

NUMBER PLATE RECOGNITION USING RASPBERRY PI

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Abstract

Recognizing vehicle number plates is a difficult but much needed system. This is very useful for automating toll booths, automated signal breakers identification, finding out traffic rule breakers and to detect stolen vehicles. The developed system consist of a Raspberry Pi based vehicle number plate recognition system that automatically recognizes vehicle's number plate using image processing. The system uses a digital camera along with LCD display circuit interfaced to a Raspberry pi processor. A rear image of vehicle is captured and processed using various algorithms. The system constantly processes incoming camera footage to detect any trace of number plates. On sensing a number plate in front of the camera, it processes the camera input and extracts the number plate part from the image. The image is extracted using OCR. And by using Haar-cascade, the number is extracted from the image. The system then displays the extracted number on a LCD display. The implemented system consist of a fully functional vehicle number plate recognition system using Raspberry Pi considering success rate and processing time as parameters. The developed system can be used for security purpose in housing societies to monitor the entry/exit of authorized vehicles. It is observed that the developed system successfully detects and recognizes the vehicle number plate on real time images. The system accuracy is about 80%.

INTRODUCTION

Automation is the most frequently spelled term in the field of electronics. Automatic number plate recognition (ANPR) is a surveillance system that can be used for monitoring traffic management, at toll booths, security of authorized vehicles and parking systems in housing societies. The automated number plate system reduces human interferences. With advancement in technology, effective ways have been developed for fast and accurate detection of number plate. The number plate system is designed to ensure a steady flow of traffic. It is seen that the traffic authorities face problems whenever they chase a vehicle which broke the traffic rules. So, in order to make this process autonomous, we can install this system so as to automatically detect the vehicle that violates the traffic rules, take a picture of it and store it in database for further inspection. The aim of the project is to recognize the number plate of a vehicle automatically. The system makes use of Raspberry Pi processor which acts as heart of the project. The system works in four steps – the first one in image acquisition, second is image extraction, third is image segmentation, and last is character recognition. The project aims to develop an ANPR system running solely on the Raspberry Pi using Open CV and OCR. Once the camera captures an image, image de saturation and character recognition is all done on the Raspberry Pi before the extracted number plate is displayed on the LCD. The developed system has been prototyped using python and Raspberry Pi and real time results are been shown. Systems of automatic recognition of number plates are sets of hardware and software to process a signal that is converted into static images that recognize the characters in the plate. As a vehicle approaches the camera, the camera takes a series of snapshots and stores them in a file. Then the extracted data of number plate in saved in a cloud platform. The associated database provides information regarding the vehicle and the user In order to overcome the challenges in this application that includes crucial need of an efficient code and reduced computational complexity while offering improved flexibility, an algorithm is developed using Open CV on Raspberry Pi. Optical Character Recognition is used to convert image to text. Also, Haar-cascade feature is used for character recognition. Cascade amplifier is suitable for localization of number plates with accuracy of more than 90%. ANPR is supporting the safety and security of citizens and enhances the effective transport flow in real time. The system is used in automating access control. The number plate system can be used in variety of other ways to support the security and safety of public with transportation and vehicle based infrastructure. The system is designed to replace the manual systems with an automated system with proper localization of number plate information.

LITERATURE SURVEY:

Agrawal and Pardakhe [1] investigated an input image to identify some local patches containing license plates. Since a plate can exist anywhere in an image with various sizes, it is infeasible to check every pixel to locate it. The objective of the paper was to implement a completely automated license plate recognition system using the Optical Character Recognition (OCR) to read information on the images of license plate of vehicle using Raspberry Pi processor.

Kumthekar et al. [2] his paper proposed a method to detect Korean vehicle plates from black box videos. It works in two stages: The first stage aims to locate a set of candidate plate regions and the second stage identifies only actual plates from candidates by using a support vector machine classifier. In this system, open CV and OCR (optical character recognition) platforms are used. To capture vehicle number plate on gate they have used ultrasonic sensor which will be helpful for the calculating the distance between camera and vehicle

Dangre and Dalvi [3] proposed that the vertical and horizontal edge diction is used which represents the position of license plate region. The algorithm of connected component analysis

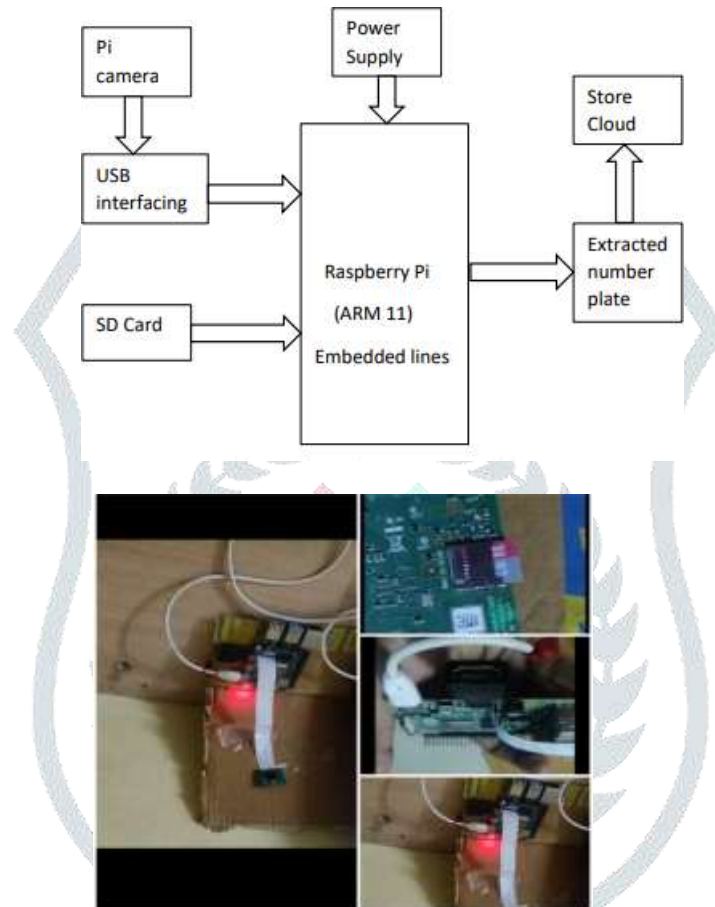
is used to locate the coordinates of the 8-connected components. Plate compatible filter technique is used to find exact license plate Radial Basis Function (RBF) neural network is used for both number plate detection and extraction. In image preprocessing gray scale

transformation, edge detection, image dilation and filling interior gaps, filtering, smoothing is used

Abirami and Jasmine [4], the objective of their paper was to complete automatic recognition system using OCR. They have used the existing closed circuit, television or road rule for informant cameras or ones specifically designed for the task. The images of vehicles license plate is captured and is processed by segmentation of character and is verified by Raspberry pi processor authentication proposed.

HARDWARE DESIGN:

In this project we create number plate recognition system using Raspberry pi 4B. The developed system is built on Raspberry Pi with a pi camera to capture number plate images of the vehicle. In this system we use raspberry pi 4B model because Raspberry Pi 4 offers the new technology of more RAM, faster processing and quality graphic support, able to decode 4K video, benefiting from faster storage via USB 3.0, and faster network connections via true Gigabit Ethernet. Also it consists of separate pi camera port. It requires low voltage (5V) supply. Applications of ANPR is parking automation and parking security: ticketless parking fee management, parking access automation, vehicle location guidance, car theft prevention, toll booth passing. In this system we use Pi camera, Raspberry pi 4B, LCD monitor, HDMI cables, C type connector for power supply.



SOFTWARE DESIGN:

The ANPR system uses OpenCV's cascade classifier for multi-scale detection of number plate regions in the image. The classifier needs to be trained with positive, real-time images. The Raspberry Pi is uses Raspbian operating system. The extracted image is stored in Google cloud platform that has been created with variations in capturing distances.

OpenCV Library: *OpenCV* is a cross-platform library using which we can develop real-time computer vision applications. It mainly focuses on image processing; video capture and analysis including features like face detection and object detection.

Image Processing: This module covers various image processing operations such as image filtering, geometrical image transformations, color space conversion, histograms, etc. In the python library of OpenCV, this module is included as a package with the name *org.opencv.imgproc*.

Haar Cascade XML file: It is a machine-learning based approach involving AdaBoost. It uses the 'Cascade of Classifiers' for character recognition.

Cascade Classifier: It is a machine learning based approach where a cascade function is trained from positive images. The plate detection uses Haar feature based cascade classifiers.

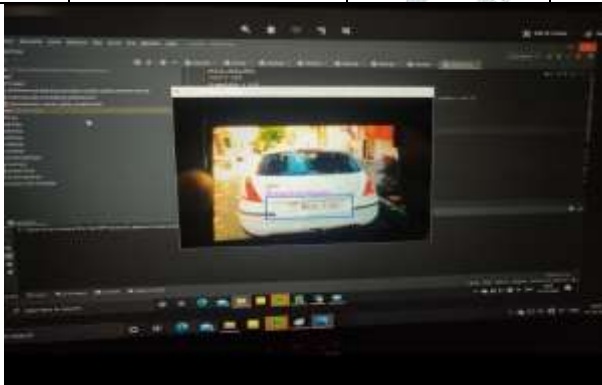
ALGORITHM:

- Install OpenCV.
- Open Pi camera.
- Input the rear image of car.
- Image Gray scale conversion.
- Number plate is detected.
- Number is displayed.
- Image is stored in Google cloud.

TEST RESULTS:

- The test was performed on high end computer having Intel i7 processor running at 3.6GHz with 32 GB RAM.
- Total 10 images were captured out of which 8 images were detected successfully.
- The image was detected when camera was kept at a distance of 1.5m.
- The time taken for recognition of number plate was 3 secs.
- The recognition accuracy was acceptable when camera is placed in front side of plate exactly at 90°. The accuracy drops when there is variation in camera angle
- The overall accuracy of the system is 80%.
- The number plate could be recognized easily irrespective of their background color.
- The ability of the system to detect the number plate is irrespective of the weather conditions

Sr. No.	Number Plates	Detected/Not detected	Time required for detection (seconds)
1.	MH 12 AW 6910	Detected	1.5
2.	MH 12 GA 8965	Detected	2
3.	MH 14 AH 1053	Detected	2.4
4.	MH 02 EA 8755	Not Detected	3.8
5.	MH 14 EM 3858	Detected	3.2
6.	MH 02 CN 5413	Detected	2.9
7.	MH 14 FF 8983	Detected	3.2
8.	MH 12 DE 1433	Not Detected	3.4
9.	MH 01 AE 8071	Detected	2.8
10.	MH 12 EF 3259	Detected	2.5

**CONCLUSION:**

The objective of the project is to study and resolve algorithmic and mathematical aspects of ANPR systems.

The system gives a recognition method in which the vehicle's number plate is obtained by cameras and the image is processed using image processing algorithms.

ANPR systems function to automatically capture a rear image of the vehicle's number plate, transform the image into alphanumeric characters using character recognition, and recognize the number plate image by character segmentation and to display the characters on display.

The system is implemented using Open CV library and its performance is tested on real time images.

The overall accuracy of the system is 80%. The test was performed on high end computer having Intel i7 processor running at 3.6GHz with 32 GB RAM.

ANPR technology uses image processing to identify vehicle number plates. The technology is rapid and able to identify and record a license plate number under most ordinary driving conditions. It offers advantages in law enforcement, security and vehicle access.

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