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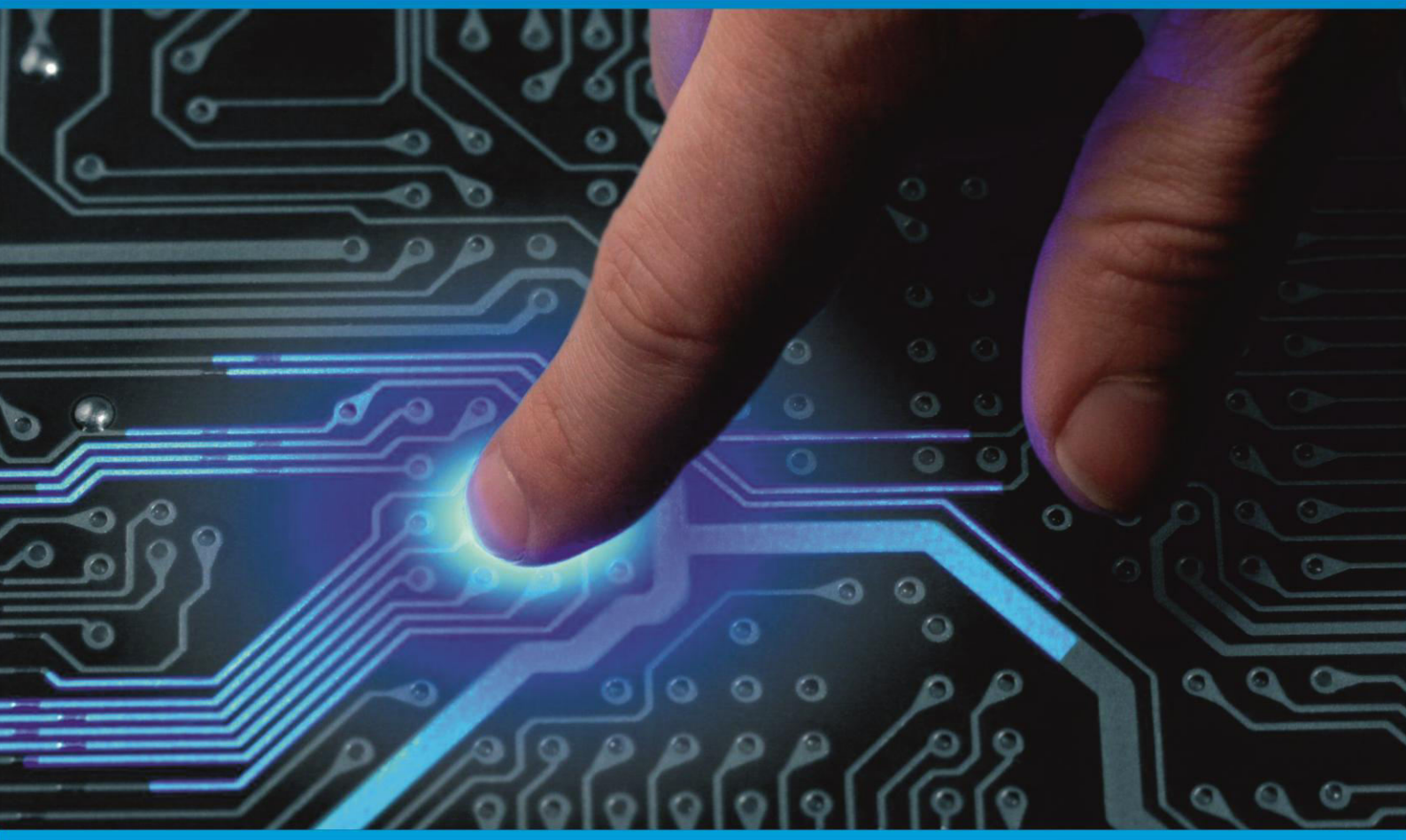

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Automatic Number Plate Recognition for Gate Access Control

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ABSTRACT: Automatic Number Plate Recognition (ANPR) is a real time embedded system which automatically recognizes the license number of vehicles. In this paper, the task of recognizing number plate Residential Parking is considered. The system consists of integration of algorithms like: 1.'Scan line algorithm for localization and segmentation'. 2.'Template matching' for pattern recognization'. Currently only manual recording systems are used and ANPR has not been commercially implemented for residential parking in India.

KEYWORDS: Pre-processing, Number Plate Localization, Scan Line Algorithm, Character Segmentation, Template Matching, Character Recognition.

I. INTRODUCTION

The ANPR was invented in 1976 at the Police Scientific Development Branch in the UK. Prototype systems were working by 1979, and contracts were let to produce industrial systems, first at EMI Electronics, and then at Computer Recognition Systems (CRS) in Wokingham, UK. Early trial systems were deployed on the A1 road and at the Dartford Tunnel. The first arrest through detection of a stolen car was made in 1981.

ANPR is a mass surveillance system that captures the image of vehicles and recognizes their license number. In this paper, the task of recognizing number plate for Residential Parking is considered. The system consists of integration of algorithms like: 1.'Scan line algorithm for localization and segmentation'. 2.'Template matching' for pattern recognization'.

ANPR systems have been implemented in many countries like Australia, Korea and few others. Strict implementation of license plate standards in these countries has helped the early development of ANPR systems. These systems use standard features of the license plates such as: dimensions of plate, border for the plate, color and font of characters, etc. help to localize the number plate easily and identify the license number of the vehicle.Wide variations are found in terms of font types,script, size, placement and color of the number plates.In few cases, other unwanted decorations are present on the number plate.

Also, unlike other countries, no special features are available on Indian number plates to ease their recognition process. Hence, currently only manual recording systems are used and ANPR has not been commercially implemented for residential parking in India.

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II. PROPOSED SYSTEM

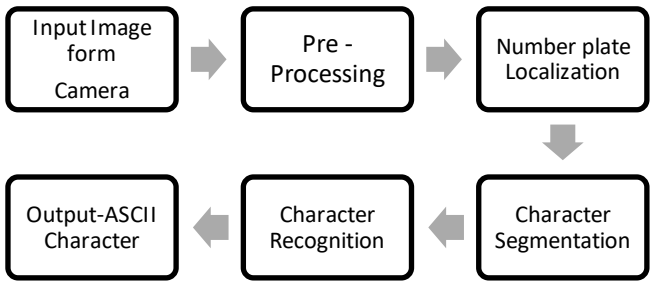

Figure 1: Software flow of the system

A rear image of a vehicle is captured and processed using various algorithms. Initially, the number plate area is localized using a novel'Scan line algorithm'. This algorithm satisfactorily eliminates all the background noise and preserves only the number plate area in the image. This area is then segmented into individual characters using Scan line algorithm. After this step, the characters are extracted from the gray-sale image and each character is enhanced using some character enhancement techniques. These characters are given to the character recognition module, which uses 'Template matching' to recognize the characters.

III. SYSTEM OVERVIEW

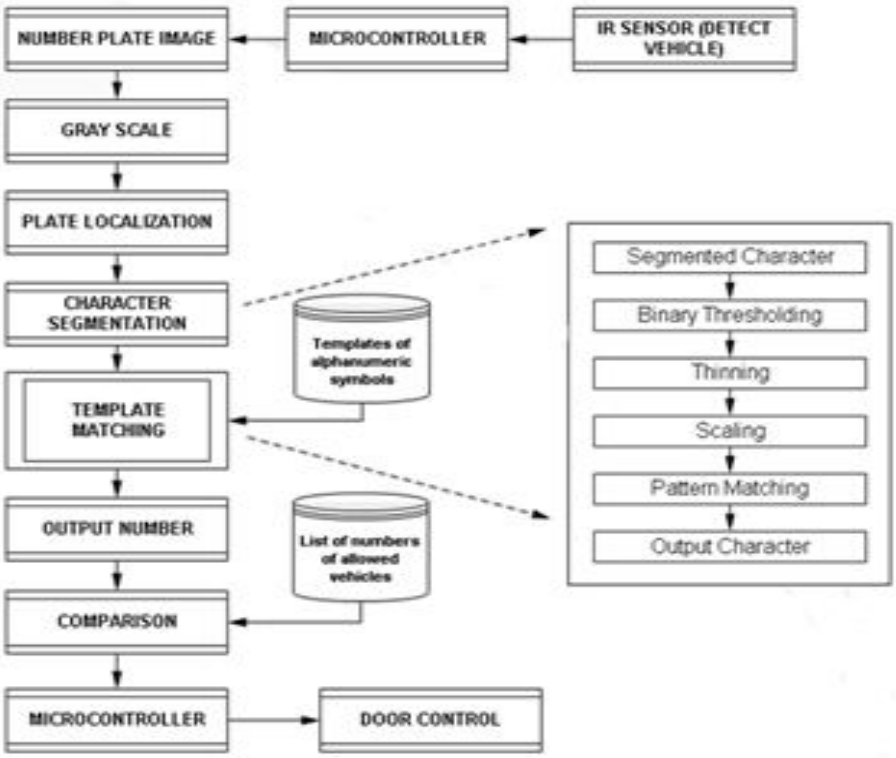

Figure 2: System Overview

Vehicle detection module detects the presence of vehicle by using inductive sensors in which metal wire loop is placed beneath the road. When a vehicle crosses the loop, there is change in induced current which detects presence of vehicle. As a result the microcontroller is interrupted and it triggers the IR to capture the image (fig. 2).

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The captured image is processed by microcontroller to recognize license number of vehicle by employing various image processing algorithms, as mentioned earlier. The microcontroller gives the license number in ASCII format, using which all relevant details about the vehicle are obtained from a centralized database.

IV. PRE-PROCESSING

For pre-processing, the input image (fig.3) is converted to gray-scale(fig. 4) image using 'Luminance Formula'. The input gray-scale image is adaptively converted into binary image (fig. 5) using 'Otsu's method'.

Figure 3: Input Image

Figure 4: Input gray-scale image.

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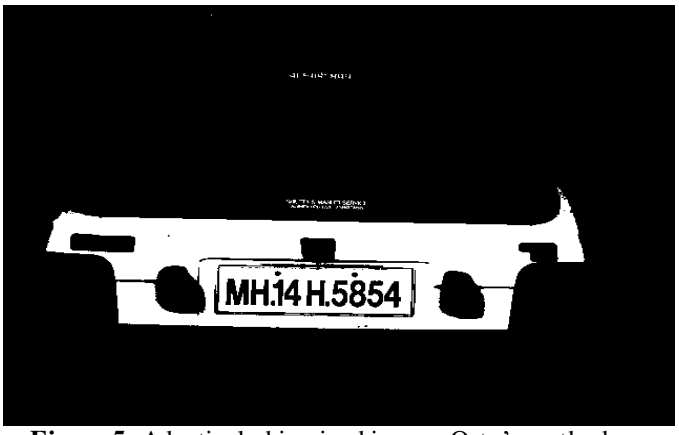

Figure 5: Adaptively binarized image: Ostu's method.

V. NUMBER PLATE LOCATIZATION

In number plate localization 'SCAN LINE ALGORITHM' is used which is as follows:

STEP I: Detect the clusters of transitions together in succession .

STEP II: Find the mid line that does not contain single black pixel.

STEP III: Search all the possible rectangles. These rectangles are drawn when detected.

STEP IV: Remove all the invalid rectangles. For the rectangles which do not have enough black pixels, calculate average width that lie near to center of rectangle.

STEP V:Drop rectangles that are double the average size, that have their centers on extreme left and right, that are more away from nearest rectangle

Figure 6: Localized Plate

VI. CHARACTER SEGMENTATION

In character segmentation also 'SCAN LINE ALGORITHM' is used. The array of elements is considered. Each element of array corresponds to one column of the image and its value equals the sum of the pixel values of that column. The horizontal profile show dips because of the inter-character spacing in the number plate. These dips need to be identified. The distance between consecutive dips gives the length of one character. All the characters from the number plate thus can be extracted.

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Figure 7: Number Plate after Segmentation

VII. CHARACTER RECOGNIZATION

We implement Character Recognition using Artificial Neural Network(ANN)[6]. In this process, the input image is sampled into a binary window which forms the input to the recognition system. In figure(8.b), the alphabet A has been digitized into 6X8=48 digital cells, each having a single color, either black or white. It becomes important for us to encode this information in a form meaningful to a computer. For this, we assign a value +1 to each black pixel and 0 to each white pixel and create the binary image matrix I which is shown in the Fig. (8.c).

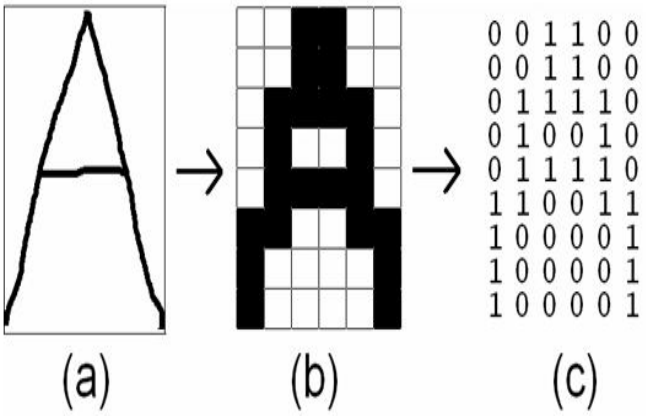

Figure 8: Image Digitization

Various characters are taught to the network in a 3 supervised manner. A character is presented to the system and is assigned a particular label. Several variant patterns of the same character are taught to the network under the same label. Hence the network learns various possible variations of a single pattern and becomes adaptive in nature during the training process. The following figure shows the digitization of three input patterns representing S that are presented to the system for it to learn.

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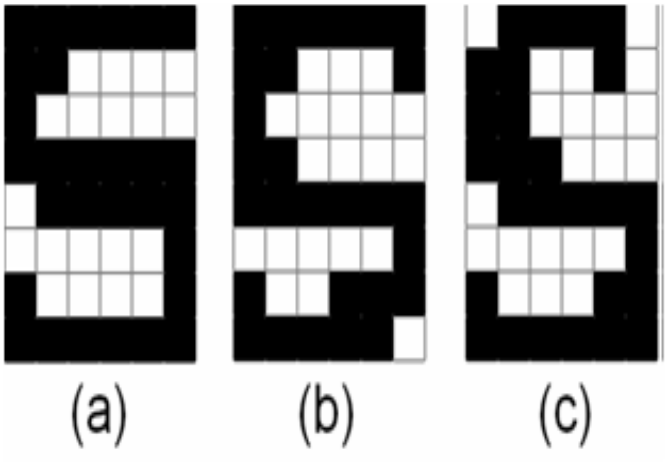

Figure 9: Learning Mechanism

Fig. (9) gives the weight matrix,corresponding to the alphabet S. The matrix is has been updated thrice to learn the alphabet S. It should be noted that this matrix is specific to the alphabet S alone. Other characters shall each have a corresponding weight matrix. The matrix-elements with higher (positive) values are the ones which stand for the most commonly occurring image-pixels. The elements with lesser or negative values stand for pixels which appear less frequently in the images. Neural networks learn through such updating of their weights. Each time, the weights are adjusted in such a manner as to give an output closer to the desired output than before.

VIII. RESULT ANALYSIS

	NO. OF INPUT IMAGE	NO. OF IMAGE RECOGNIZED	NO. OF IMAGE NOT RECOGNIZED	ACCURACY
INITIAL IMAGES	**10**	**4**	**6**	**40%**
DATABASE IMAGES	**15**	**15**	**-----**	**100%**
UNUSED IMAGES	**10**	**7**	**3**	**70%**

Table1: Result Analysis

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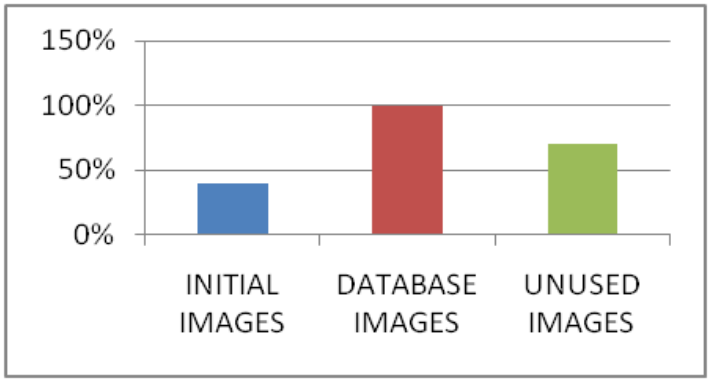

Figure 10: Graphical Representation of Result Analysis

IX. CONCLUSION

In this proposed model pre-processing and number plate localization is performed by using "Otsu"s methods" and "Scan Line Algorithm" respectively. It provides satisfactory results for a wide variation in selected for binarization. Character segmentation a new "Horizontal Scan Line" algorithm is used. It gives reliability and time optimization. Finally the character recognization performs using ANN. This application is very useful in government as well as big private organizations. But ANPR system still has some restriction such parameter like environmental effects, script on the number plate and skew in image This can be removed by enhancing the further algorithms.

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BIOGRAPHY

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