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Vehicle Number Plate Recognition using Micro Processor

Preetaj Yadav , Laxmi Singh ,Nandlal Shah

Abstract: ***An automatic license number plate recognition system that uses image processing technology for identifying the written characters and numbers on the vehicle' license plate. The system can be used in highly secured areas to provide more safety, and can be used in parking, traffic, and other places to monitor all vehicle's number plate in a predefined area. The character is recognized by the OCR technology that is optical character recognition system. It generates the vehicle's license plate number in a text format. The recognized number from the license plate then can be used to retrieve more information about the vehicle and the owner.***

Keyword: ANPR, raspberry pi, camera, OCR, license plate

I.INTRODUCTION

An Automatic Number Plate Recognition system (i.e. ANPR) has been developed some decades ago in the UK by its Police scientific research and development branch[1]. However the capabilities of the ANPR was limited to an extent due to low computational power[2] at that time and also due to the poor image quality captured by the camera at that time. Whereas in recent time there exists advance digital cameras that are far more capable of capturing high quality images in very low sizes[3]. The basic principle of the system is to automatically detect and extract the valuable information from the vehicle's number plate from the captured image from the camera[4].

The camera is used for capturing images of any incoming or outgoing vehicle from a predefined area or building area and then a microprocessor finds the license number in the image to extract the written characters that is written on the license plate through the help of OCR[5] algorithm to convert the detected pixels from the image to a recognizable text. The ANPR [6]is very useful for government and private authorities for maintaining high security around any building or at any zone. This paper shows a system that is used for identifying the number plate of any type of vehicle and recognize the characters written on the number plate in real time. The earlier systems uses Hough transform in order to recognize the character but that method took high computational power and required very large number of training data.

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***** Correspondence Author
Dr. Preetaj Yadav*, Department of Computer Science & Engineering, Rabindranath Tagore University, Bhopal
Dr. Laxmi Singh, Department of Electronics & Communication Engineering, Rabindranath Tagore University, Bhopal
Nandlal Shah, Department of Electrical & Electronics Engineering, Rabindranath Tagore University, Bhopal

II.HARDWARE USED

The hardware that are used in the project comprises of Raspberry Pi 2 and a 5 MP pi camera unit.

A. Raspberry pi 2 – The Raspberry pi 2[7]is a credit card sized small computer developed and made by the Raspberry Pi foundation. The hardware specifications of the raspberry pi 2 are as follows:

- SoC: System on chip, Broadcom BCM2836
- CPU: a 900 MHz quad-core ARM Cortex A7
- GPU: a Broadcom Video-Core IV at 250 MHz
- Video input: a 15-pin MIPI camera interface (CSI) connector
- Video outputs: a HDMI
- Storage: Micro-SD
- Audio outputs: Analog via 3.5 mm jack; digital via HDMI and I²S
- Network: 10/100Mbps Ethernet
- Peripherals: a 17 GPIO plus specific functions, and HAT ID bus
- Power source: a 5 V via Micro-USB or GPIO header

Figure 1: A raspberry pi with the pi camera module

B. Pi Camera Module

- Fully Compatible with Both Model A and Model B Raspberry Pi

- Takes still picture with Resolution: 2592 x 1944
- Video: Supports 1080p @ 30fps, 720p @ 60fps and 640x480p at both 60/90 fps Recording
- Multi 15-pin MIPI Camera Serial Interface (CSI)
- Size: 20mm x 25mm x 9mm
- Weight: 3g

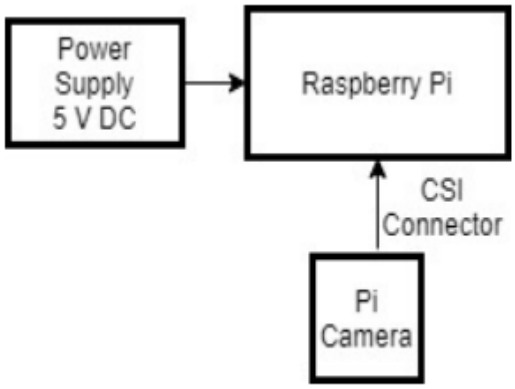

Figure 2: Raspberry pi connection with camera and power module

III. SOFTWARE USED

The main aim of the project is developing ALPR system that uses an open source library called the Open-ALPR. The Open-ALPR consists various dependencies that includes:
Open-CV:An Open Source Computer Vision library that was developed to analyze various images by using computer vision at the Intel Research Center. The whole computer vision library is written in an Optimized C/C++/python and takes the advantage from the multicore processing.
Leptonica – The leptonica is open-source image-processing and image analyzing library. Different featured operation of leptonicathat includesRasterop, Affine transformations, Pixelwise masking, blending, enhancement, arithmetic ops, etc.
Tesseract OCR – The Tesseract is an open source Optical Character Recognition engine developed under Apache 2.0 license. The OCR has ability to detect and recognize greater than 100 languages and it can also be trained to detect and recognize other languages as well. The tesseract OCR works on the machine learning platform to convert the images with text into an actual text format.

IV. METHODOLOGY

A. Detection

Detection of each input photo using a LBP algorithm that happens for only one time. The LBP finds a possible way to detect license plate region (i.e. x,y, along with width, height). Each region is then sent to next pipeline stage for further processing. Detection phase took high computational power. A GPU can be used for providing acceleration to the training for faster processing.

B. Converting image from RGB to Binary

This stage occurs multiple times in the whole process for converting the captured or given image from its original RGB state to Binary state. This image consists 3 layer of information that stores Red, green and blue pixel values of the image, these layer are then mixed together to show or present a colorful image. Thus this RGB image stores very high information and making it more time taking due to the high computational usage, hence the RGB image is converted to a Binary image that consists only 0 or 1 that is only black and white pixels for presenting the image. Thus making it faster and less computational power usage.

C. Character Detection

This phase finds all character that are written on the detected region. First of all it finds all the connected blobs in the detected region of license plate. These are then used to find and detect the straight and curved lines with width/height and top/bottom points. Then it looks for the character to recognize. This process is done many times in that region for better recognition.

D. Detection of edges on the License Plate

This step detects the edges of the license plate in order to provide the region of the license plate is occupying. The detection of the license plate defines the area larger than the area occupied by the license plate for better recognition results. This phase detects the region in a very precise manner. In this phase first step is to use Hough lines transformation method for detecting horizontal and vertical lines. It uses numerous weight in order to detect all edges and determine which line makes sense in the given image.

E. Segmentation of the Character

The isolation of the characters makes up the whole text to read from the image. This stage isolates every character recognized from the image in order to analyze it further. The recognized characters are then lined up together for making the whole text that is written on the license plate.

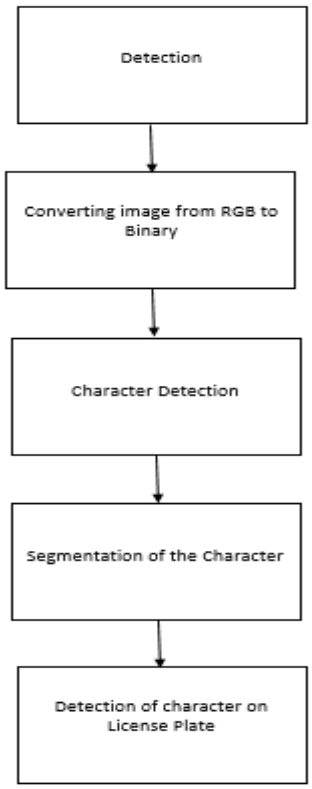

Figure 3: Showing Block Diagram of the Whole Process

V.RESULTS

A test input image is given to the system for recognition that is shown in figure 4 and output generated by the given system as shown in the figure 5.

Figure 4: Test input image

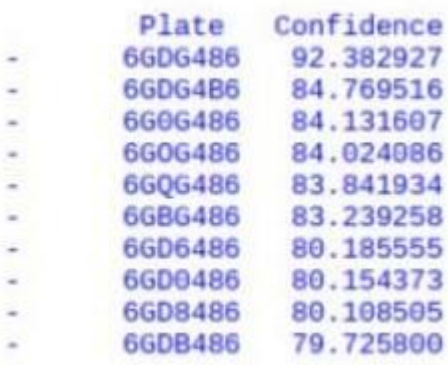

	Plate	Confidence
-	6GDG486	92.382927
-	6GDG4B6	84.769516
-	6G0G486	84.131607
-	6GOG486	84.024086
-	6GQG486	83.841934
-	6GBG486	83.239258
-	6GD6486	80.185555
-	6GD0486	80.154373
-	6GD8486	80.108505
-	6GDB486	79.725800

Figure 5: Output Image

VI.CONCLUSION

This paper presents a real time recognition of license plate number using ANPR system by OpenALPR API on the raspberry pi platform with a camera module to capture the image from the surrounding. The OpenALPR shows a stable and efficient method for recognizing the number on license plate with help of a low computational powered computer i.e. raspberry pi. The system has been trained and is now capable of detecting and recognizing new datasets with increased overall accuracy.

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