

Automatic Number Plate Detection and Recognition on an Embedded Platform

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Abstract

Since last 10 years Automobile industry is expanding. Due to rapid development there is a increase in number of vehicles drastically. As security and transport monitoring is a big problem so each vehicle required monitoring and supervision. Due to this increase, it is becoming difficult to keep track of each vehicle for purpose of law enforcement, security and advance traffic management system. By doing literature survey number of techniques were implemented for detecting number plate which have their own significance but there disadvantages has been overcome by the proposed technique that is defined and implemented in this paper. Various algorithms has been applied by taking the image of the rear no plate of the vehicle. Here I have described technique based on MATLAB Platform to detect number plate using Image Processing. The software role of ANPR system is done with the help of MATLAB and for displaying the number on LCD, ARM processor is used as hardware.

Keywords: ARM Processor, LCD, MATLAB Tool Yellow Algorithm

1. Introduction

The major need in this world is security i.e. security to public, security for military (official) purposes and security to vehicle. Vehicles have increased drastically as population is increasing. Security to vehicle is provided by a system which is capable of managing whole threats to vehicles. The system should be such that it is able to track each vehicle for the purpose of security, government record and managing law and order¹. Therefore, detection of number plate and its recognition is becoming a need in today's world. . Many states and some countries are connected with the highways or freeways and the maintenance fees for such highways and freeways are collected with the help of toll collection. At toll collection, such detection and recognition system is implemented for detecting unwanted vehicle and for maintaining account department². Including toll booths and parking structures, Advance Traffic Management Systems are installed on freeways to check speeds of moving vehicles

which is not acceptable by law. Technology and science continuously makes effort for increasing the effectiveness of ANPR system. The first objective of any county or any state is making their country a crime free state. If crime Free State is achieved by any real time system then the loss of lives and injuries reduces to minimum. Real system is nothing but ANPR⁴]. One database comparison just tells in a minute that it is an unwanted vehicle and the driver is a criminal. Another objective of any country is to reduce the damage of any infrastructure. Sometimes on catching the thief, government property suffers a lot. So simple solution is to get rid of from such loses is to use a flexible, portable and cheapest system i.e. nothing but an ANPR system. Country is made a developed or prosperous country only with a proper law. Law and order maintenance is done by maintaining the traffic rules or maintaining the vehicles record. ANPR provides both of these advantages in very less time and no hard labours are required².

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2. Methodology

2.1 ANPR for Indian Plate Recognition

Our Indian government uses feature based algorithm for detection of stolen vehicles. It is a real time embedded platform for detection of vehicles. These are called feature based because these algorithm execute on the basis of the feature of number plate. India consist of many states and each state has a different way of writing the numbers therefore such techniques plays a very important role in such country. Such a technology consists of localization, image scissoring and statistical feature. Each step has a different function like localization for extracting the ROI from the image that is captured. The captured image consists of unwanted images also so therefore there is a need to extract the region of interest with the help of localization technique. After obtaining the region of interest, the characters have to be cut for getting the numeric or alpha-numeric characters. These cutting of characters have to be cut with the special type of real time scissor called image scissoring technique. After image scissoring, characters has to be recognized, this recognition task has to be done with the statistical feature technique.

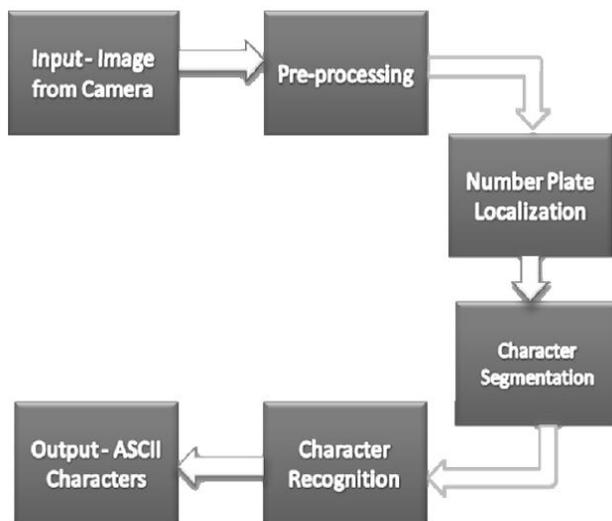


Figure 1. Feature based technique flowchart.

2.2 ANPR based on Image Processing Techniques

ANPR implementation is based on image processing techniques is divided into four phases²⁻

1. License plate area location module
2. Pre-processing module
3. Text recognition module
4. Authentication module

In this phase the issue is to when camera will be started for taking the video. This issue is resolving by placing the sensors on the road side⁷. This sensors send some signals to the system so that system will switch on the camera and sensors are placed 8 feet above the ground which is a good position.

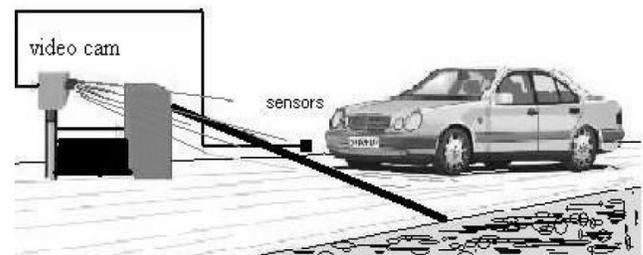


Figure 2. LPA Location module.

The procedure is as follows

1. Placing the video camera, so that input is perfectly clicked. Perfectly clicked means no unwanted environment is there in the image⁷.
2. Convert the image into gray scale. Then extract the frame from the gray scale image.
3. Identify the edges in the frame with the help of sobel edge detection method. Sobel edge detection identifies the corner detection, rectangular detection and range of rectangle. Start from step 1 again if edges not detected.
4. The third step is pre-processing, apply histogram equalization technique that smooth the rectangle of license number plate and sharpens the characters of the license number plate. This gives a threshold value.
5. The fourth step is recognition. Divide horizontal segment into three horizontal segments. It recognizes the character from the number plate or from the segments of number plate

Authentication is the fifth step in which segmented data is compared with the data stored in database.

2.3 ANPR based on FPGA

ANPR is also called intelligent transportation system. In this proposed paper, ANPR implementation based on FPGA is discussed which consist of

1. Number plate localization (NPL) - Number plate is detected [6]
2. Character Segmentation (CS) - It is a pre-processing step, where each character can be segmented.
3. Optical Character Recognition (OCR) -OCR compares the characters that are segmented with those characters which are stored in the database.

2.4 ANPR based on Neural Network

The ANPR system composed of, extracting ROI, segmentation of characters & recognition of characters⁵. This number plate is a key of interest so that it would be extracted from the whole i/p image. This number plate is processed in the next steps of character segmentation. In this part each and every character gets segmented or isolated or separated. Based on the individual feature of characters, each character is identified.

Firstly, it is necessary to know what neural network is. A neural network is a device with one or more inputs and one output. The neural network has two modes of operation:-

1. Training mode
2. Using mode

The supervised learning technique has been applied where the neuron is trained and can fire random input pattern. As per training given to the neuron if the input pattern similar to the taught one is detected then the output will be created as the present input. After training if the neuron will not recognize the taught input pattern then the decision will be taken as per the firing rule taught to the neuron.

3. Proposed Design

3.1 ANPR based on Yellow Algorithm

Different countries have different number plates so their techniques also differ for detecting the vehicles. In this way, the one country namely Sind have a different ANPR's algorithm¹. This algorithm is called yellow algorithm because number plate is in yellow color. The proposed system detects the vehicle and then captures the vehicle image. Then extraction part plays by the image segmentation. Character recognition done with the help of OCR. Then the output of OCR is compared with the

database stored in the computer. The working of OCR is combination of software and hardware models. The software model is carried out with the MATLAB 7.0.1. Software model is categorised as¹

1. Capture the image
2. Extract the plate
3. Recognition

The first step is carried out with the help of USB camera attached to the port attached to the PC. This image is in red green blue format (RGB) so that further processing is made easier. The second step of the proposed ANPR is the extraction of region of interest i.e. number plate. For this purpose we are using yellow search algorithm. This is the highlight feature of this proposed technique. This algorithm extracts the number plate efficiently. In SINDH number plate has yellow background with alphanumeric characters are in black color so it is easy for such algorithm to extract the characters.

The procedure for such algorithm is as follows:-

1. The algorithm is search for yellow pixel or that pixel which is closer to yellow value.
2. If pixel value is of yellow color then set that pixel equal to 1, otherwise set that pixel equal to 0.
3. The image obtained after search algorithm is black and white in color.

After search algorithm, filtering action is employed. There are two different filtering action is employed. The first technique is removing all white patches that are connected to border and set that pixel value equal to 0. The second method is based on the pixel count method. In this method number of white pixels counted and regions that contain less white pixel than the threshold value set that region equal to 0¹. At this moment, vehicle image is obtained. Smearing algorithm is used need to extract this image is obtained. This algorithm is looking for last and white pixels from the top left corner of the image. Smearing algorithm is used to crop that image.

Then the role of optical character recognition comes, it recognize or identify the number. The resultant output of smearing algorithm or it can be called cropped image gets inverted i.e. white pixel changes to black or black to white pixels. This leads to text is in white colour and plate background. The separation process separates the individual line. This separation process adds the each pixel value in a row. If the resultant sum of row is zero it means no text is

present or if the resultant sum of row is greater than zero that means text is present in that row¹. The first additive sum which is greater than zero states that starting of line and last additive sum states that end of line. This start and end values are behaving as limits which is used to crop the image. Line wise extraction finishes. Then column wise recognition starts and same procedure is applied.

The OCR is used to compare the output with database stored in PC.

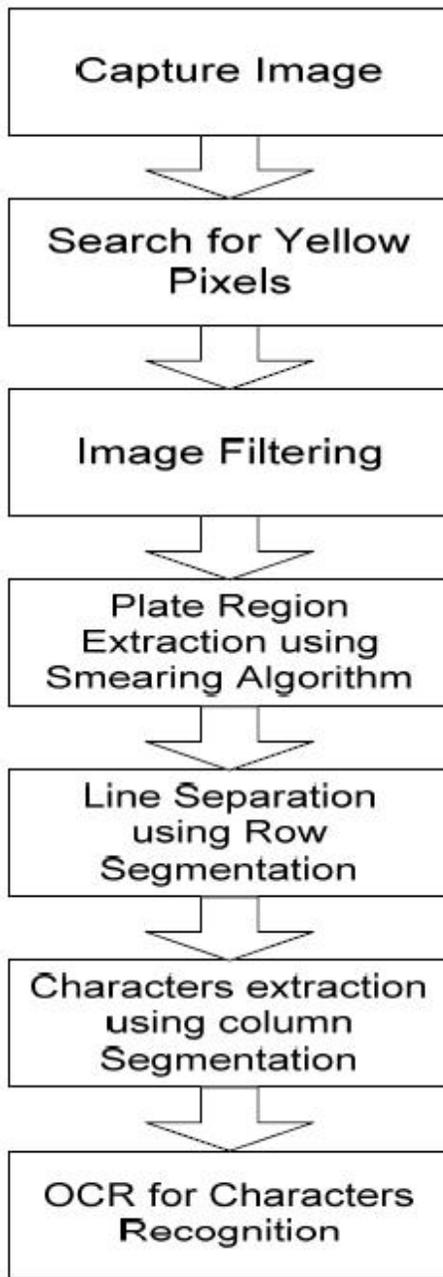


Figure 3. Flow chart for proposed technique.

4. Result and Discussion

It describes how License Plate Detection algorithm is implemented using MATLAB firstly. Initially input image of a vehicle is captured considering the ROI, then this original image is transformed into a grayscale image which is further inverted and filtered to get the output.

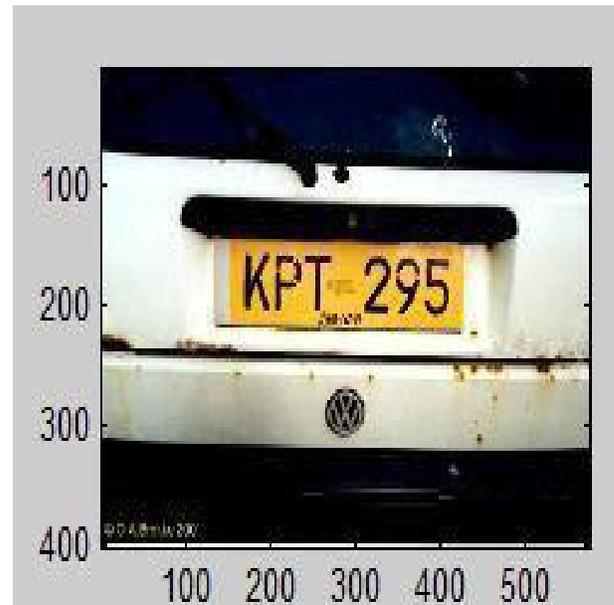


Figure 4. Original Image.

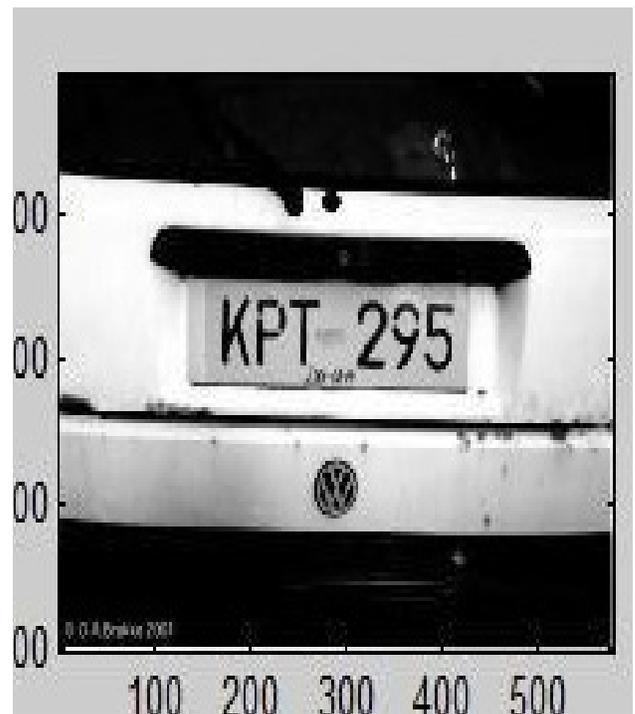


Figure 5. Grayscale image.

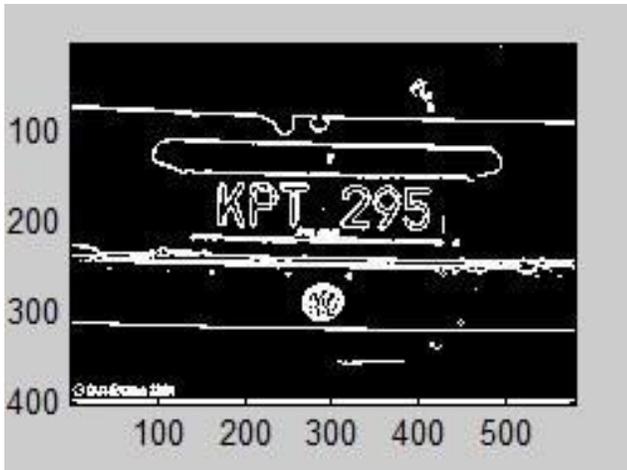


Figure 6. Inverted image.

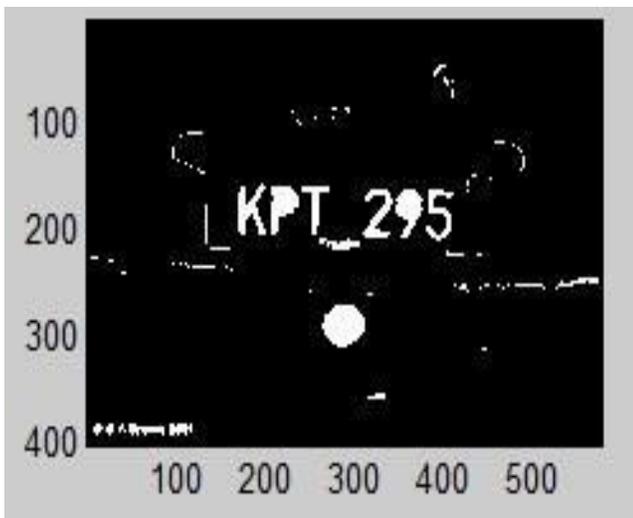


Figure 7. Filtered image.

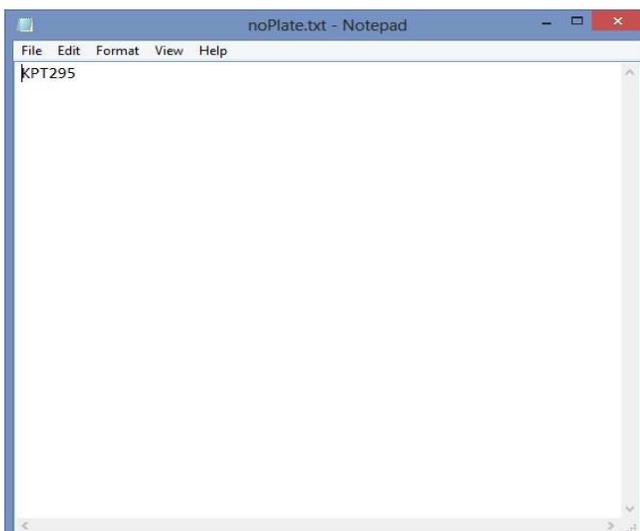


Figure 8. Number Displayed on PC.

Secondly, after the implementation of algorithm, using MATLAB Same number displayed on notepad as per fig 8 and the same code is embedded into the ARM processor serially. Further ARM processor is interface with the LCD for displaying the number as in figure 9.

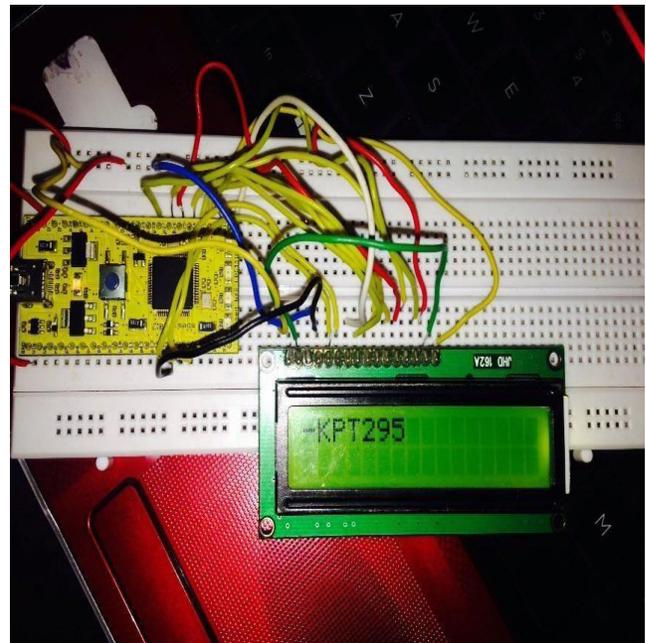


Figure 9. Interfacing of Arm Processor with LCD.

5. Conclusion

Vehicle is identified with the help of number plate and this whole identification system is called ANPR system. It is implemented on MATLAB and its testing is done on the basis of real images. The algorithm which I am using in this study is used for detecting yellow number plate only. The result shows that ANPR effectively detect in any lightning conditions. Firstly, the extraction, localization, segmentation, displaying number in notepad file is done with the help of MATLAB. Then this MATLAB code is embedded into the ARM processor serially. Further ARM processor is interface with the LCD for displaying the number.

6. References

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