

VEHICLE LICENSE PLATE RECOGNITION USING ARTIFICIAL NEURAL NETWORK WITH OTP VERIFICATION GATE CONTROL SYSTEM

Sushmitha. A¹, Varsha. K², Vidyashree. M³, Suma. B⁴, Sunitha. R⁵

^{1,2,3,4} Student, electronics and communication, RRCE, Karnataka, India

⁵ Associate professor, electronics and communication, RRCE, Karnataka, India

ABSTRACT

In this paper, License plate recognition (LPR) is presented. License plate Recognition System(LPRS) plays a vital role in small city initiatives such as traffic control, smart parking, toll management and security. Automatic Number Plate Recognition (ANPR) is an image-processing technology and an important field of research that identifies vehicles by their number plates in which the number plate information is extracted from vehicle's image or from sequence of images without direct human intervention. It is used for real time application and it has to recognize the number plates of all types under different environmental condition. In this paper we propose a new method which is robust enough to recognize the characters from the number plates with the help of artificial neural network(ANN. The extracted license number plate is matched with the database to check the authorization of the vehicle. Once the authorization is confirmed in the software then the second level authorization is confirmed by sending the OTP (One Time Password) using GSM to the predefined mobile number. The received OTP has to be entered in the keypad connected to the microcontroller, once the entered OTP matches the sent then the Magnetic Coil connected to is unlocked otherwise it will be in the locked condition. The proposed vehicle license plate recognition using artificial neural networks and remote load operation recognizes the license plate robustly and it includes two level securities one is the authentication in the software and second one is OTP generation which will improve the security.

Keyword:-VNPR: otsu method; probabilistic neural network.

1. INTRODUCTION

Vehicle license plate recognition (VLPR) is an image processing system whereby it is used to recognize the vehicles by identifying the license plate. There is a need for intelligent traffic management systems in order to cope with the constantly increasing traffic on today's roads. License Plate Recognition systems are very popular and studied all over the world. VLPR is an advanced machine vision technology used to identify vehicles by their number plates without direct human intervention. It is an important area of research due to its many applications. The some problems about images with license plates like poor image resolution, the plates is too far away, low quality camera, motion blur, poor lighting and low contrast due to overexposure, reflection or shadows, dirt on the plate. The major steps involved in the ANPR recognition system is character extraction, character segmentation, character recognition. The characters can be extracted from the image based on some features such as boundary, colour, characters on the number plate etc. The characters can be segmented based on the connectivity of the pixel by labelling the pixels, horizontal and vertical projection of the license plate,

template matching method etc. Different techniques have been proposed for the character recognition such as template matching method, neural network, support vector machine, hidden markov model etc.

2 PROPOSED METHODOLOGY

An algorithm using MATLAB recognizes the License plate based on the ANN gives a matched / mismatched condition and this status is updated to embedded unit (EU) through UART. Embedded unit designed using Microcontroller to receive the status transmitted from MATLAB unit and decode the received information. If the decoded information indicates a matched / mismatched condition, the EU takes the required action. If the number plate is matched with number plates stored in data base, an OTP(One Time Password) is sent to the predefined mobile number of the owner through GSM.

Owner should enter the OTP in the Keypad if and only if it is matched the system goes to unlock condition ,if the entered OTP is wrong the system remains in locking condition only. If the number plate is not stored in the database the system remains in locking condition and display the status in the LCD.

2.1 BLOCK DIAGRAM

Preprocessing

The preprocessing step consists of Color Transformation, Cropping, Resize and Binary image conversion.

Color Transformation: The input color image should be converted to grey scale image. There are two techniques for conversion, they are average method and weighted average method. The color image consists of three planes R (Red), G (Green) and B (Blue). The first method treats the contribution of each color as equal but in reality the contribution will be different. The equation used for color transformation is mentioned below.

$$\text{Grey pixel image} = 0.2989 * R + 0.5870 * G + 0.1140 * B$$

Where R, G and B represent the pixels belongs to the each plane respectively.

Image Crop: The input vehicle front or back image is cropped to get only the license plate portion. The position of the license plate varies as the image captured in different orientations.

Resizing of Image: The cropped image is resized to particular size of 1000X2000. The proposed algorithm works for a particular size, so the image should be resized before applying to the algorithm.

Binary Image Conversion

After resizing the image is converted to the binary image by thresholding. The thresholding is selected by the Otsu's method. The Otsu method gives better threshold compared to normal thresholding, where the threshold is fixed for every image, where as in the Otsu method the threshold varies for each of the image. It is used to maximize the inter class variance between the pixel so that the foreground object can be distinguished from the background image.

Database Creation

To recognize the characters, first the database of characters is created. The database is created from the license plate images by manual cropping and storing the each character using MATLAB. The each image is preprocessed and then the each character is cropped and written to a particular location with the folder name same as the character. The created database example is shown in the below figure.

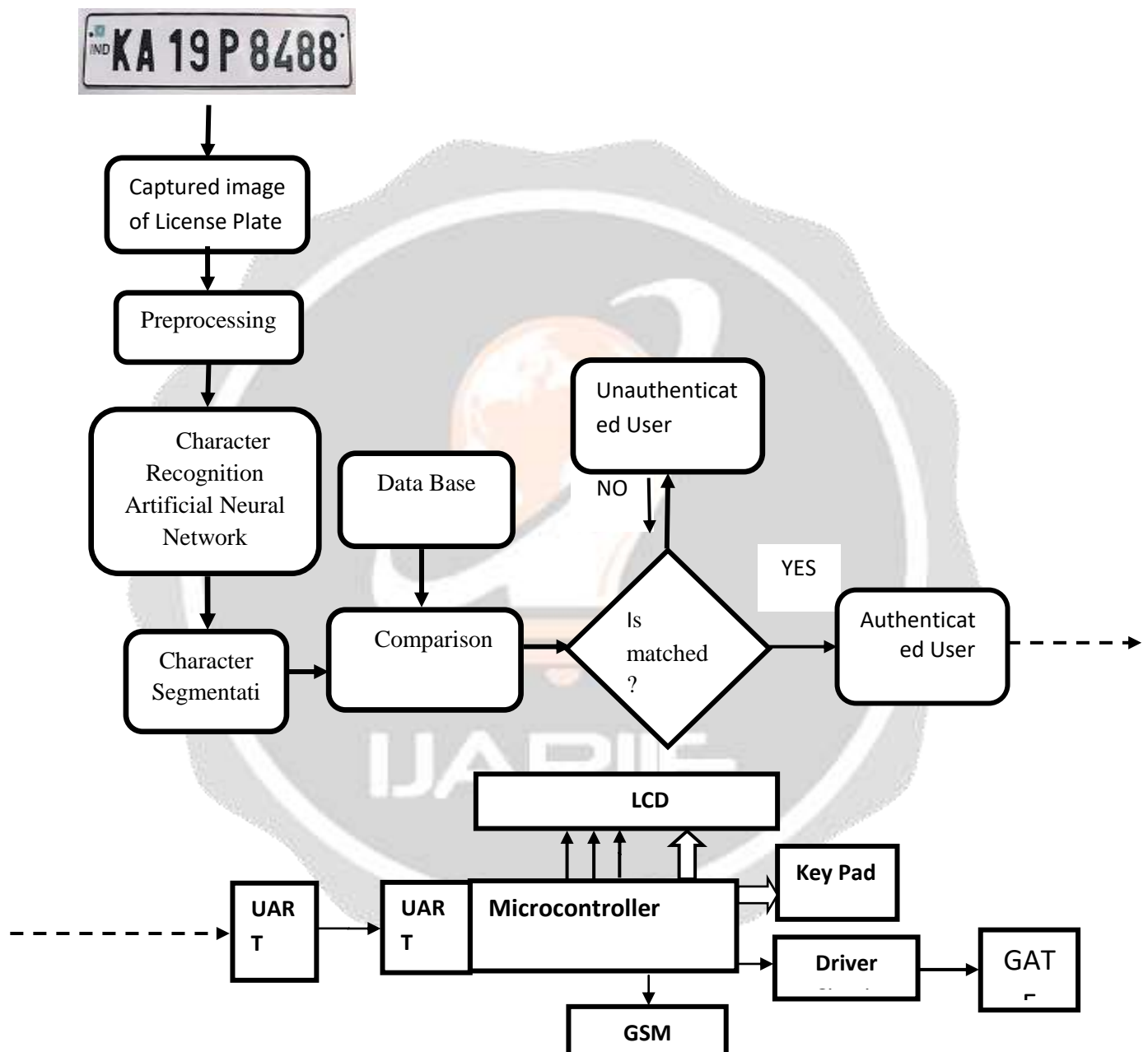


Fig.1 : Vehicle license plate recognition using Artificial Neural Network

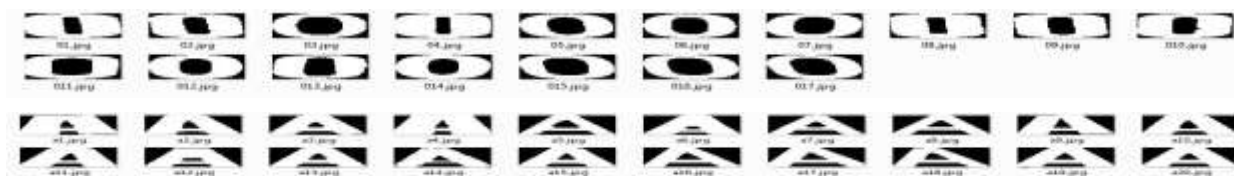


Fig-2 : The Database of Characters with the size 90X40

Character Segmentation

The character segmentation is a major step, as the accuracy of the character recognition relies on the accuracy of the character segmentation. we are using the projection method in order to segment each character from the number plate. In order to extract the each and every character, the starting and ending location of plates and top and bottom of the plate is to be determined. Addition of the individual columns and individual rows of the extracted number plate gives the horizontal and vertical projection. The average local minima of the horizontal and vertical projection are taken to threshold the horizontal and vertical projection of the image. The characters are segmented based on the x and y location of the image. The x locations of the plate is determined by change in black to white pixel for all the characters in the image which stores the value when the pixel value changes from 0 to 1. This helps us segment each and every character from the plates.

Character Recognition

The segmented characters are given as an input to the character recognition system and the output is the license plate number. The character recognition involves a lot of challenges due to the different size of the segmented characters, breaks occurring in certain characters etc. Template matching method is one of the techniques used for optical character recognition. It can only recognize the character that shows a similarity with the standard template created for each character in the database. In this paper artificial neural network is used to improve the performance of the character recognition.

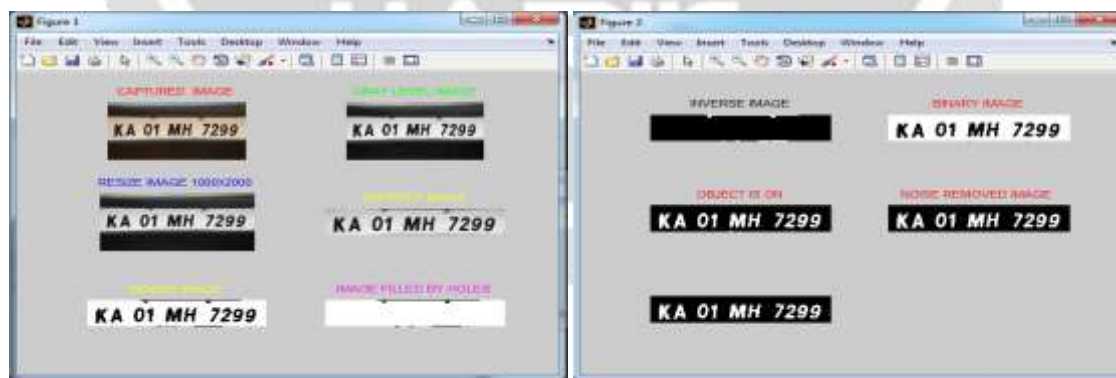


Fig-3: preprocessing image

Artificial neural network

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous system. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Neural networks are consists of several processing elements called neurons operating in parallel. These elements are inspired by biological nervous systems. The neural network

can be trained to perform a particular function by adjusting the values of the connections (weights) between elements.

Probabilistic Neural network

Probabilistic neural networks can be used for classification problems as shown in fig.4. The first layer computes the distance between the input vector and the trained vectors and produces a vector how close the input to the training vector. The second layer sums these contributions for each class of inputs to produce as its net output a vector of probabilities. The competitive layer known as output layer picks the maximum of these probabilities, and produces a 1 for that class and a 0 for the other classes. The graphical representation of probabilistic neural network is shown below. In this paper we have trained around 190 characters which are segmented from the image taken from the database. Pre-processing is done before training the character. The segmented characters are resized into 90×40. Each and every character is trained using the neural network. After training, the segmented characters are given to the network for testing which recognize the character.

Comparison

Once the characters are detected using ANN, then the license plate number is compared with database license plate stored in the excel sheet. Once the license plate is matched or mismatched, the result is displayed. The obtained result is transferred to the microcontroller using serial communication.

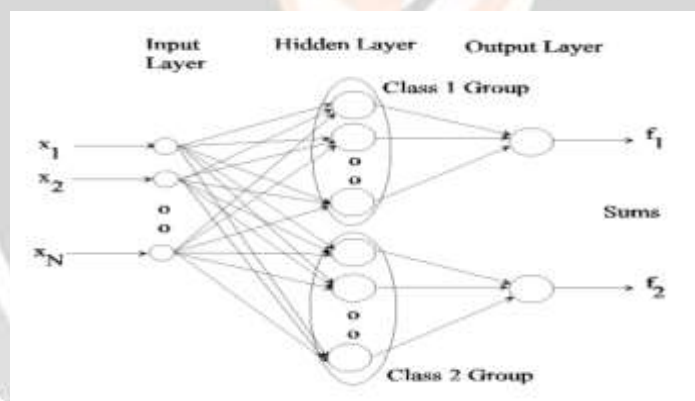


Fig-4: Probabilistic Neural Network

Microcontroller(P89V51RD2)

8 bit 80C51, 5V low power, 64kB Flash microcontroller with 1 kB RAM. The key feature of the P89V51RD2 is its X2 mode option. The design engineer can choose to run the application with the conventional 80C51 clock rate(12 clocks per machine cycle) or select X2 mode to achieve a twice the throughput at the same frequency.

UART

Uart stands for Universal Asynchronous Receiver/Transmitter is a computer hardware device for UART protocol. It's not an a communication protocol like SPI and I2C, but a physical circuit in a microcontroller.

GSM

GSM is a standard developed by the European telecommunications standards institute (ETSI) to describe the protocol for second – generation digital cellular networks used by mobiles phones.

3. EXPECTED RESULTS

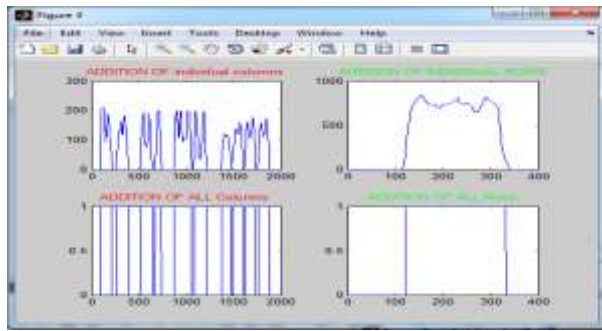


Fig – 5: vertical and horizontal projection of image

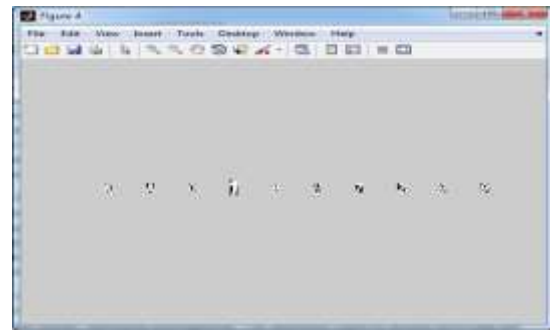


Fig-6 : Segmented character

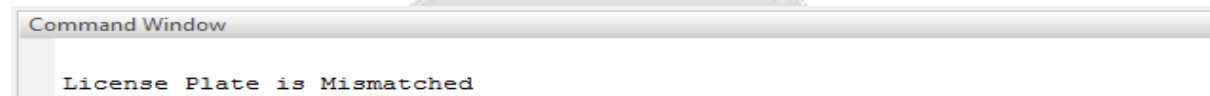


Fig-7 : Output of Mismatched condition of License Plate Recognition

All the characters are recognized using the neural network. The extraction, segmentation and recognition of the character is successfully implemented. The VNPR information is send to the microcontroller by using serial uart communication .

4. CONCLUSION

From this paper ,we able to conclude that VNPR is successfully implemented for the front and back view of the vehicle's number plate under restricting environment and it takes lot of time due to the training of the number of samples. And if vehicle is authorized owner should enter the OTP, finally the gate will be opened.

5. REFERENCES

- [1] Divyagilly, Dr. Kumudharaimond , “License Plate Recognition- A Template Matching Method ”, International Journal of Engineering Research and Applications ,Vol. 3, Issue 2, March -April 2013.
- [2] Isack Bulugu, “Algorithm for License Plate Localization and Recognition for Tanzania Car Plate Numbers,” International Journal of Science and Research (IJSR), Vol. 2 Issue 5, May 2013.
- [3] Lucky Kodwani & Sukadev Meher , “Automatic License Plate Recognition in Real Time Videos using Visual Surveillance Techniques”, ITSI Transactions on Electrical and Electronics Engineering (ITSI-TEEE) : 2320 8945, Volume -1, Issue -6, 2013 .
- [4] Bharat Bhushan , “License Plate Recognition System using Neural Networks and Multi thresholding Technique,” International Journal of Computer Applications (0975 – 8887), Volume 84– No 5,December 2013.
- [5] Anuja P. Nagare, “License plate character recognition system using neural network,” International Journal of Computer Applications (0975 – 8887) ,Volume 25–No.10, July 2011.
- [6] Anish Lazrus, Siddhartha Choubey, “ A Robust Method of License Plate Recognition using ANN,” International Journal of Computer Science and Information Technologies, Vol. 2 (4) , 1494- 1497,2011.
- [7] V.Karthikeyan, R.Sindhu , “Vehicle license plate character segmentation – A study,” International Journal of Computer and Electronics Research, volume 2, issue 1, February ,2013.
- [8] Er. Kavneet Kaur, Vijay Kumar Banga, “Number plate recognition using ocr technique”, International Journal of Research in Engineering and Technology, Volume. 02, Issue. 09, Sep-2013.