

# Automatic Gate Control System using Image Processing of Vehicle Number Plate

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## Abstract

Modernization is forcing people to adapt latest technologies not only in their daily routine but also in social life. Some automatic things makes people's life painless & free of complications. One of the most automatic thing which is now in trend is automatic gate control system using image processing this device which is very impressive & influencing for the visitors. Sliding/ swing doors can be opened automatically which serves for invitation as well as for protection of the visitors. There is no need to put efforts to open & close gates manually. These openers are highly recommended for authorized car entry and exits. Automatic Gate openers are convenient for heavy gate of factories & other organizations like colleges, industries, etc. Automatic Gate Control System using image processing is a simple but very useful project, which help is automatically opening and closing the entry gate upon detecting arrival or departure of the car. To avoid the human intervention at gate. This project will not only make the system more reliable & precise, but also save the authorities from hiring man power to do the job. You may take it as a onetime investment. The Automatic Gate Control System Project makes use of an pi B model to control the whole circuit. The Servo motors are used to open and close the entry gates. Four IR sensors are used for sensing the arrival or departure of car. The main objective is to provide security. It allow only authorized entry and restricted for unauthorized entry. Lastly, no human resource is required. This makes its running cost very low compared to manned gates.

**Keywords: Automatic Number Plate Recognition(ANPR), Raspberry-Pi processor**

## I. INTRODUCTION

Number Plate Extraction of a system is the method in which the system automatically captures the image of the number plate of a vehicle and these details were verified using RaspberryPi -processor for authentication. The system also alerts the authorities when any unauthorized image of number plate was detected using buzzer alarm system. Pi processor is considered as one of the advanced System On Chip(SOC)processor. The Edge detection algorithm is considered in the proposed system where the range of the captured image can be calculated [1],[4]. The number plate details are fed inside the processor and the details are compared with the captured image the capturing techniques [2],[3]. The normal image is converted into gray scale image. To perform this task, Pi processor is programmed using embedded system. The proposed method is a high-performance and parameterized Security System on a single Pi Board, which has more flexibility, power, efficiency and stability. There security is very important for them, this system is going help to recognize number of unknown vehicle on gate. The same system can be used in the areas where security is the most important. The recognition of vehicle number plate is working in four steps. The first one is image acquisition, second is license plate extraction, third one is license plate segmentation, and last one is character recognition. OCR is the process which converts image into text [15].

## II. LITERATURE SURVEY

Using morphological processing results analyzed in plate localization efficiency. In this the algorithm poorly performed under brightly illuminated environments but use of edge detection algorithm improves efficiency. After this the neural network using feed-forward back propagation algorithm is used to enhance the system. This system is tested in dynamic environment wherein it automatically detected the movement of the vehicle above the sensor, plate localization and character recognition was performed successfully in a time span of 1.3 seconds. This system works for skewed angle up to 10 degrees[7].The system is able to display car license plate as output on MATLAB GUI, and it can recognize license plate and compare it with the information in the

database. The system can also make decision to open the gate barrier. The performance of the developed of algorithms for License Plate Localization and License Plate Recognition is acceptable range. Also this will be able to use in all the places, and able to works automatically without need human beings and also the system will be able to recognizes license plates. But this system is limited because Number plate is differed in term of color, size and type from country to country. Different algorithm has to be applied for different type of number plates[8]. The overall objective of the paper is to develop a system that recognizes vehicle number plate from a car at a gate entrance of a parking area. The software could lead to a less expensive and faster way of enhancing and determining the performance of the recognition system. The system will generate report on the vehicle number plate it has captured. Once the vehicle number plate is captured, the characters will be recognized and displayed on the screen. Proposed Automatic Car Number Plate Recognition System mainly focusing on red light jump. If a vehicle jumps a red light the sensors are placed on which detect the presence of vehicle. As the vehicle passes the sensor, the camera will automatically capture the image using MATLAB image processing[9]. The proposed program did not correctly recognize an image with dark shadow spots. This belongs to binarisation stage which has depended on global threshold rather than local threshold, where local threshold is more effective in heterogeneous illumination. Likewise, the experiment has shown the system inability to recognize the LP image if the horizontal axis is tilted more than 20°. The accuracy rate could be decreased in case of using different camera to take the samples of numbers than the installed camera on the roads. Using template-matching method gives accurate and quick outcomes. The proposal system proved its efficiency on the main entries of the Iraqi cities in spite of huge numbers of cars. The MATLAB Computer Vision toolbox was used to exploit the GPU ability, which increased the processing performance significantly[10]. The paper aims at designing a system which captures the image of the number plate automatically of a vehicle and these details were verified using Raspberry-pi processor for authentication. The system also alerts the authorities when any unauthorized image of number plate is detected using buzzer alarm system. Edge based algorithm cannot reduce noise to overcome this problem Neural Network Technique is used[11]. Thus by studying the above literature survey we conclude that by using the Raspberry-pi and opencv-python programming the system is implemented. USB Camera is used as a sensor for video image detection due to its capability and realization cost. It uses edge detection with boundaries condition method for image detecting .The model is going to work purely on the grounds of image processing and also security is provided with the use of the concept of ANPR.

### III. SYSTEM CONCEPT

The objective of this project is Usage of image authentication technology, capturing of vehicle number plate using camera, unauthorized authentication and alerting through buzzer alarm. The figure shows the block diagram of recognition of vehicle number plate using Raspberry -pi .In this system Raspberry -pi 3B+ is the heart of system and we have installed some important library and packages to convert image to text like opencv OCR. Raspberry-Pi is SOC device. Here we interface web camera to Raspberry-pi on a port where we interface camera. The camera is performing main role in this system. When vehicle comes in range with IR sensor the system will turn on the camera automatically the image of number plate get capture and converts into text using OCR and opencv. Then compare the text into exiting number plate. If number plate gets match servo motor opens the gate else buzzer blows to in built operator that vehicle is unknown .

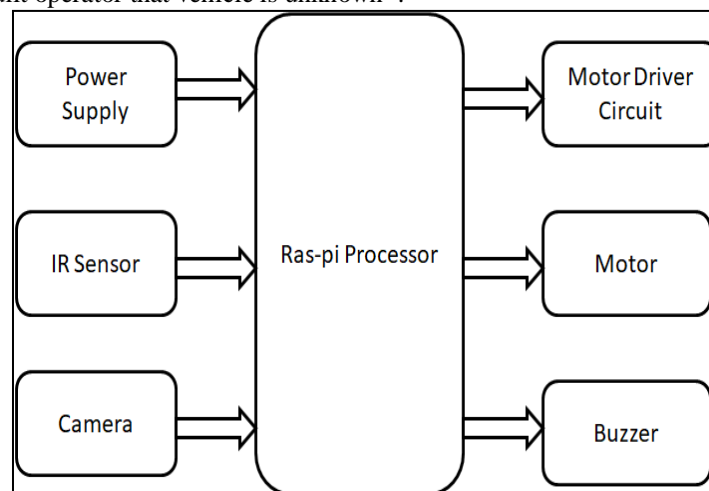


Fig. 1: Block Diagram

#### IV. DESIGN AND IMPLEMENTATION

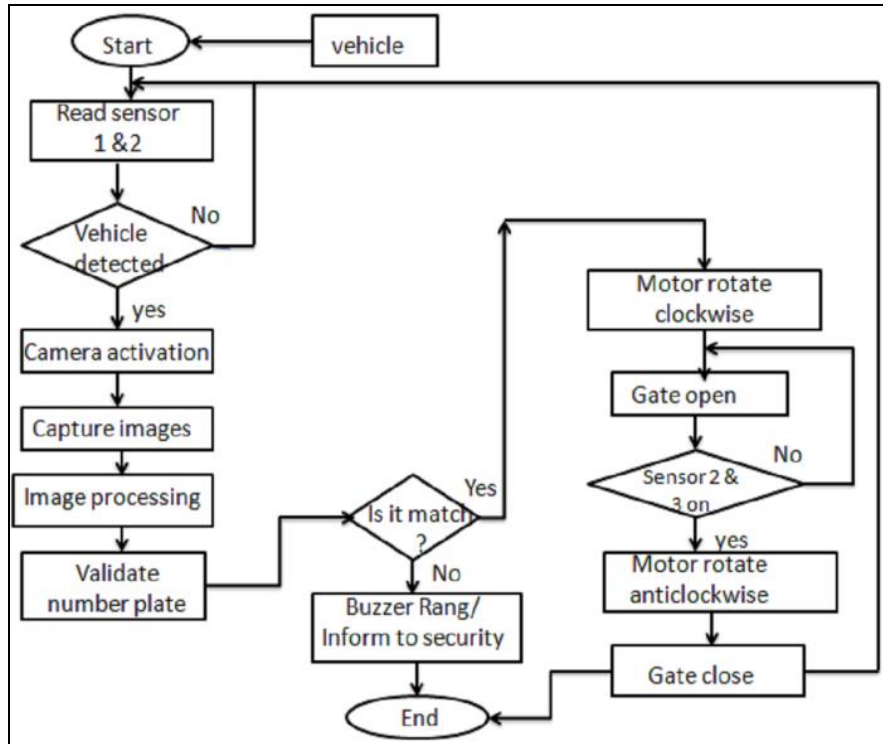


Fig. 2: Flow Chart

This system consists of DC power supply is used that supplies the constant DC voltage to its load. It provides DC power of 5v. It supports up to 2.5A of current which is plenty through the four USB ports on the board.

##### A. Components Used

Following are the hardware which are used for developing the proposed system

###### 1) Raspberry Pi 3B+

The Raspberry Pi 3 Model B+ is the latest product in the Raspberry pi 3 range, boasting a 64-bit quad core processor running at 1.4 GHz, dual-band 2.4 GHz and 5 GHz wireless LAN, Bluetooth 4.2/BLE, faster Ethernet. The dual-band wireless LAN comes with modular compliance certification, allowing the board to be designed into end products with significantly reduced wireless LAN compliance testing, improving both cost and time to market.

###### 2) Camera

A webcam or USB camera is a video camera that feeds its image in real time to a computer or computer network. Unlike an IP camera which uses a direct connection using Ethernet or Wi-Fi, a USB camera is generally connected by a USB cable, FireWire cable, or similar cable. Other popular uses include security surveillance, computer vision, video broadcasting, and for recording social videos. Webcams are known for their low manufacturing cost and flexibility, making them the lowest cost form of video telephony. They have also become a source of security and privacy issues, as some built-in webcams can be remotely activated via spyware.

###### 3) IR Sensor

To detect the occurrence of any vehicle the IR sensor is used and in order to detect the ON and OFF conditions of the Raspberry pi processor buzzer is connected to the Raspberry pi processor.

###### 4) Servo Motor

A Servo Motor is a rotary actuator or linear actuator that allows precise control of angular or linear position, velocity and acceleration and trigger receives ultrasonic signal by using formula, here  $34300(\text{cm/sec}) = \text{Sound speed}$ . Servomotors are controlled by sending a PWM (pulse width modulation) using controls wire. It rotates 0 to 180 degree

##### B. Image Processing Operations

###### 1) Input Image

Real Time Input Camera, which is connected to Raspberry Pi capture the image of the car in front and to process instant vehicle license plate detection and recognition. We input an image of a car that goes through the image pre-processing stages that enhances the image quality leads to better results in later stages. The input can be of an image or a video. The process is done in online in other words it takes the input in Real time.

## 2) Image Cropping

Image cropping is a recognition process whereby it will extract the smallest rectangle which will contains the edge of the number plate and number plate itself. As the number plate surrounding is not so important, this cropping process will highly increase the speed of image processing.

## 3) Binary Images

It is an image which quantized into two values representing 0 and 1 or in pixel values of 0 and 255 representing the color black and white. Binary Images are obtained by converting the input image into grayscale format, then by converting the grayscale image to binary image by thresholding. The pixel of grey level above the threshold will be set to 1 and the rest will be set to 0. We will obtain white object with black background or vice versa. [9]

## 4) Image Enhancement

Image enhancement is used to increase and improve the visibility of the image. Image Enhancement techniques consists process of sharpening the edges image, contrast manipulation, reducing noise, color image processing and image segmentation as well [9].

## 5) Edge Detection

The initial step in recognition of vehicle number plate is by detection of the number plate size. The challenge is to include an algorithm that are able to detect the rectangle plate in the image. The horizontal and vertical edges of high density is normally caused by the contrast character from the number plate and this will eventually lead to detecting the wrong area [5][6]. Edge detection is used to find the transition between the two area based on the discontinuities in the intensity values.. Edge detection also base on the image edge information which is found by the relation of the pixel and its neighbor.

## 6) Filtering

In this pre-processing stage, filtering is used for blurring and for noise reduction and thus resulting a more sharpen image. Blurring involved in removing and cleaning up of small patches and details from the image prior to object extraction, bridging of gaps in curves and lines. Blurring with liner/non liner filter is able to achieve noise reduction. In order to reduce the background noise, softening is often applied to the low pass filter and it will affect the image to become blurring. High pass filter is used to determine and intensify the details in the image, but noise will be added during the process. High pass filter also used the convolution during the process.

## 7) Erosion

Erosion is one of the simplest method used for removing unwanted details from a binary image. There are also new method versions of erosion that work on grayscale images as well. The process of erosion basically reduces the objects size and getting rid of unwanted details by encoding the image with a structuring element of radius that is smaller than the object.

## 8) Image

Segmentation In order to extract and analyzed the object characteristic, image segmentation is used, the process which need to partition the image into different parts that will have a strong correlation with the objects. Segmentation process can be categorized into several parts. Firstly is the global knowledge of an image. The feature of the image is represented by a histogram. Secondly, in the boundary-based segmentation. edge detection is used to obtain the region contours and the objects will construct from the obtain contours. Another one is edge-based segmentation. For this paper, first category segmentation method is being used which is by using threshold

## 9) Feature Extraction

Feature Extraction From Digital Image The digital image description is based on the external and internal representation. The color or texture of the image is the internal representation whereas the external representation is based on the characteristic of the shapes of characters. The descriptor vector includes the characteristics as the number of lines, vertical or diagonal edges etc. The process of the feature extraction is to transform the bitmap data into a form of descriptor in which more suitable for computer. If we classify the similar character into classes, the descriptor of the character from the same class is close to each other in the vector space and this will lead to a success in pattern recognition process.

## V. CONCLUSION

The project “Automatic Gate Control System using Image Processing” was designed such that the system captures the image of the number plate of a vehicle and these details of number plate were verified with the predefined details using Rasberry Pi processor for authentication.. The software of the system uses series of image processing algorithms for number plate recognition and finally identifying the vehicle from the database stored on the PC. This software has been written opencv python. The intelligence and efficiency is improved with the help of Rasberry pi and USB camera. And also this system is reduces the manpower. The system is less time consuming, efficient and secure. In future, the cloud computing can be used, which will be very helpful for storing the data permanently.

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