

Automatic Monitoring and control of Vehicle Entry/Exit In Forest Area with Raspberry-pi, python and open cv

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ABSTRACT

In this paper we propose a completely automated monitoring and control of vehicle entry-exit in restricted area using raspberry pi system. The project aims at designing a system which captures vehicle image along with its number plate automatically and further these details are verified with the database filled in online registration form consist of username, mobile number, vehicle number and full address. Farther the details are authenticated then it is processed by Raspberry Pi to authorise to enter the vehicle in the forest area. Once the information is filled in an online registration form the user gets a four digit random code as the receipt of conformation. That random code will be enter at the time of visiting. On the entrance gate camera capture image of vehicle and from that image the number plate is extracted then that extracted number is verified with the authorised registered number plate number. Raspberry Pi is connected with a server for verification of registered data with the image processing tool OCR. If the verification is susses fully done with the comparison of online registered data base and the extracted number plate number then visitor enter their four digit random code. If the code is match then the gate will be open. When the authorized vehicle was detected then the system operates the gate using DC motor. The system also alerts the authorities when any unauthorized image of number plate was detected using buzzer alarm system and led. The aim of this research is to develop and implement an authorized automatic gate control system that will increase security and convenience at entrance of all restricted forest places that require protection and Security. The auto gate control will be works without manual help and the system will help to recognizes license plates with the authority at entrance gate and take an action to permits the vehicle in a forest area.

Keywords— *Image processing tool, OCR, Raspberry pi model b, python, open cv, web page, web camera, dc motor driver, LED, buzzer.*

I. INTRODUCTION

In a restricted area like forest the entry will be conform after getting permission from the special authority. In design of this project we make an authorized online registration form. This page store the data require for the point of security under authority of forest. ALPR can be used to store the images captured by the cameras and the text from the license plate, with some configurable to store a photograph of the vehicle. These recognition Systems commonly use the camera to take the picture at time of the day. ALPR technology tends to be region-specific, want to plate variation from anywhere. Concerns about these systems have centered on privacy fears of government tracking movements, misidentification, high error rates, and increased government spending issue. The registration page on which user fill their information data as per the page contain .The registration form consist of username, mobile number, vehicle number and his full address. After filling information on a registration page user gets a four digit random code. That random code will be re-enter on the time of entry after verification of a number plate at the time of visiting. The four digit random code is the indicatation of conformation.

The paper want to design a system in which camera captures the image of the number plate automatically of a vehicle and these details were verified using Raspberry Pi processor for authentication. With the help of image processing tool OCR and python language the number plate is to be recognized and verified with the registered data. The authorities be alert by this system when any unauthorized image of number plate is detected using LED and buzzer. After this verification process the gate is to be open for the legal entry. If data is to be match then with dc motor gate is to be open to inter. Day by day Automation is the most frequently spelled term in the arena of electronics. The innovative hunger of automation brought many revolutions in the existing technologies.

In India, basically, there are two types of number plates, black characters in white plate and black characters in yellow plate. The former for indivisual vehicles and latter for public service vehicles. The system tries to address these two categories of plates[1].Conventional NPR algorithms are generally divided in 5 steps:

- 1) Capture.
- 2) Preprocess.
- 3) Licence Plate Extractor.
- 4) Character Segmentation.
- 5) Optical Character Recognition.

A better choice is an Infrared (IR) camera. The camera may be adjusted with respect to the number plates. Filtering is the set of algorithms applied on the image for better quality. It is an important part of any computer vision system. For the present system filtering consists 2 processes: **Resize** – The picture size from the camera may be large and can make the system stumpy. It is to be resized to a probable aspect ratio.

Convert Color Space – Pictures captured using IR or pictorial cameras will be either in untreated format or prearranged into some multimedia standards. Normally, these images will be in RGB mode, with three components (viz. red, green and blue). In image handing out techniques, Haar-like features are worn to be familiar with objects from image . If upcoming system is selected to detect only number plates then the Haar-like features are used for this intention and no supplementary processing is done. This technique is aged and backbreaking and more over needs a big database to accumulate the collected samples almost about 10000 images of the plates and characters. Fig.2 shows the filtered image. In the other case, if our projected system has to distinguish number plates, then the binary representation is formed from the image.

In character segmentation image processing is done on extracted number plate to eliminate redundant data[2]. After character segmentation, the extracted number plate has only those characters that fit in number plate. This also accomplished with the size elevation ratios identical with the contours detected on extracted number plate.

Finally, the chosen bloks are send to an Optical Character Recognition (OCR) Engine, which proceeds the ASCII of the number plate. Currently number plate detection and recognition dispensation time is fewer than 50 ms in several systems. Accurateness of Character Recognition depends on how Number Plate Detection and Character Segmentation are locating vehicle number plate and divide each character. The recognition of a single number plate and the recognition of its font in a reliable way is an pricey task, since it depends on computation concentrated algorithms. Devoted systems have been developed for this reason delivering the necessary computational power. Typical NPR systems are implemented using proprietary technologies. This congested approach also stops extra research and growth of the system. The increase of free (accessible to everyone) and unlocked source technologies the enumerate world is wide open to new heights.

II. LITERATURE SURVEY

Previously more traditional means of license plate recognition, number plate recognition access control were used. Automatic number plate recognition ALPR system is a mass surveillance method that uses optical character recognition (OCR) on images to find vehicle registration plates. They also used at an existing closed-circuit or road-rule for enforcement cameras, or ones specifically designed for the task of recognition and verification. They are used in police, Special Forces and as a method of electronic toll collection on pay-per-use roads and cataloguing the movements of traffic.

Automatic License Plate Recognition is a real time embedded system which automatically recognizes the license plate of vehicles. There are many applications ranging from complex security systems to common areas and road toll system, parking allotment to urban traffic control. Most of the ALPR systems are built with proprietary tools like Matlab software. Instead of matlab this paper gives alternative method of implementing ALPR systems using Software including Python language and the Open Computer Vision Library as open cv. The ALPR systems are works using proprietary technologies that make it costly. Using this rise of free and open source technologies the computing world is lifted up to new heights automation. The observable thing is the contribution of the open source community to the scientific world is Python. Intel's researches in Computer Vision bore called Open Computer Vision (OpenCV) library, which help to support computer vision development.

III.SPECIFICATION

A. Project Specification

- 1) Creating a online web page as a registration form for feeding the information data.
- 2) Camera captures the images and sends it to raspberry pi.
- 3) Processing the images and detect the object using Raspberry Pi by writing proper python code and open cv.
- 4) Verification of data in a capture images and registered data.
- 5) Conformation of registered data for opening the gate with dc motor with LED and buzzer.

B. The main Hardware/Software used is

- 1) Raspberry Pi
- 2) Image Processing
- 3 Open CV
- 4) Python
- 5) Camera
- 6) Keypad for entry of random code
- 7) Internet server
- 8) Web page(Registration form)
- 9) Dc motor
- 10) LED and buzzer

IV. SYSTEM DEVELOPMENT

A. Image Acquisition

This is main component of NPR system. In this component following steps are performed:

- 1) Image Capturing
- 2) Image Color Conversion

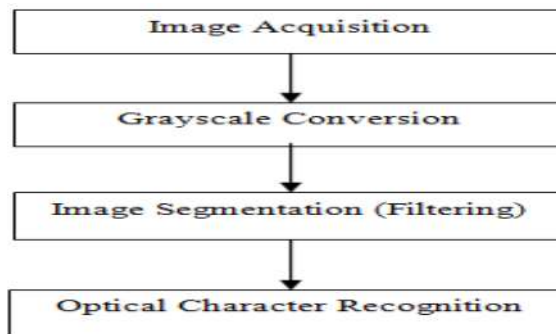


Fig.1. image acquisition system

B. Gray Scale Conversion

A gray scale or gray scale digital image is an image in which the value of every pixel is a single sample. These Images also known as black-and-white are made of totally of shades of gray, changeable from black at the weakest strength to white at the strongest intensity. Black-and-white images or gray scale are different from black and white metaphors, which in the perspective of computer imaging are images with no more than the two colors. Gray scale images have large number of shades of gray in between. Gray scale images are frequently the result of measuring the intensity of light at every pixel in a single band of the EM spectrum (e.g. infrared, detectable light, ultraviolet,) and in these cases they are monochromatic proper when only a specified frequency is captured or taken[3]. But also they can be synthesized from a full color image. This is most critical process in Number Plate Recognition System

C. Character Segmentation

In this part further image processing is done on extracted number plate to remove unnecessary data. After character segmentation, the extracted number plate has only those characters that belong to license number[5]. This also achieved by means of the width height ratios matching with the contours detected on extracted number plate. After character segmentation, the extracted number plate has only those characters that belong number[2].

D. Optical Character Recognition

OCR is utilized to extract characters from an image or a scanned document. These characters are used for additional processing such as it can be edited, formatted, searched, indexed and automatically translated or converted to speech[4]. In this part, character segmented number plate is passed to optical character recognition engine.OCR engine returns number plate in text format.

Tesseract-ocr is an open source engine. It is written using C/C++ and developed at Hewlett-Packard (HP) lab from 1985 and 1996. They didn't utilized it in their products. It was one of the best engines in the 1995 UNLV Accuracy test. In 2005, it was released as open source engine. From 2007, Google has started the supervising tesseract-ocr for further development and maintenance. It takes gray or color image as input and gives output in text format. IN early stages, only .tiff type of image was used to support but now it also supports additional types of images like .png .jpg, etc. It is capable of reading data in any language from image like English, Swedish, Danish, Chinese etc. and developers or users can train their own language if the support for a particular language is not offered[5]. Google Developer experienced it on Windows and Ubuntu operating system but it can also installed on other Mac and Linux platforms, etc. We can also utilized this library on mobile platforms like Android and iPhone etc

II. FLOWCHART

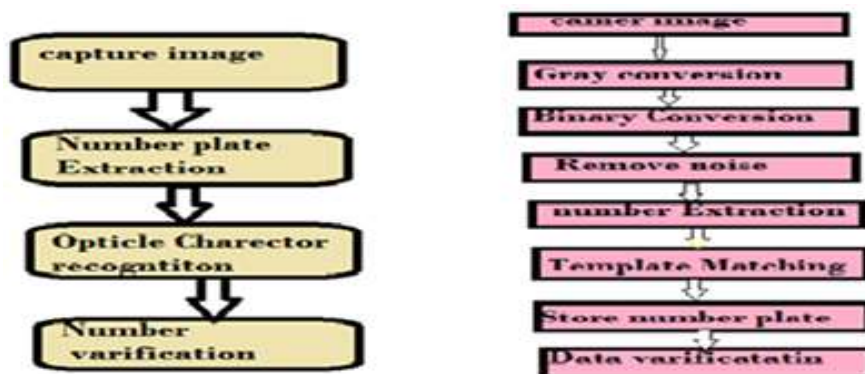


Fig.2. flow chart of ALPR

In this design of project ALPR system captures the image of the number plate of a vehicle. Then details of number plate were verified with the predefined details with Raspberry Pi processor for authentication. Number is to be

extracted with OCR technology in which gray scale conversion, binary conversion and noise removal is to be carried out. If the number plate number is to extracted then comparison with the template is to be matched with stored data base. The authorities be alert by system when any unauthorized image of unregistered number plate was detected through camera using buzzer and LED

IV. ALGORITHM

- 1) Capture image with camera using python script.
- 2) Converting image to grayscale and saving the captured Image as a time/date stamp.
- 3) Filtering and denoising of image.
- 4) Applying Tesseract OCR on filtered image.
- 5) Displaying extracted numbers and text

V. PROJECT BLOCK DIAGRAM

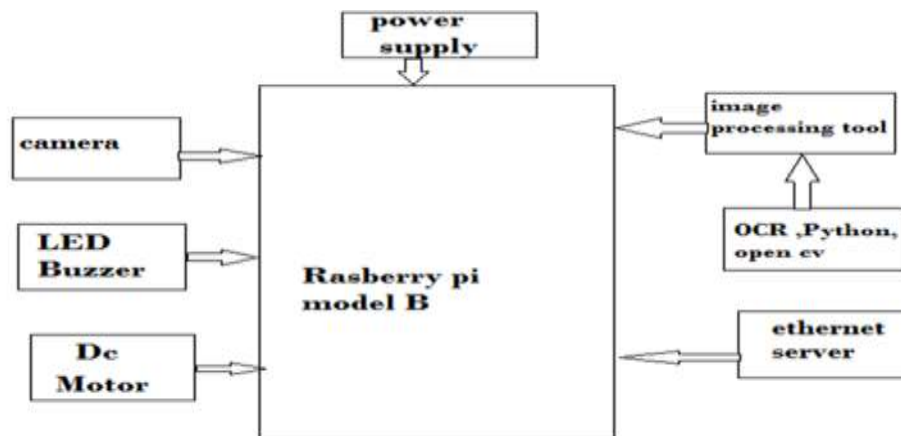


Fig.3.Circuit diagram of Raspberry pi model B with external peripheral

In the circuit diagram, the raspberry pi model B Broadcom BCM2836 SoC with a 900 MHz 32-bit quad-core ARM Cortex-A7 processor connect with image processing tool OCR, Python, open cv. There is sensor to sense a vehicle at the entrance gate with the help of LED and buzzer. There is power supply cable to start it. Dc motor is used for opening and closing of gate automatically. Today image processing is used in various techniques with matlab. This paper presents the implementation of image processing operations on Raspberry Pi. The Raspberry Pi is a basic embedded system and having a low cost a single board computer used to minimize the complexity of systems in real time applications. This project programming is mainly based on python language. Raspberry pi consist of USB slot to interface the raspberry pi with camera. The aim of this research is to develop and improve an automatic gate control system that will elongated convenience and enhance security at entrance of all the restricted places that require protection and Security. The automatic gate control will be able to works without need human beings. The system able to recognizes license plates from vehicle at entrance gate and take an action for vehicle to take granted to go or not.

ALPR is a real time embedded system which automatically recognizes the license plate of vehicles. There are various applications work from complex security systems to common areas and road toll system, parking allotment to urban traffic control. Most of the ALPR systems are built with proprietary tools like Matlab software. This paper gives alternative method of implementing ALPR systems using Software including Python language and the Open Computer Vision Library as open cv

VI. OVERVIEW

1. Raspberry pi

The Raspberry Pi is a credit-card-sized single-board computer developed Raspberry Pi Foundation in UK. In real time applications of embedded system the number plate of a vehicle is extracted to find the number as an authorized or

unauthorized number. The proposed application solve a better way to locate the number plate of the vehicle using the Raspberry Pi called advanced processor which is a system on chip processor. The authorized images are stored inside the processor then after comparison is performed. The presence of a vehicle is detected using the IR sensor, if the vehicle is to be detected then camera starts capturing the image. After detection the captured image is compared with stored predefined number inside the processor. In this project the DC (Direct Current) Motor is used for gate operation to give entry. If the camera captured image is recognized with an authorized image then the gate will be opened and the number will be sent to Server, if it is not an authorized image the number then gate will not be opened

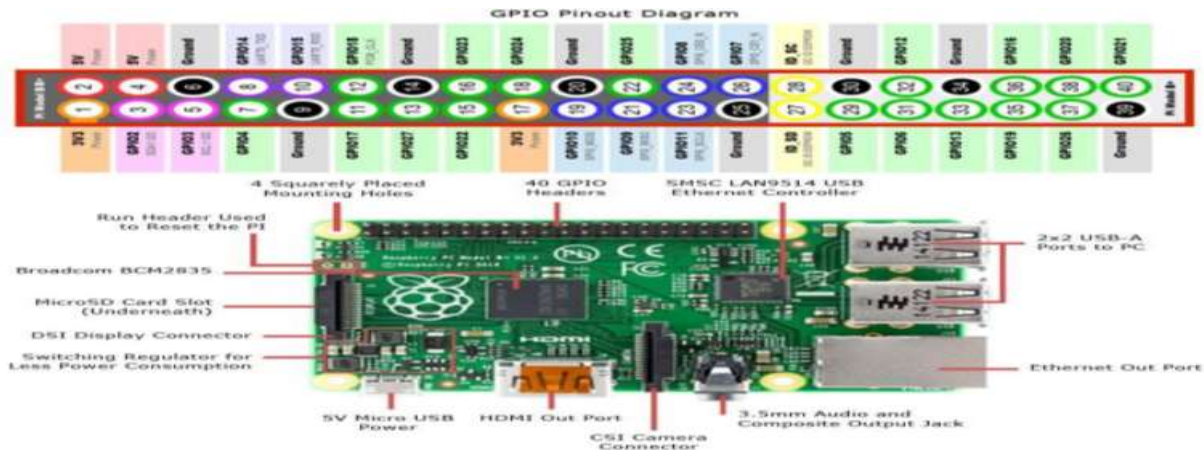


Fig.4. Raspberry pi model B and GPIO pin out diagram

2. USB camera

USB Camera captures the image and sends via USB port of the Raspberry Pi board .A webcam or USB camera is a video camera that feeds its image in real time to a computer or computer network. An IP camera which also uses a direct connection using Ethernet or Wi-Fi, a USB camera is generally connected by a USB, FireWire cable, or similar cable. Similarly use of video camera for the World Wide Web gave the webcam its name. Other popular uses like security surveillance, computer vision, video broadcasting and for recording social videos .Webcams are popular for their low manufacturing cost and flexibility, making them the lowest cost form of video. They fulfil there a source of security and privacy issues, as some built-in webcams can be remotely activated using spyware.

3. DC motor

Dc motor produces the electrical energy to mechanical energy, through the interaction of magnetic field and current carrying conductors. In the reverse process dc motor can produce electrical energy to mechanical energy accomplished by an alternator. Mainly the DC motors have two features one is rotating part that is known armature and another is the stationary part that includes coils of wire called the field coils.

The project mainly focuses on the object detection and tracking. The input to the project will be the image data which is continuously captured with the help of a webcam which is interfaced with USB to the Raspberry Pi. It detects the object and tracks the object by moving the camera in the direction of the object. First step is to install all the Linux os into the Raspberry Pi board with Micro SD card and proper code is written in Python language for the object detection using the Open CV libraries and is dumped in the board base. The visual data images captured by the webcam are processed in the Raspberry Pi. The number on number plate of vehicle standing outside the gate and stored information of user number plate number is matched automatically without any human effort Using this rise of free and open source technologies the computing world is lifted up to new heights automation. The observable thing is the working of the open source community to the scientific world is Python language. Newly Intel’s researches in Computer Vision named Open Computer Vision (Open CV) library, which help to support computer vision development.

VI. RESULT

The registration form consists of username, mobile number, vehicle number and his full address. After filling information on a registration page user gets a four digit random code. That random code will be reentering on the time of entry after verification of a number plate at the time of visiting.



fig. online registration page

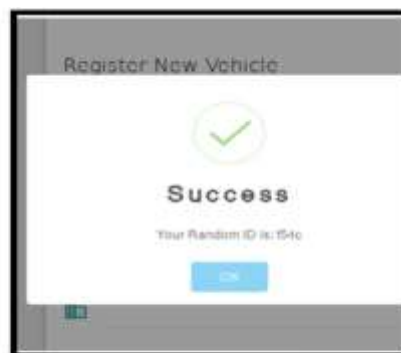


fig. getting 4 digit random number after registration

Fig.5. online registration form and susses full registration

The project mainly focuses on the object detection and tracking. The input to the project will be the image data which is continuously captured with the help of a webcam which is interfaced with USB to the Raspberry Pi. Camera captures the images and this image having vehicle number plate number is to be matched with the registered vehicle number in the data base. That random code will be re entering on the time of entry after verification of a number plate at the time of visiting. The four digit random code is the indication of conformation. After filling this 4 digit random number gate will be open

Camera captures the image of the number plate automatically of a vehicle and these details were verified using Raspberry Pi processor for authentication. With the help of image processing tool OCR and python language the number plate is to be recognized and verified with the registered data. The authorities is be alert by this system when any unauthorized image of number plate is detected using LED and buzzer. After this verification process the gate is to be open for the legal entry. If data is to be match then with dc motor gate is to be open to inter.



Fig.6. Experimental setup

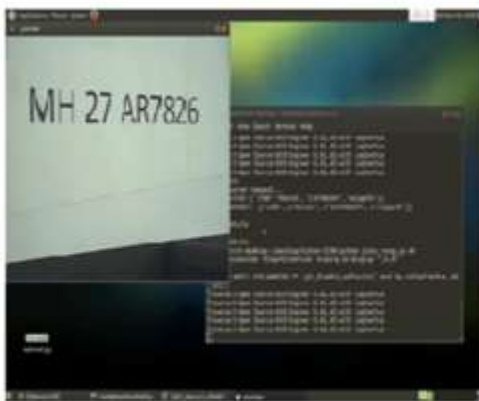


fig. screenshot of extraction and comparison of number plate



fig. after conform comparison of number plate entre the 4digit random number

6. Future scope

This paper can be farther work with grate efficiency GPS receiver and a GPRS module. The intimation by GPRS module gives for the vehicle tracking directly on to the predefined web link for tracking the vehicle using Google maps. The project will be extended with USB camera for vehicle monitoring from longer distances and a memory card with which the travelled path can be stored which helps in storing the tracked path along with speed and time.

7. Conclusions

The above work is in a direction of fast algorithm for the vehicle number plate detection and verification. Instead of matlab we used raspberry pi which gives us more accuracy and fast programming time. Using online registration form it increases chances of conformation of visiting any restricted authorized location, it effect on users valuable time and money also. Raspberry pi model B has fast processing time and real time. Automatic monitoring of vehicle reduces human work and effort of official registration, verification and making record of entry exit of vehicle with counting number of entrees using counter by making data base. This combination of software as web page, image processing tool, OCR, Python, open cv and hardware resolution camera, monitoring display, keypad, dc motor, LED, Buzzer gives us more automation in field of electronic and promoting making India dream who makes Digital India.

8.Achnowledment

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