

ACCURATE VEHICLE NUMBER PLATE REGOGNITION AND REAL TIME IDENTIFICATION USING RASPBERRY PI

N.Abirami¹, Dr. J.S.Leena Jasmine²

¹PG scholar, Department of ECE, Velammal Engineering College, Chennai-600066.

²Associate Professor, Department of ECE, Velammal Engineering College, Chennai-600066.

Abstract - Automatic License Plate Recognition system, detecting and recognizing the characters in the vehicle number plate and the classified characters are used further use in many traffic, security, access control applications. Accurate car plate recognition (ALPR) has complexity features due to diverse effects like light and speed. Most commonly LPR, which comes under image processing uses proprietary tools like MATLAB.

The alternate and more efficient technique for Vehicle Number Plate Recognition is Open Computer Vision. In this system OCR is performed by OpenCV. The main difference from the MATLAB and OpenCV is online and offline process. Which means MATLAB cannot be performed in ON line process it can be performed ONLINE whereas OpenCV is for Real time applications. This paper presents another faster method of implementing LPR using Software Language Python and the Open Computer Vision Library.

Key terms: - ALPR, Real Time, OpenCV, OCR

I. INTRODUCTION

ALPR, is a method of classifying the characters that are present in the car number plate which are then resulting as the recognized outputs. Vehicle Number Recognition system in common comes under image processing is been mostly carried out by MATLAB. Over the previous few years, the License Plate Recognition (LPR) has been most widely studied and many researches are undergoing as of present [1]. There were many works have done by many researchers in order to find an efficient way to recognize the characters in number plate. In initial stages of Optical Character Recognition (OCR), is carried out by simulation method such as the code is executed in MATLAB package. Automatic Number Plate Recognition emerged for many reasons and applications and mainly because of traffic monitoring and to solve vehicle-based issues. Using car plate detector, user can track, identify the vehicles automatically. Here comes OCR, we use this to read the number plate character, it is called as "Optical Character Recognition" method. Many significant applications like vehicle surveillance, where Automatic Number Plate recognition plays a very vital role in recent years because of the unlimited increase of the car which make it difficult to manage, hence we have applied many algorithms to recognize the character using MATLAB and open CV [2]. In the proposed system we have

used Open Computer Vision, which is much better than the MATLAB. OpenCV can be used for Real-Time applications. Principle Component Analysis algorithm is used for Feature Extraction. The classification is done by the classifier called Convolution Neural Network, which is used to recognize the characters.



Fig (1) LPR

II. MATLAB VS OPENCV

In present day, OpenCV is the most comprehensive open source library for computer vision and it has large user community. OpenCV has much more functions for computer vision than MATLAB. Many of its functions are implemented on GPU. The library is being continuously updated (an updated version is released approximately every 3 to 4 months). In general C++ OpenCV code runs faster than MATLAB code. OpenCV has more functions for computer vision than MATLAB. Many of its functions are implemented on GPU [3]. In common C++ OpenCV code runs faster than MATLAB code but when compared to OpenCV C++ OpenCV python is much better than the C++, python is a better and easier than the other programming language like C++. In computer vision, we are faced with similar choices. Which tool should a computer vision engineer / programmer learn — OpenCV using C++, OpenCV using Python, or MATLAB, as for the present we have a few options to choose from. Before in past there were no good libraries for computer vision. We get to know about these studies by related books which were available and started coding own mini library of computer vision algorithms [6].

Like MATLAB, OpenCV was also made for Image processing and used as alternative and much faster tool than the other simulation processes. Every package in OpenCV, the function and data structure were designed with the Image Processing coder. MATLAB, on the other side, we get almost anything and everything in the world in the form of toolboxes. Even though MATLAB is a relatively easy language to get to grips with, this high-level scripting language, becomes slower in some cases. In such cases, OpenCV works better and produces accurate results. Memory management or any other low-level programming issues. Likewise, it can be very easy to handle some code to prototype your image processing idea. To read in an image from file and display it. One of the notable contribution of the open source community to the scientific world is Python.

First, multiple sequential LR license plate frames of the same scene are taken as the input observations. Second, the effective image registration is carried out to obtain precise motion parameters between the LR input images, which is our main focus. Third, the image reconstruction is implemented to obtain a HR reconstructed image [7].

Accurate image registration is of vital importance for the success of SR methods. On one hand, the frequency approach proposed by P.Vandewalle in [5] outperforms previous frequency methods and some spatial domain methods. It works particularly well on images with strong frequency content in a number of directions, and it satisfies the subpixel accuracy in the larger translation and rotation estimation [8]. However, Vandewalle's algorithm has the deficiency that it assumes motion model contains only rotation and translation, which leaves the scaling movement unsolved. This registration algorithm is simply used for license plate image SR reconstruction, we may get a blurred HR image, which can be observed from the experimental results. On the other hand, the classic FMT algorithm, mostly used in image mosaic [7], can execute scaling, rotation and translation estimation between frames, but it is only on the integer-pixel level, which can't meet the requirements of SR for license plate image. On the base of above analysis, a novel frequency domain registration method is proposed

III. OPEN COMPUTER VISION

Open Source Computer Vision Library is cross platform and a set of programming functions for real time applications. OpenCV library contains several algorithms, for exactly more than five hundred optimized algorithms. It is mostly used around the world, with forty thousand people in the user group. The languages which were initially used and being used in the open computer vision platform are C, C++, the library is mainly written in C, which makes it portable to some specific platforms such as Digital Signal Processor. Now the language called Python is used recently, it is developed to encourage adoption by a wider audience. These languages

recent versions have interfaces for C++. OpenCV is a cross-platform library, which It has C++, Python and Java interfaces. OpenCV was designed for computational efficiency and with a strong focus on real-time applications.

As for now, OpenCV supports a lot of optimized algorithms related to Computer Vision and Machine Learning and it is been spreading day-by-day. Currently OpenCV supports a wide variety of programming languages like C++, Python, Java etc and is available on different platforms including Windows, Linux, OS X, Android, iOS etc Here in this system we have used python as a code language. Which is called as OpenCV python. We choose python because it's easy to understand and more efficient. The proposal combines the best qualities of OpenCV and Python language.

IV. ALPR USING OPEN COMPUTER VISION

ALPR also called as Number Plate or Vehicle plate Recognition is nothing but recognizing the characters on the car number plate by using extracting method. In India, basically there are two kinds of license plates, black characters in white plate and black characters in yellow plate. So, classification is based on the basic plates from India

Automatic Vehicle Plate Recognition (ALPR) could be a computer vision technology to extract the identification number of vehicles from pictures. it's associate degree embedded system that has various applications and challenges [10]. Typical ALPR systems area unit enforced victimization proprietary technologies and thence area unit expensive. This closed approach conjointly prevents additional analysis and development of the system. With the increase of free and open supply technologies the computing world is upraised to new heights. folks from totally different communities act in a very multi-cultural atmosphere to develop solutions for mans never ending issues. one in every of the notable contribution of the open supply community to the scientific world is Python [13]. Open Computer Vision (OpenCV) library, which might support computer vision development acts well in image recognition technique, where in our proposal have used in real time identification.

V.RASPBERRY Pi

A Raspberry Pi is a credit card-sized computer designed for numerous applications. it quickly adopted by tinkerers, makers, and electronics enthusiasts for projects that require more than a basic microcontroller. provides e all the expected abilities that implies, at a low-power consumption level.

Raspberry Pi is open hardware, with the exception of the primary chip on the Raspberry Pi, the Broadcom SoC (System on a Chip), which runs many of the main components of the board-CPU, graphics, memory, the USB controller, it is a

trending technology so we can even use the Raspberry Pi to learn about operating systems by designing our own.

The Raspberry Pi 3 Model B is the latest version of the Raspberry Pi computer. The Pi isn't like your typical machine, in its cheapest form it doesn't have a case, and is simply a credit-card sized electronic board -- of the type you might find inside a PC or laptop but much smaller. Raspberry Pi 3 the recent version has been used to build tablets, laptops, phones, robots, smart mirrors, to take pictures on the edge of space, to run experiments on the International Space Station. Here in our method, we have used Raspberry pi, for the interfacing the raspberry Pi camera. It acts as a interfacing tool and the main source in classification, in other words Raspberry Pi 3 is used for recognizing characters from the image. This small computer can have certain the operating systems. But here we have used Raspbian as its operating System.



Fig (2) Raspberry Pi

VI.RASPBERRY Pi CAMERA MODULE

The Camera is used to interface to the Raspberry Pi. This camera captures image of the license plate immediately.it assist the Raspberry Pi in displaying the captured picture online. In other words, it acts as a real time capturing camera.

The Raspberry Pi camera module can be used to take high-definition video, as well as stills photographs. It's easy to handle but has plenty to offer advanced users. There are lots of examples online of people using it for time-lapse, slow-motion and another video cleverness. We can use the libraries package to bundle with the camera to create effects. Ultimately it gives you amount which aids to fix the camera in the desired position as well as provides protection for the camera board. The camera is connected to the Raspberry Pi setup in order to give a real time input, so that the process can be done on the online process.



Fig (3) Raspberry Pi USB Camera

VII.PROPOSED SYSTEM

The Proposed System has two set of process combined. The below block represents the system The Indian License plates contains different font types with different background by using neural network we can recognize the characters in the plate without errors

The car number plate recognition is recognized using many methods previously, like MATLAB. Those methods had some complexity in getting accurate result, Efficient rate, time taken **etc.** to overcome such complexity the other method can be used is Open CV. The language used is python, so it is called as OpenCV Python. Raspberry pi is used mainly here for recognizing the captured image, it acts as a Realtime displaying system.

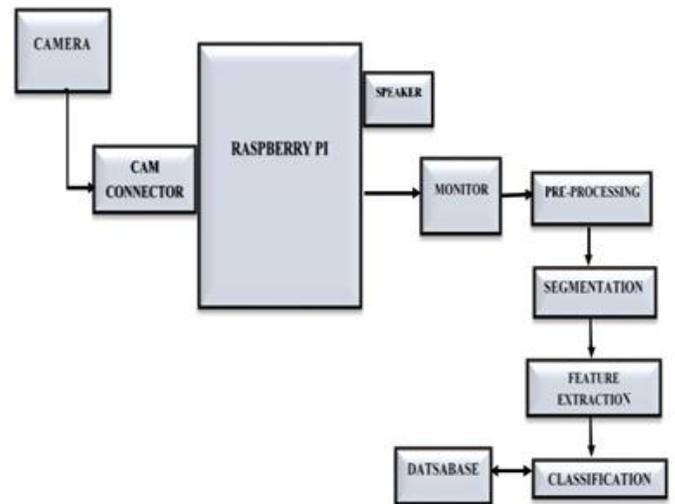


Fig (4) Proposed System

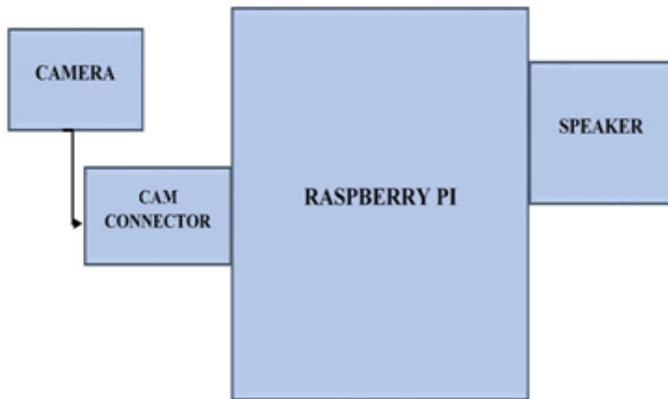


Fig (5) Hardware Block

The Hardware part consists of raspberry pi 3, camera and a speaker. This entire hardware setup is called 'Raspberry pi Camera Module'. Where the recognition is done by raspberry pi from the image which the camera captures in real time. This Module is connected to a monitor, which is used for display. In addition, Raspberry is connected to mouse and keyboard. As we know that raspberry pi can be connected to PC monitor, laptop or TV monitor here in this case it is been connected to the PC monitor along with mouse and keyboard. Monitor is used to display the captured image and also the recognized character whereas mouse and keyboard are the supporting features that acts as a accessing tool to the monitor for controlling the raspberry pi recognition. After these capturing process the basic image processing steps are taken place. For performing every individual steps the specific algorithm should be selected based on the applications, because these algorithms can improve the recognition rate, efficiency rate and reduces time taken.



Fig (6) Hardware

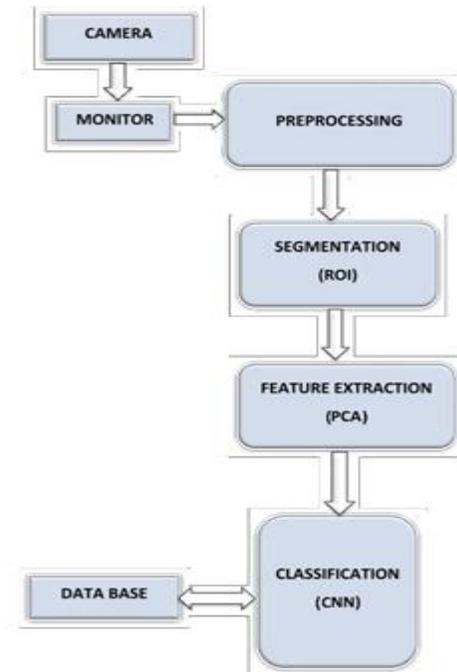


Fig (7) Image Processing steps

The Common image processing steps are used for this process, here we have used many efficient algorithms for each step. Feature extraction is done by PCA algorithm and classification by CNN algorithm. For segmentation the separate region is parted and segmented after that the classification step is taken place. CNN classifier is used to recognize the characters present on the vehicle plate. These algorithms are called out in the package. In python, the programming code is grouped as package



Fig (8) ALPR setup Using Raspberry Pi 3

1. 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 Realtime.



Fig (9) License Plate Image is captured (Modal)

2. Pre-processing

Pre-processing is an important step in any image analyzing system. While not a correct pre-processing, the popularity is ineffective or could provide improper ends up in later stages. The most motive of pre-processing is to reinforce the standard of the image which will be processed for recognition. Various processes that we tend to area unit progressing to apply area unit changing RGB image to Gray scale, noise reduction and binarization of image. In python Many packages are available to perform this step.

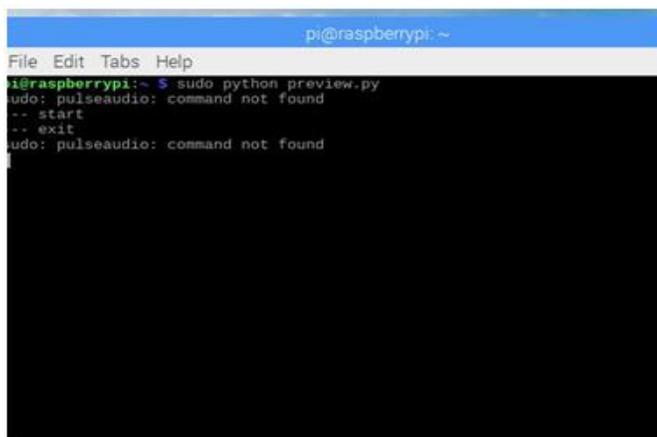


Fig (10) Raspberry Pi Window

After we enter the respected code `sudo python review.py` on the Raspberry Pi window, we get to see the 'Movement Indicator' window. Movement Indicator is nothing but a display of the motion pictures that are being captured. It displays the view through camera.

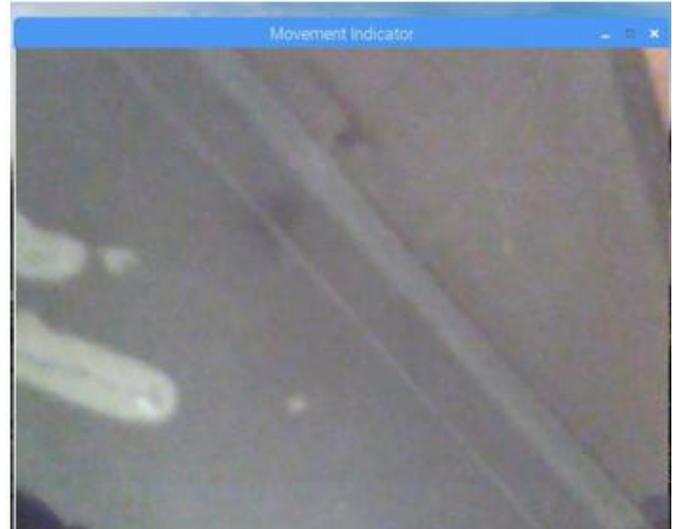


Fig (11) Movement Indicator

With the help of movement indicator, we can capture the license plate of the car that we want to classify. The following figure shows that the Realtime capturing image. That is being taken as input.



Fig (12) Image is taken as Input

3. Segmentation By ROI

Character segmentation is carried on the binary image of the extracted registration number plate. The algorithmic program used for a similar is horizontal scanning that makes use of a scanning line that finds the conditions satisfying the beginning and end position of the character

4. Features Extraction Using Principle Component Analysis

Principle Component Analysis algorithm is used for feature extraction. In PCA, Image is being converted by grey images. Here the images level is extracted based on the parameters and the matrix values.

5. Plate Recognition

In Car number plate recognition, where the characters are recognized is an important step. This can be called as Optical Character Recognition where the segmented characters from previous step are recognized. Neural network is an intelligence good engine that gain greater accuracy recognition rates and with faster in time recognition speed.

6. Classification Using Convolution Neural Network

To recognize the segmented characters efficiently, we used artificial neural network training to train our system over a dataset downloaded. After this training, we used the same neural model to recognize the characters

7. Recognized Character

The characters are recognized and displayed in the monitor, the output is the characters on the license plate.

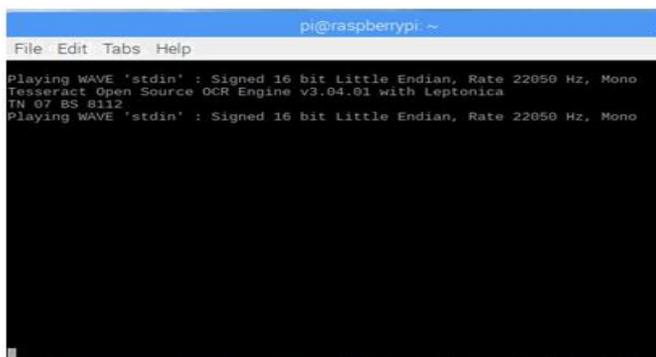


Fig (13) Output Window

The below figure shows the output window, where the characters are zoomed in. The recognized characters can be viewed by this window.

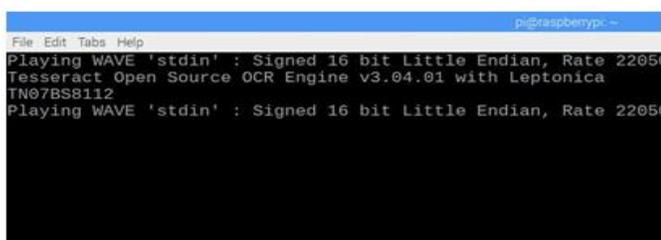


Fig (14) Output (Recognized Characters)

VIII. CONCLUSION

Thus, this research is to show that free and open source technologies are matured enough for scientific computing domains. The system works satisfactorily for wide variations in illumination conditions and different types of number plates commonly found in India. When compared to simulation process it is for sure, a better alternative to the existing proprietary systems. Currently We have proposed the algorithms for our ALPR system. In future we would implement this system on Open CV library and would also do the performance check of the system designed. the algorithms which is suitable for this application is been chosen and the process were performed and executed successfully.

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