presence of RFID reader, a passive battery, assisted (BAP) has a small battery on board and is activated. A passive tag is a less expensive because it does not have a battery; instead the tag uses the radio energy. But, it must be operated with a power level almost a thousand times higher than for

signal transmission to operate a passive tag. This makes a change in interference and radiation exposure.

RFID reader receives bits of data from the RFID tag on the vehicle; the reader can have an integrated antenna or separate the antenna as a requirement. Reader is fixed at the center of the gate and connected to the backend database.

RFID tags[1] include three parts; integrated circuit that stores information and modulates demodulates radio frequency (RF) signals; means to collect DC power from reader signal and an antenna to receive and transmit the signal. Information in RFID tag could be stored in non-volatile memory. This tag includes fixed or programmable data and sensor data processing respectively.

Usually RFID reader transmits a 125 Kilo Hertz of a signal. RFID tag is a passive, power-free component where the tag induces some voltage when it comes close to the reader and therefore the tag transmits to the reader a unique 16 bit tag number having specific information. RFID reader sends this information to the microcontroller. As there is a loop inside the RFID tag and it sends a 12 byte character code to the reader for further processing when it is affected by an attractive field.

When the car stops at the entrance on the [3] where the reader is fixed, the reader will read the RFID tag information. The tag having a data that includes the Unique Number of Identification (UID).

Each UID has its information about the car driver on database. The system's beauty is that the user interface can generate active queries in a real time and processes quickly Thus system's setting is equipped with RFID tags and divided into different areas. The system's middleware is divided into two layers, namely the layer of guidance and monitoring. Handheld RFID reader is provided to the guidance layer to provide periodic locality information to the monitoring layer. Thus the monitoring layer has the complete information of whole environment.

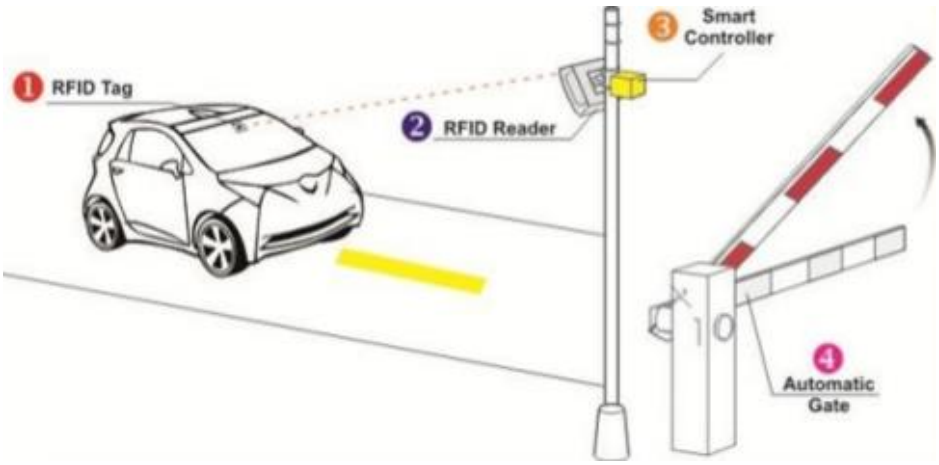

Figure 2.1: RFID based Vehicle Entry System

2.2 Image Processing based Parking System:

In our project, we are using video image detection; the camera can be used to find empty slots. The image can be captured and detected using various processes having boundaries to image segmentation and edge detection. The car must be parked in a specific area, first the parking area must be identified by the system and then the parking slot must be identified and check the whole area whether any slot is empty or not. In that parking system, the image processing technique that undergoes the Image Segmentation and Edge Detection will be implemented to get better results for the user. The processing and control unit is a Raspberry Pi 3 Model B. An image can be captured of the parking lot with the help of the USB web camera. An Open CV [4] is installed on a raspberry pi interface and the image processing technique can be applied to the captured image. The status of vacant parking slot is available to the user on it mobile phone. The user can be easily found the vacant parking slot from anywhere to park his vehicle.

Figure 2.2: Image Processing based Parking system

2.3 Related work

Our project could be executed in numerous ways; different microcontrollers could be used such as Arduino boards and Raspberry pi. Empty spaces could be detected with the help of a Raspberry pi camera to detect the empty parking space and update the information in the main server in real time. Additional technologies can also be used to identify the presence of the vehicle such as infrared sensors, pressure sensors and ultrasonic sensors. This information could be retrieved by the user with the help of mobile application.

In Moscow, Russia SENSIT technology is being used to detect the empty parking space. These sensors consist of magnetic field infra-red eye to detect the availability of parking and to record for how long the parking space was being consumed. [2]

In a research for finding parking space through DSRC communication, a system is suggested in which user can reserve parking space with the help of mobile. [2]

A cloud based parking system is proposed in a research in which the reservation can be made through a mobile application, each car required RFID tag to identify the presence of vehicle in the parking lot. [5]

Another research proposes the utilization of already installed closed circuit television (CCTV) and computer vision detection. For the precision of system more cameras are required but the precision reduces when the light is hazy. [6]

2.4 Pros and cons of some technologies involved in detection:

Parking System	Pros	Cons
Image Processing	Does not require extra sensors for detection	Lots of cameras are required for detection to cover the entire parking lots. An accuracy is reduced when the light is poor
Pi camera	Low cost	Low pixel quality
Mobile Application	Users can easily find empty slots	Data would be required for accessing

Table 2.1: Pros and cons of Parking System

Collecting information with the camera images involves digital image processing (DIP). This technique does not require additional sensors which are less accurate, but it is an expensive

way to implement Parking System technology as compared to using of sensors but a lot of sensors is required to cover the whole parking lot [7].

As Pi camera can capture the images of whole parking lot but during capturing of image a good quality of light could be required in parking area because for image processing technique a fair quality of light is needed.

Chapter 3

Project Architecture

This chapter provides information on the block diagrams and flo wcharts of the project architecture.

3.1 Block Diagram “RFID based Vehicle Entry System

In RFID based vehicle entry system, RFID card is mounted on wind screen of a vehicle and RFID reader is installed at the entry gate which receives bits of a data from RFID card. RFID reader will send this information to the microcontroller and then a microcontroller will check this information and compares it with authenticated data and then it will send command to the motor driver. Now if the vehicle is authorized, the barrier will open, and if vehicle is unauthorized system will show a message to “consult

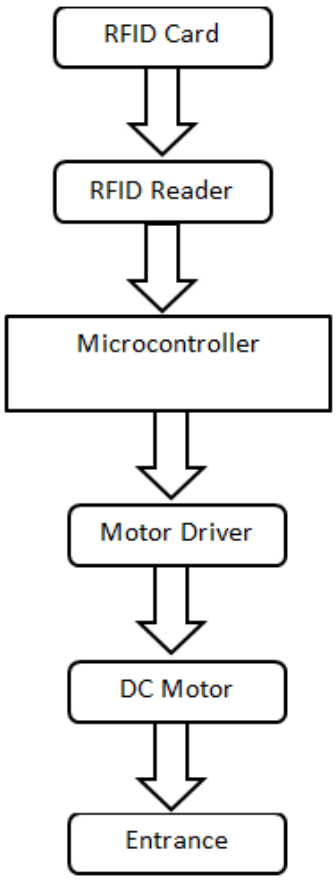

Figure 3.1: Block diagram "RFID based Vehicle Entry System"

3.2 Block diagram: Image Processing based Parking System

In image processing-based parking system, in parking area there are number of parking slots and a camera is fixed on the top of the parking area which will capture an image continuously. A Camera is connected to a raspberry pi, which will send this information to the user. At the end, the information regarding vacant parking slot will be available to user on its mobile phone

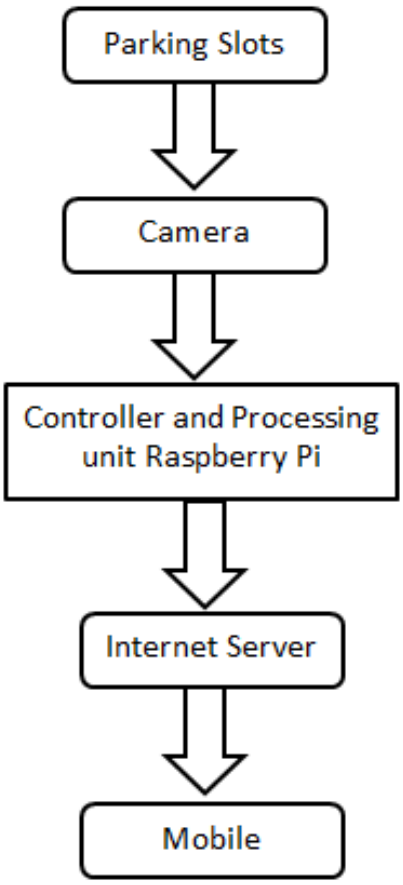

Figure 3.2: Block diagram "Image Processing based Parking System"

3.3 Flow Chart “RFID based Vehicle Entry System”

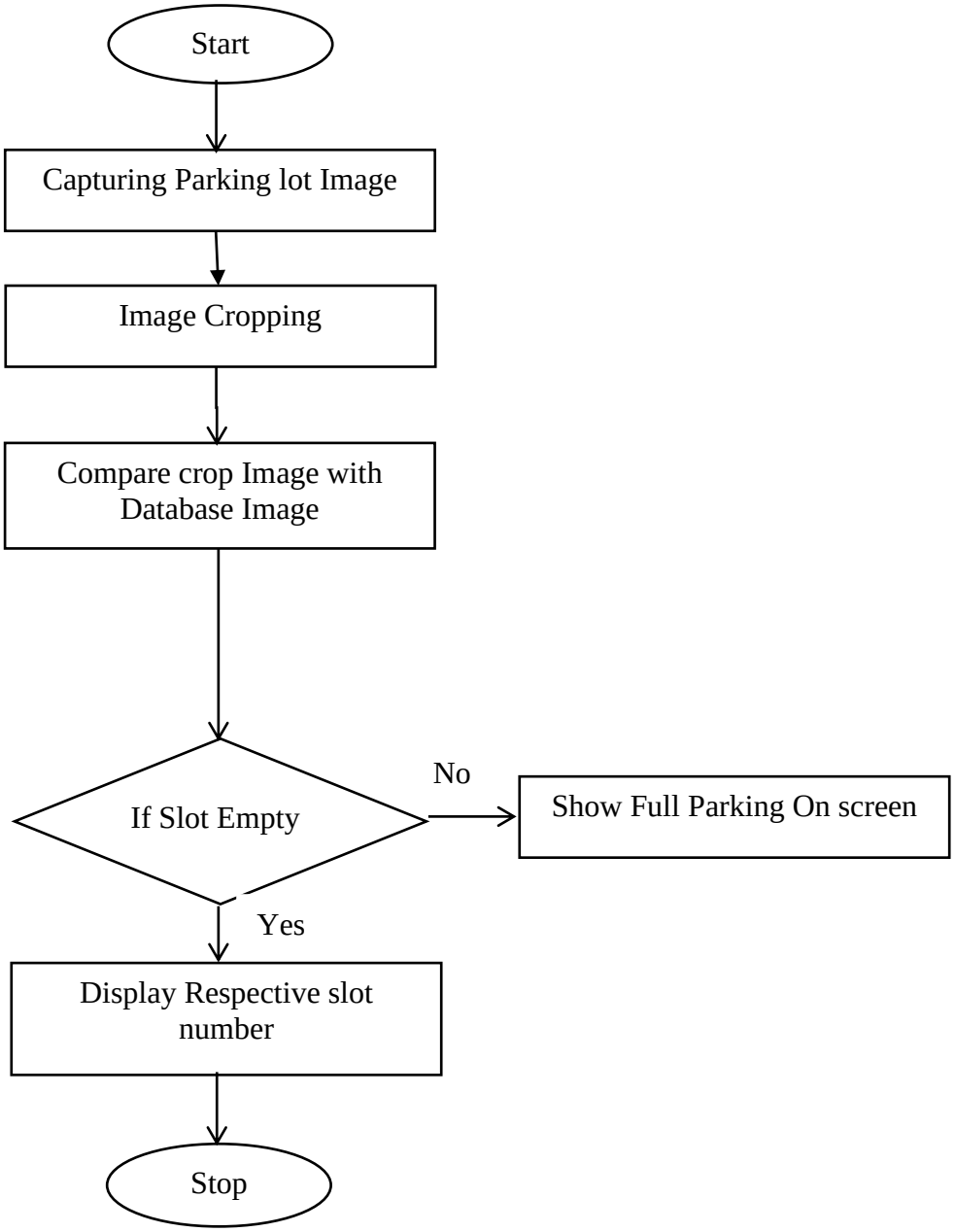

Figure 3.3: Flow Chart “RFID based Vehicle Entry System”

3.4 Flow Chart “Image processing-based parking system”

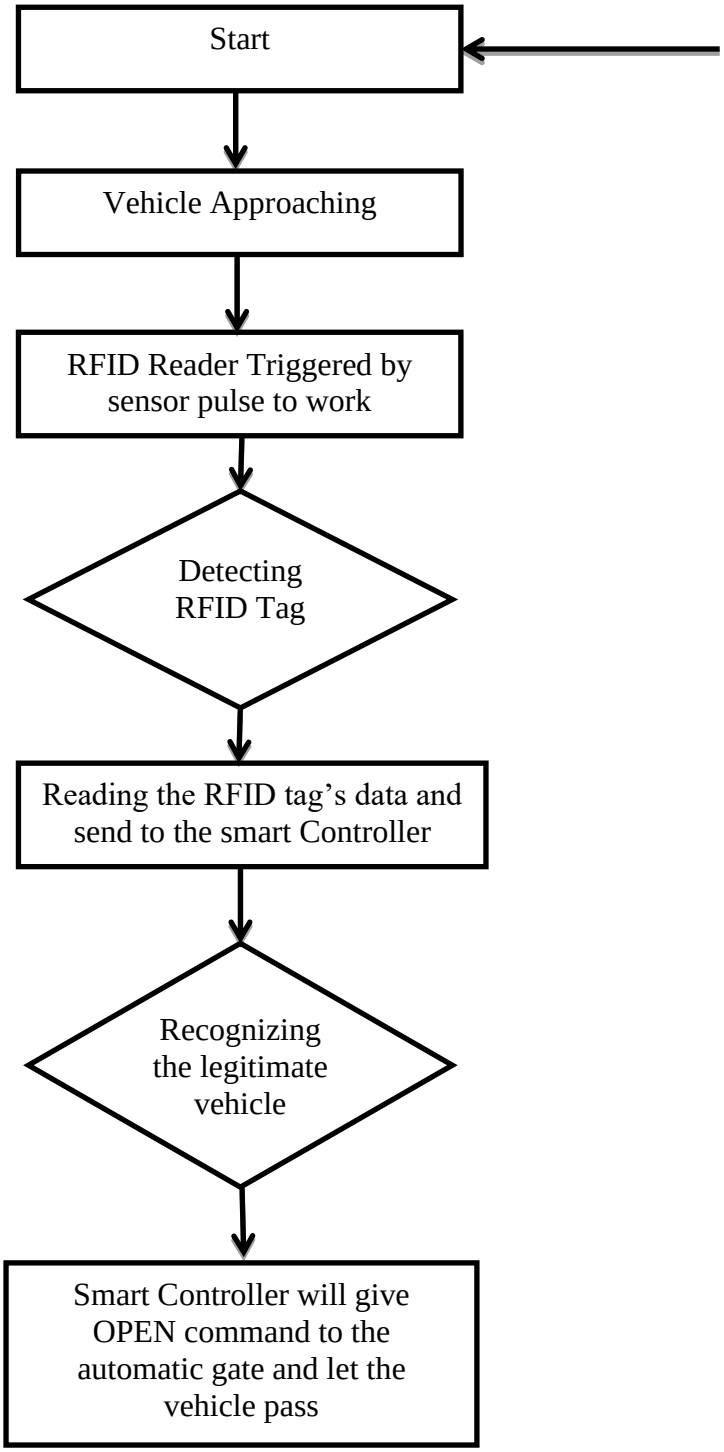

Figure 3.4: Flow Chart "Image processing based parking system"

3.5 Open CV (Computer Vision):

OpenCV-Python is a Python library designed to solve problems with computer vision. Python is a general-purpose programming language, mainly used because of its simplicity and code readability. Programmer can express ideas in less code lines without reducing readability. As its difficult searching for a parking spot by driving around and around the parking lot. It turns out that this is a relatively easy problem to solve using deep learning and OpenCV.

Overview

Parking detection model consists of following two steps:

1. Identifying the location of all vacant parking spots.
2. Identifying if a parking spot is vacant or unavailable.

As our web camera is mounted on top, one-time mapping of each parking lot is done by OpenCV. Once the location of each parking slot is known, then using deep learning prediction can be made whether the slot is vacant or occupied.

Each spot is assigned ID' this ID and its coordinates are saved in database. This database is preserved so it can be regained in future. Since our camera is mounted' we don't need to compute the location of each slot again and again.

3.6 MIT App Inventor:

App Inventor is an Android based open-source application that provides by Google and run by the Technology Institute of Massachusetts (MIT). It allows new inventors to create android based applications without any programming to create application that is not an easy task. So MIT is an easy to create Android operating system (OS) software applications.

It uses a very similar graphical interface to Scratch and the Star Logo TNG interface that enables the users to drag and drop the visual objects to create android based applications. When creating App Inventor, Google used considerable prior research in educational computing as well as work has to be done on online development environments.[1]

Figure 3.5: MIT App Inventor

In our Project, we develop an android based mobile application that is used by the user to find the empty parking slots in a highly crowded area. It is a user friendly application that is easily accessed by any lay-man people.

We connect this MIT android based application with the help of Hostname-IP address to the server Apache 2 to get real time status of Parking lot from Raspberry Pi. This application gave the information about parking slots is occupied or empty to the user easily.

3.7 Apache 2 Server:

Apache is the most frequently used Linux system on web server. Web servers are used by client computers to serve Web pages. Using Web browser applications like Firefox, Opera, and Chromium, or Internet Explorer, clients typically request and view Web pages.

Users are entering a Uniform Resource Locator (URL) to a point in a Web server by using their Fully Qualified Domain Name (FQDN) and the path to resource required.

The most common protocol used to transfer Web pages is the Hyper Text Transfer Protocol (HTTP). Protocols such as Hyper Text Transfer Protocol over Secure Sockets Layer (HTTPS), and File Transfer Protocol (FTP), a protocol for uploading and downloading files, are also supported.

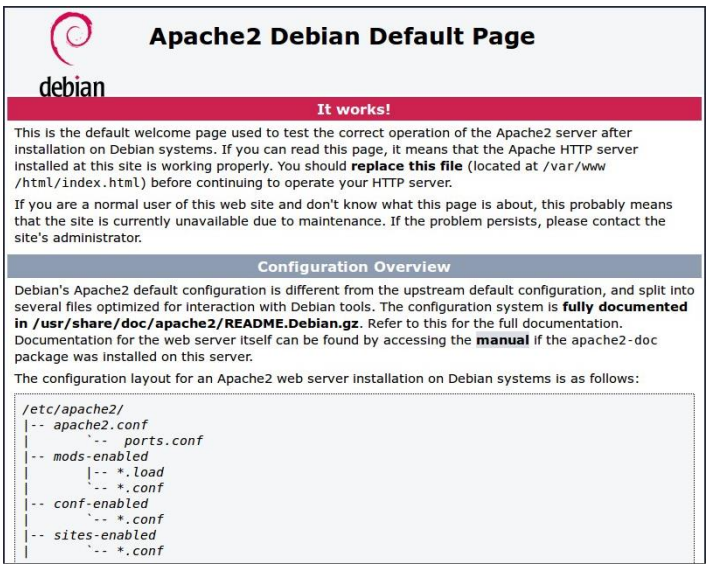

Figure 3.6: Apache 2 Server

Apache Web Servers are used in a conjunction with the MySQL database, the scripting language of the Hyper Text Preprocessor (PHP), and other common scripting languages like Python and Perl. This configuration is also called LAMP (Linux, Apache, MySQL and Perl / Python / PHP) and it is a valuable and robust platform for web-based application development.

3.8 Results

3.8.1 RFID/Face/Number plate Detection based vehicle entry system

If the user is authorized, then the serial monitor shows the display.

Figure 3.7: Result of Authorized Vehicle

3.8.2 Drawing Frames on parking slots

Drawing dynamic frames by selecting the coordinates on parking slots for vehicle detection.

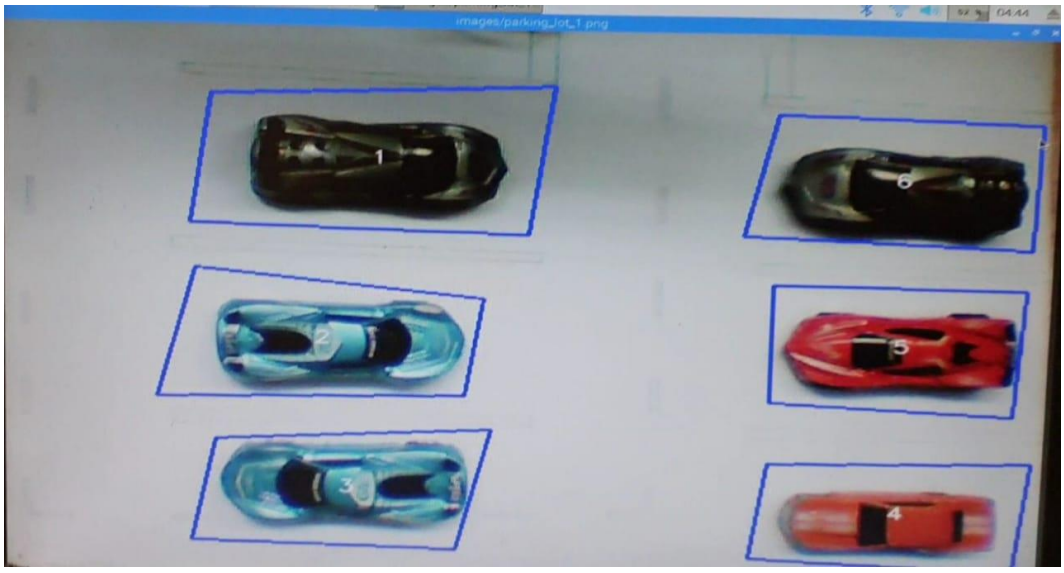

Figure 3.9: Parking slot frames

3.8.3 Parking slot detection

Now system checks continuously that which is occupied or which slot is empty for user.

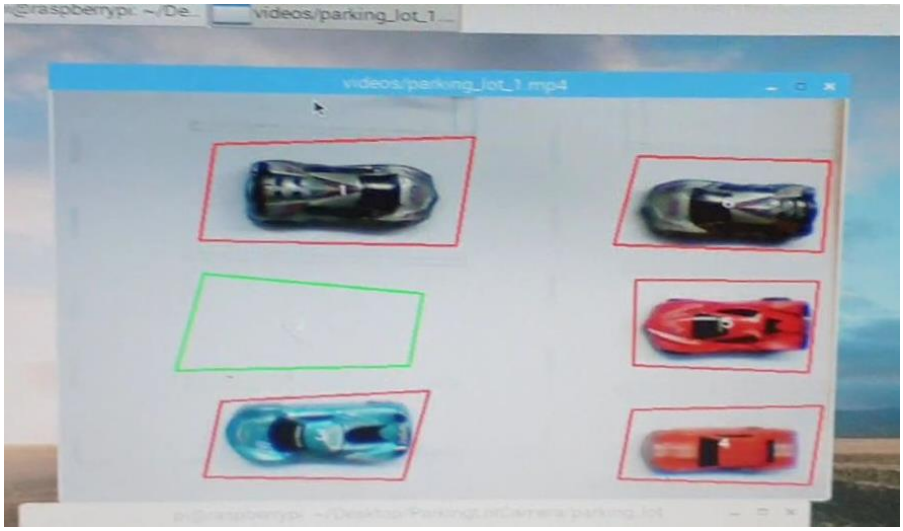

Figure 3.10: Parking slot detection

3.8.4 Mobile Application

Now the user will check the status of parking lot on his mobile application through a web server. It is android based mobile application that's easily connected with internet by giving the Hostname IP address of the web server.

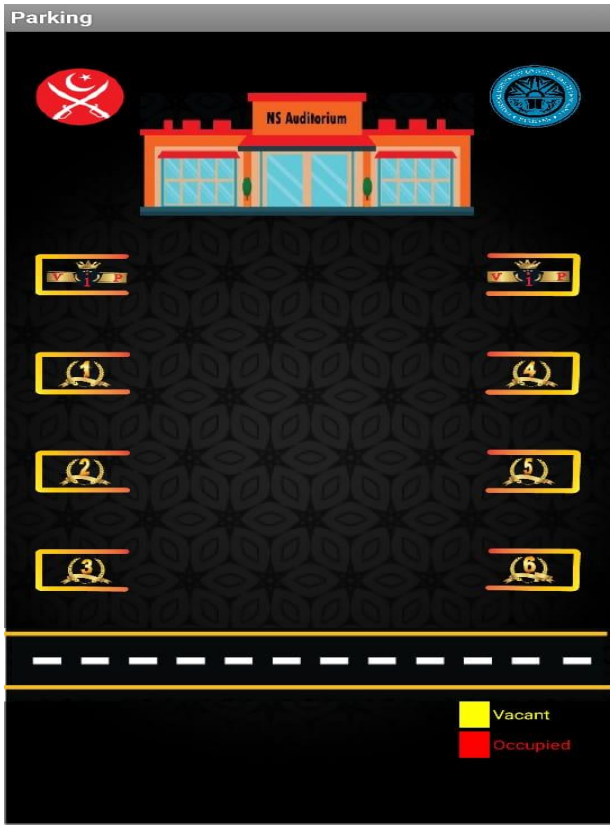

Figure 3.11: MIT based Mobile Application via web server

3.9 Number Plate & Face Detection

To add an increased security feature in our project we have introduced the number plate and face detection system. This addition is added security feature on one hand and will further enhance the outlook of the project on the other.

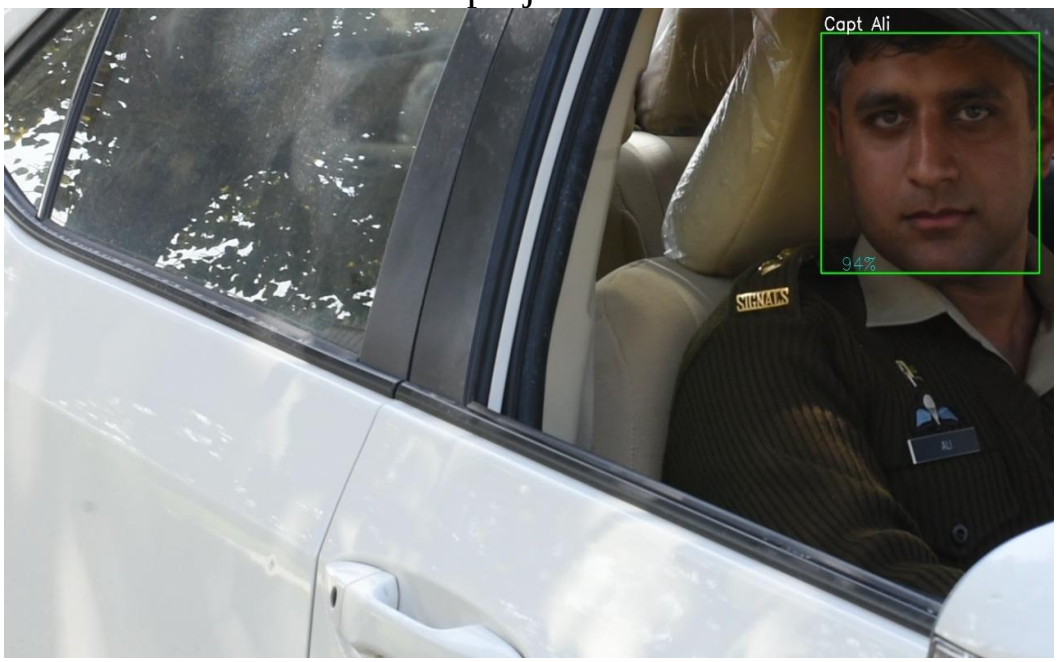

Figure 3.12: Face detection

Python Code to recognize face from Image:

```
import cv2
import numpy as np
import os
from openalpr import Alpr
import sys
import json
# Call when completely done to release memory
recognizer = cv2.face.LBPHFaceRecognizer_create()
recognizer.read('trainer/trainer.yml')     #load trained model
cascadePath = "haarcascade_frontalface_default.xml"
faceCascade = cv2.CascadeClassifier(cascadePath);
font = cv2.FONT_HERSHEY_SIMPLEX
#iniciate id counter, the number of persons you want to include
id = 2 #two persons (e.g. Jacob, Jack)
names = ['','Adnan','Capt Ali']  #key in names, start from the second place, leave first empty
# Initialize and start realtime video capture
cam = cv2.VideoCapture('DSC_0189.MOV')
#cam.set(3, 1600) # set video width
#cam.set(4, 900) # set video height
# Define min window size to be recognized as a face
minW = 0.1*cam.get(3)
minH = 0.1*cam.get(4)
FRAME_SKIP = 10
_frame_number = 0
cv2.namedWindow('camera', cv2.WINDOW_NORMAL)
cv2.resizeWindow('camera', int(1920*0.7), int(1080*0.7))
#alpr.set_top_n(3)
while True:
        _frame_number += 1
        ret, img =cam.read()

        #if _frame_number%3==0:
```

```
        gray = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
        faces = faceCascade.detectMultiScale(
            gray,
            scaleFactor = 1.2,
           minNeighbors = 5,
           minSize = (int(minW), int(minH)),
        )
        for(x,y,w,h) in faces:
            cv2.rectangle(img, (x,y), (x+w,y+h), (0,255,0), 2)
            id, confidence = recognizer.predict(gray[y:y+h,x:x+w])
            # Check if confidence is less them 100 ==> "0" is perfect match
            if (confidence < 100):
                id = names[id]
                 confidence = "  {0}%".format(round(110 - confidence))
            else:
                id = "unknown"
                 confidence = "  {0}%".format(round(110 - confidence))
            cv2.putText(img, str(id), (x+5,y-5), font, 1, (255,255,255), 2)
            cv2.putText(img, str(confidence), (x+5,y+h-5), font, 1, (255,255,0), 1)

        cv2.imshow('camera',img)
        cv2.imwrite('hello.jpg',img)
        k = cv2.waitKey(10) & 0xff # Press 'ESC' for exiting video
        if k == 27:
            break
# Do a bit of cleanup
print("\n [INFO] Exiting Program and cleanup stuff")
cam.release()
cv2.destroyAllWindows()
```

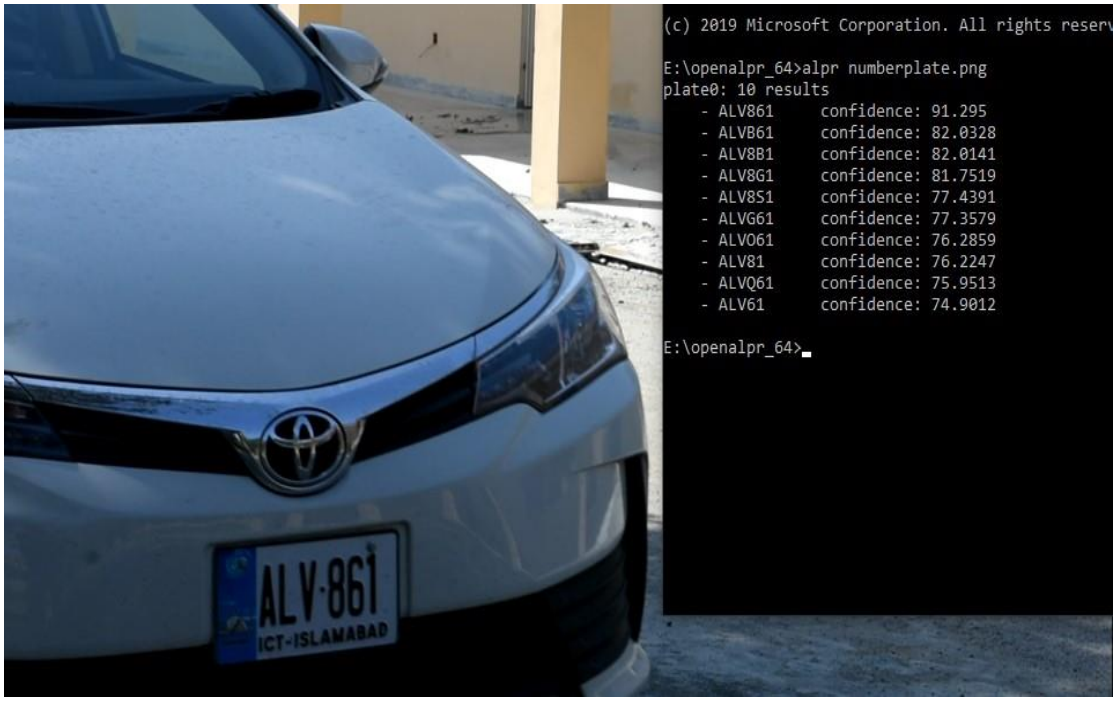

Figure 3.13: Number Plate detection

Python Code to recognize license plates from one Picture:

```
from openalpr import Alpr
import sys
alpr = Alpr("us", "/path/to/openalpr.conf", "/path/to/runtime_data")
if not alpr.is_loaded():
    print("Error loading OpenALPR")
    sys.exit(1)
alpr.set_top_n(20)
alpr.set_default_region("md")
results = alpr.recognize_file("/path/to/image.jpg")
i = 0
for plate in results['results']:
    i += 1
    print("Plate #%d" % i)
    print("   %12s %12s" % ("Plate", "Confidence"))
    for candidate in plate['candidates']:
        prefix = "-"
        if candidate['matches_template']:
            prefix = "*"
```

```
        print("    %s %12s%12f" % (prefix, candidate['plate'],
candidate['confidence’]))
# Call when completely done to release memory
alpr.unload()
```

Chapter 4

Hardware Components

This chapter provides the overview of all the hardware used and its uses for other projects.

4.1 RFID Tag

Tags are called RFID tags in which identification data can be embedded. it consists of an electronic circuit and combined antenna fit into one. RFID tag's electronic circuit has a memory in which data can be saved. Data that can only be read may be stored on these cells, like serial number written at stage of manufacturing while former cells can be written to and read repetitively. Tags may be active or passive reliant on the source of on-board power.

Figure 4.1: RFID Tags

4.1.1 Active and Passive RFID Tags

Two main types of RFID tags include active and passive tags. Active tags comprise an on-board battery as a power source, while a passive RFID tag has no power source, they work with electromagnetic power transferred from an RFID reader.

4.1.2 Range of Active and Passive tags.

For the communication of info, active RFID tags mostly utilize two frequencies. Transmitting information can be 433 MHz or 915 MHz. For transmission, passive tags use three frequencies: 125-134 KHz well-known as low frequency (LF), 13.56 MHz, identified as high frequency (HF) and Near Field communication (NFC) and 865-960 MHz identified as Ultra high frequency (UHF).

Whether tag is active or passive it depends on the read range of RFID. As signals are broadcasted by active tags so they have longer read range of about 300 feet or more than passive tags. It depends on the factors like operational frequency, reader power, other RFID devices interference and many other. Low and high frequency tags are normally red inside three feet and UHF tags are red between 10 to 20 feet.

4.1.3 Information storage on RFID tag

RFID tag transfers nearly 2 KB of data that is sufficient to save basic information regarding object. “license plate” tags only contain a serial number of 96 or 128 bit. Simple RFID tags are economical to produce and also useful where product packaging

will dispose of the tag. Aerospace industry has to store equipment parts history on tags that are usually 4 or 8 KB' also known as passive UHF tags.

4.1.4 Tag collision

When one or more transponder mirror back a signal at equivalent time than tag collision arises. To respond the reader one at a time different air interface protocol standards are utilized. It is done by using different algorithms to isolate the tags. As each tag is read in milliseconds all tags are appear to be read at a same time.

4.1.5 Disadvantages of RFID Tags

RFID tag cannot differentiate amongst readers; after leaving the original supply chain, almost anyone can read the information. As RFID tags are so moveable and the range of tags so good, scammers can collect the information. Thus sensitive information without the knowledge of a person can be collected. One more security concern is that it's possible to link RFID tags with credit cards.

4.2 RFID Reader

RFID reader can accomplish following tasks:

- It interconnects with tags.
- It accepts commands form application software.

RFID reader maybe handheld or mounted on specific object. The workstation, reader and antenna are all part of same device in case of handheld readers. Depending on application, data exchanged with tags can be kept and moved to the main processing unit, and the RFID reader is the channel between the app software and the antenna that radiates radio waves to the tags.

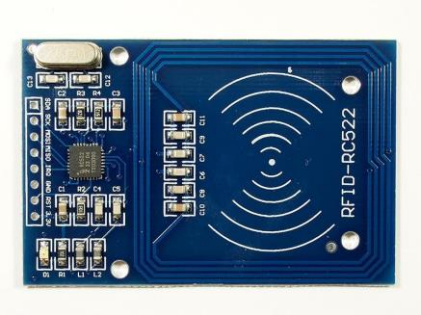

Figure 4.2: RC-522 RFID Reader

4.3 Introduction to Arduino UNO

Arduino UNO is a pocket sized microcontroller, which is an open-source platform that is based on AVR Microcontroller Atmega328. The latest Arduino UNO have a USB interface, 6 Analog input pins, 14 I/O Digital ports that are used to connect the circuits. Out of 14 I/O ports, 6 pins can be used for PWM output (3, 5, 6, 9 10 and 11).

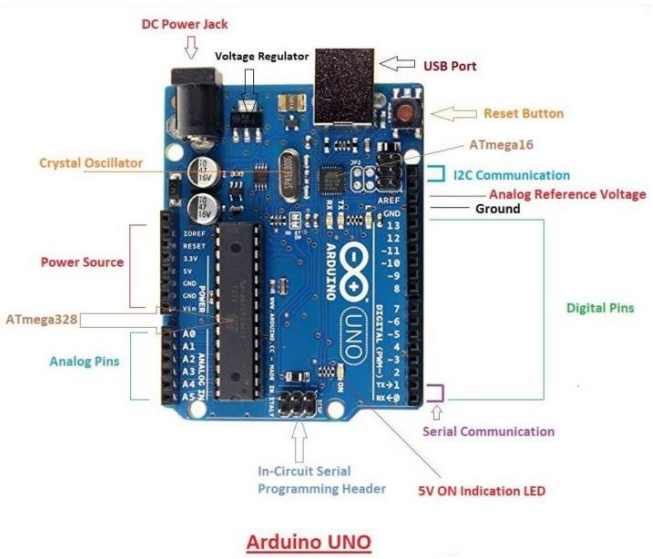

Figure 4.3: Arduino UNO

Modern Arduino UNO has all the necessary features to run the system and it is connected with the computer via USB cable that are used to transfer the program to the controller using IDE software, that are used for Arduino programming.

4.3.1 Features of Arduino Uno Board

Arduino UNO comes with a USB interface. For serial communication with the computer, the USB port is added to the board.

Atmega328 microcontroller is placed on the board which comes with such timers, counters, interrupts, PWM, CPU, I / O pins and a 16MHz clock which helps to produce more frequency.

4.3.2 Pin Configuration:

Pin Category	**Pin Name**	**Details**
Power	Vin, 3,3V 5v, GND	Vin: Input voltage. 5V: Regulated power supply. 3.3V: 3.3V supply generated by on-board voltage regulator. Current: 50mA. GND: ground pins.
Reset	Reset	Reset the controller.
Analog pins	A0-A5	It can be used in the range of 0-5V
Input/output pins	Digital Pins 0-13	It can be used as I/O pins.
Serial	0(Rx), 1(Tx)	Used to Rx and Tx TTL serial data.
External Interrupts	2, 3	Used for trigger an interrupt.
PWM	3, 5, 6, 9, 11	It provides 8-bit PWM output.

SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	It can be used for SPI communication.
Inbulit LED	13	Used to turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	It can be used for TWI communication.
AREF	AREF	Used to provide reference voltage for input voltage.

Table 4.1: Pin Configuration Arduino UNO

4.3.3 Function of Arduino UNO in our Project

In our Project Arduino UNO is used to get information from RFID reader at Entry gate. Reader takes bits of data from RFID tag and then it sends to the Arduino UNO. Then the received UID number of RFID tag with the database and then it verifies where the vehicle is Authorized or not. If vehicle is authorized the Arduino UNO sends a command to the Servo motor to open the barrier and serial monitor shows the verified information of the vehicle, and if the vehicle is unauthorized it sends the command to the buzzer and stops the vehicles entry.

4.4 Introduction to Raspberry pi

Raspberry Pi is mini single board computer having a Linux operating system that provides all the qualities of a normal desktop computer.

We used Raspberry Pi 3B in this project. It consists of 512 Megabyte of RAM and has ARMv6 architecture core supporting at 700MHz.

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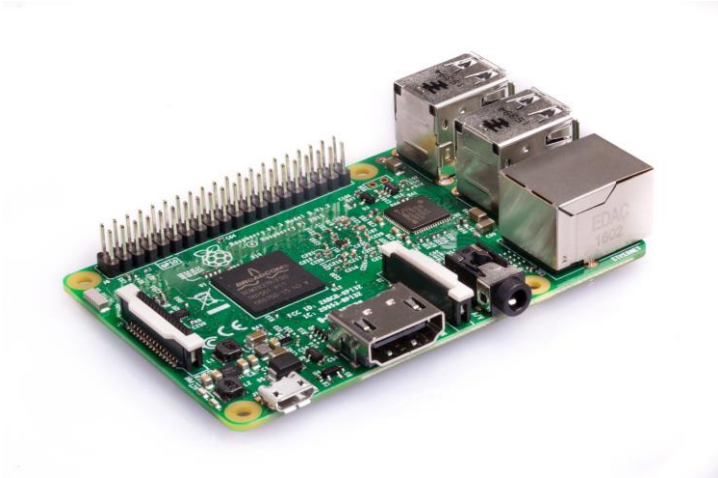

Figure 4.4: Raspberry-pi 3 B

As a common of present day PCs, nonexclusive USB consoles and mice are perfect with the Raspberry Pi. The RPI use a Linux-bit bases working frameworks. The RPI does not accompany a continuous clock, so an operating system must utilize a system time server, or approach the client for the time data at the boot time to become acquainted with information to time-date stamping.

4.4.1 LED lights on Raspberry Pi

Raspberry Pi consists of five LEDs.

LEDs	Sign
ACT	SD card contact
PWR	3.3V
FDX	Full Duplex LAN
LNK	Link LAN
100	100M bit LAN

Table-4.2: Raspberry Pi status LEDs

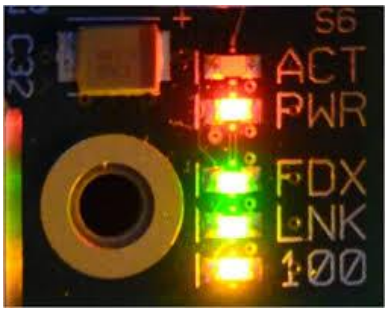

Figure 4.5 Raspberry pi LED signs

If RED LED does not light than that means power is not properly connected and you will not be able to see any display.

4.4.2 Pin Configuration (GPIOs)

Raspberry Pi 3B consists of twenty-six pins.

Pins	Purpose	Pins	Purpose
Pin1	3.3V	Pin 2	5V
Pin 3	GPIO 0	Pin4	5V
Pin 5	GPIO 1 (12C)	Pin6	Ground
Pin7	GPIO 4 (clock)	Pin8	GPIO 14(UART)

Pin 9	Ground	Pin10	GPIO 15(UART)
Pin 11	GPIO 17	Pin12	GPIO 18
Pin13	GPIO 21	Pin14	Ground
Pin15	GPIO 22	Pin16	GPIO 23
Pin17	3.3V	Pin18	GPIO 24
Pin19	GPIO 10(SP10)	Pin 20	Ground
Pin21	GPIO(SP10)	Pin 22	GPIO 25
Pin23	GPIO11(SP10)	Pin 24	GPIO 8(SP10)
Pin25	Ground	Pin 26	GPIO 7 (SP10)

Table-4.3: Raspberry Pi pin configuration

4.4.3: Storage (SD Card)

Raspberry Pi uses SD card for packing the operating system and software because it does not contain hard disk. 8 Gigabyte SD Card is used so as to evade the threat of running out of storage. Minimum of 8 Gigabyte of SD card is required.

4.4.4: Micro USB power:

We have used normal power cable to supply power to Raspberry Pi. Micro USB provides 5 volts and 2000mA. Good class of USB power source cable is recommended for optimal use.

Figure 4.6: USB power source cable

4.4.5 USB Ports:

Raspberry Pi 3B consists of four USB ports. If additional ports are required USB hub can be used.

4.4.6 Ethernet port

Raspberry Pi offers Ethernet RJ45 port. This port is used for connecting to router/host with the help of Local Area Network cable. We have used this Ethernet port to connect raspberry pi 3b and laptop using cross over cable.

Figure 4.7: Ethernet cable

4.4.7 HDMI Port

To show display of Raspberry Pi on monitor or TV High Definition Multimedia Interface port can be used. Initially this method was used but we shifted to network bridge technique to show the display of Raspberry Pi on laptop for portability.

4.5 Getting started with Raspberry Pi 3B

Key points to keep in mind before getting started with the raspberry Pi.

- SD Card of good quality should be used.
- High quality USB Cable should be used for power supply.
- Before powering off the RPI try to shut down the RPI in the right way.

4.5.1 Operating System

RASPBIAN is the recommended OS for Raspberry Pi having Linux distribution. Therefore, NOOBS and RASPBIAN were transferred in SD card to get started.

Figure 4.8: Raspberry Pi NOOBS interface

4.5.2 Obtaining the display

To get the display of RPI following steps are necessary.

- SD Card is injected in Pi board.
- To supply power USB cable is connected with RPI.
- One end of Ethernet cable is joined with Ethernet port on RPI and other end on laptop.
- Execute the DHCP server.
- Start MobaXterm.
- List the IP Address in MobaXterm provided by the DHCP server.
- Raspi_Configuration window will pop up on starting.
- Login and a password would be mandatory.
- Login is Pi and password is Raspberry.
- After all these steps we are ready to go.

4.5.3 Pros of RPI

RPI was used because:

- It is a pocket-size module and portable to use.
- It draws less power.
- Quality video streaming is supported by RPI.
- It is easy to use and affordable.

- Linux distribution is supported.
- Small board has numerous features.

4.5.4 Summary

All of the raspberry Pi's features and components have been briefly described.
It was also discussed how to get started with the RPI. All the sof tware required have also been stated.

4.6 Web camera

4.6.1 Overview of Web camera

The fundamental purpose of using a camera in our project is to o ffer a clear view of parking lots and difficult to see spots to the user. Clear vision improves the parking lot proficiency. For the following reasons, we used the Raspberry Pi camera module.

- Pi camera is 5Mega Pixels CMOS camera.
- It is competent of capturing still pictures and HD videos because of its center settled lens.
- Images have 2592 x 1944 resolution pixels.
- Videos are supported at 1080p at 30 FPS, 720p at 60 FPS and 640x480 at 60 or 90 FPS.
- PYTHON has pi camera library that supports and facilitate camera module.

Figure 4.9: web camera

4.5.2 Specs of Web camera:

Size	25x20x9mm
Resolution of images	5 MP
Video resolution	1080p at 30 FPS
Pixel size	1.5umx1.4um
Focal length	3.60mm

Table 4.4: Specs of web camera

It supports several other features such as brightness, mirror and flip images etc.

4.5.3 Pros of using Web camera

- Pi camera has dedicated RPI-designed port that delivers better performance than any other webcam.
- It offers higher resolution.
- Also Supports several other features.

4.6 Servo Motor

Servo motor is a motor type appropriate for usage in a control system with closed loop. It follows a PWM (Pulse width regulation) principle. A servo motor is an electrical device which can push or rotate an object with great precision. If we want to rotate an object at some specific angle or a distance,

then we use servo motor. It is just made up of simple motor which run through gears having a servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages.

Figure 4.10: SG-90 Servo Motor

4.6.1 Working Principle

A servo motor consists of a potentiometer, a gear assembly and a controlling circuit. We use gear assembly to reduce RPM (revolution per minute) and to increase the output torque of a motor. At initial position of servo motor shaft, the position of the potentiometer knob is such that there is no signal generated at the output of the potentiometer. So an electrical signal is given to another input of error detector amplifier. Now the difference between two signals, one comes from potentiometer and another comes from the source, will be processed in

feedback process then output of that system will be provided in terms of an error signal. This error signal acts as an input signal for motor and it starts rotating. Then motor shaft is connected with a potentiometer. As a motor rotates, it will generate a signal. So as potentiometer's angular position changes, its output feedback changes. After sometime the position of potentiometer reaches at a position that the output of potentiometer is same as external signal provided. At this condition, there will be no output signal from the amplifier to the motor input as there is no difference between external applied signal and the signal generated at potentiometer, and in this situation motor stops rotating.

Chapter 5

Conclusion, Future Work and Scope

A detailed procedure is explained in this report by introducing the technological advancement so that current parking situation can be improved. This project is completed to with the minimum amount of resources in the limited time frame to achieve maximum output of it.

However, human nature is to go towards advancements so there is always a room for improvement. This project could be further improved and could be made even better.

5.1 Improvements

In our project, we tried to give our best to design something which could help the society but there could be some improvements that can be further made. Few of them are listed below.

5.1.1 Software Improvements

Since the application is developed on android platform so currently the IoT users with android smartphone can gain benefits from this system. To make it beneficial for all the smartphone users an application should be developed at user end

that could run on all operating system widely used such as iOS, windows and blackberry.

5.1.2 Hardware improvements

Currently, the obstacle is at the main entrance of the parking lot and only the valid users are permitted to enter the parking lot.

- In this project, Raspberry pi 3B is used for better efficiency compared to previous model.
- Pi camera is used because it is easy to interface with Raspberry Pi and better picture quality.

5.2 Security

Nothing could be considered as much secured in the time we are living as internet can be accessed publicly. Hackers can obtain public copy of an application in the consumer apps and reverse engineering can be applied on it. So, we should ensure that our mobile application is secure and protected from the hackers so that any undesirable activity can be avoided.

To avoid the threat of attackers a proper framework should be followed at the stages of creating, deploying and executing a secure android application by following ways.

- Protection of code: A secure application should be built.
- Projection of device: Detect harmful and unprotected run time environment.
- Protection of data: Limiting leakage and data theft.

5.3 Scope:

In this project “RFID based vehicle entry system along with image processing based parking system” using IoT technology is developed and executed. This system eases the user to reserve the parking spot in advance to save the time in finding the best place to park the vehicle. This also saves the fuel, wasted in searching around the crowded area where success rate is minimum to find the best spot. Eventually traffic congestion takes place which results in road blockage and this contributes to road rage. The situation becomes inferior on special events when the shopping areas become fully crowded and people have difficulty to find a place so they double park the vehicles which causes disruption for others.

With our developed mobile application, user can easily inspect the empty parking lots on mobile application through server. However, they must prove their identity at the entrance of the parking lot. Only those users are allowed to enter the parking lot that has a registered vehicle in the database.

The data about the parking lots are intermittently updated in the database and only those slots are available for the users which are empty. Therefore, our designed system will not only save the time for the drivers but also ensure a smooth traffic flow.

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