Compressed Number Plate Templates Transmission in ANPR System

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Abstract— In ANPR the Extracted license plates area unit divided into individual characters by employing a region-based technique. The popularity theme combines adaptive reiterative thresholding with a guide matching rule. The strategy is powerful to illumination, character size and thickness, skew and tiny character breaks. The main blessings of this method is its period of time capability which it doesn't need any extra detector input (e.g. from IR sensors) except a video stream. This method is evaluated on an outsized variety of car pictures and videos. The system is additionally computationally terribly economical and it's appropriate for others connected image recognition applications. This system has big selection of applications akin to access management, tolling, petrol, control, finding taken cars, etc. what is more, this technology doesn't would like any installation on cars, akin to transmitter or communicator.

Key words: IR Sensors, ANPR, Extracted License Plates

I. INTRODUCTION

The escalating increase of contemporary urban and national road networks over the last three decades emerged the need of efficient monitoring and management of road traffic. Conventional techniques for traffic measurements, such as inductive loops, sensors or EM microwave detectors, suffer from serious shortcomings, expensive to install, they demand traffic disruption during installation or maintenance, they are bulky and they are unable to detect slow or temporary stop vehicles. On the contrary, systems that are based on video are easy to install, use the existing infrastructure of traffic surveillance. Furthermore, they can be easily upgraded and they offer the flexibility to redesign the system and its functionality by simply changing the system algorithms. Those systems allow measurement of vehicle's speed, counting the number of vehicles, classification of vehicles, and the identification of traffic incidents (such as accidents or heavy congestion).There is a wide variety of systems based on video and image processing employing different methodologies to detect vehicles and objects.

II. OVERVIEW OF THE PROPOSED MODEL

A typical surveillance system consists of a traffic camera network, which processes captured traffic video on-site and transmits the extracted parameters in real time. Here our focus is on the study of algorithmic part of such a system. In this thesis, we present full-featured vehicle detection, tracking and license plate recognition system framework, particularly designed to work on video footage [5]. This system mainly having four modules

- Video Acquisition
- Vehicle detection and tracking
- License plate extraction
- Character recognition unit

A. Automatic Number Plate Recognition

Automatic number plate recognition (ANPR) is a mass surveillance method that uses character recognition on images to read vehicle registration plates [1]. They can use existing closed-circuit television or road rule enforcement cameras, or ones specifically designed for the task. They are used by various police forces and as a method of electronic toll collection on pay per use roads and cataloguing the movements of traffic or individuals and also for traffic law enforcement. ANPR can be used to store the images captured by the cameras as well as the text from the license plate. ANPR technology tends to be region specific, owing to plate variation from place to place. Concerns about these systems have centred on privacy fears of government tracking citizens' movements, mis-identification, high error rates, and increased government spending [9].

The system is designed for real time videos where a camera is used for continuous recording of videos. The view of camera or the area covered by camera is fixed between entry zones and exist zone. Each frame is continuously processed to check the presence of a vehicle. A defined connected component area is taken as threshold; if the detected area is above that threshold value then it will be recognized as a vehicle and will be tracked [4]. A distance is defined between the vehicle and the camera and when the vehicle comes within that range i.e. vehicle's connected component area is maximum, these frames of video are passed to license plate recognition algorithm. After that recognition of character takes place and data is stored and compare with data base.

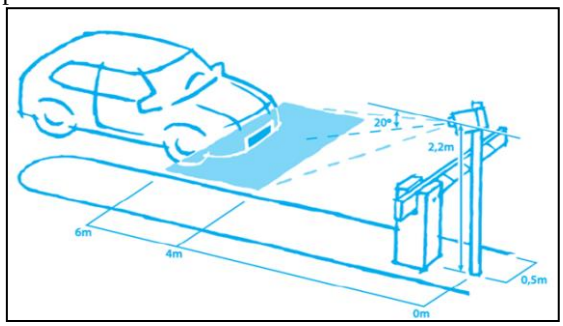


Fig. 1: ANPR System Implementation in Practical Scenario

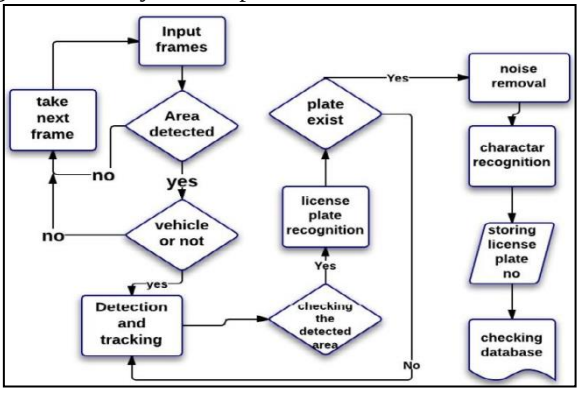


Fig. 2: Flow Chart of the System

This Proposed System having mainly four modules:

1) Video Acquisition

In this module videos are taken by the static camera situated at traffic scenario. A camera network that has the ability to transmit images in real time to a central operational centre. The processing of the images can be carried out on-site saving valuable network bandwidth as it transmits only the outcome of the calculations. The whole process can also be performed either in real time video streaming from an operational centre or in already stored & Material

2) Vehicle Detection & Tracking

In vehicle detection we have simulated various background subtraction techniques available in the literature. The background subtraction technique should overcome the problems of varying illumination condition, background clutter, camouflage and shadow. Motion segmentation of foreground object has been done in real time. It's hard to get this entire problem solved in one background subtraction technique. So the idea was to simulate and evaluate their performance on various video data taken in different situations [1, 2].

3) License Plate Extraction

License plates are first located in current frame then they are extracted using various available techniques in the literature based on Hough Transform method, Template matching technique, Region growing algorithm, Histogram Approach and Edge Detection Approach [1,2].

4) Character Extraction

Images of the extracted plates are the input to this module. Here first license plate image is cropped in lines, and then characters are segmented and recognized.

The result of localization given by Mr. Bhavin V Kakani gave accuracy of 96.7% whereas the character recognition technique yielded 92.2% accuracy [1]. The complete Automatic Number Plate Recognition System Gave 94.45%. Upon 300 odd images of vehicles at different viewing angles and environmental conditions. Using Artificial Neural network the system showed better results on single set of templates. The training period taken by ANN was 12 seconds and once trained, it recognizes the test samples fed to the network efficiently.

III. PROPOSED METHODOLOGY

In this paper he overviewed the problem of Vehicle Number Plate recognition with various types of Number Plates. He proposed a correlation based character recognition system, which provides result with significant accuracy, which is very simple to implement. The system has been tested on MATLAB environment with satisfactory results. Most of the time the input image taken from low-resolution mobile camera which does not have very good quality image output [5,7]. Given a better device the result should increase in accuracy significantly.

A. Pre-Processing & Localization

For efficient output the image is altered intensely in this stage. Color image is converted to HSV color space which is two dimensional in nature. The advantage of HSV color model is we can neglect the effect of shadow in an image. The Saturation value is extracted that gives us the image by neglecting the shadows. It is then transformed to binary image using edge detection technique for better processing.

Fig. 3: The RGB & HSV Colour Image

B. Edge Detection

Edges in an image are calculated by periodic convolution of function f with specific types of matrix m [8]:

$$f'(x,y) = f(x,y) \circledast \mathbf{m}[x,y] = \sum_{i=0}^{w-1}\sum_{j=0}^{h-1} f(x,y)\cdot \mathbf{m}\left[\mathrm{mod}_w(x-i), \mathrm{mod}_h(y-j)\right]$$

Here w and h are dimensions of the image represented by function f.

C. Localization

It is necessary for the Localization algorithm to yield high accuracy as the Character Recognition Technique would be ineffective if the Number Plate is not localized correctly. Two techniques are utilized and compared for localization of number plate.

D. SKEW Correction & Segmentation

The main challenge in image deskewing is to calculate the angle at which the number plate is rotated or skewed. Hough transform is used to extract shapes and features of that specific shape out of the image as a special operation.

E. Optical Character Recognition Using Feature Extraction

This algorithm uses the fact that every character has unique set of features such as corners, ending and bifurcations. Inheriting these features makes the algorithm fast and less complicated. The input character is converted to edge image and the features are extracted from it in iterative process. These features are then stored in the feature vector with the number, direction and state of the features. It is explained detail in [3, 4].

Next the character feature is obtained by a unique width analysis technique. Every character have unique lines or slopes when observed from the boundary of the segmented character image. This methodology uses this feature to recognize the characters. After the character is segmented out, it is resized in such a way that the character touches from all sides to the boundary.

ALPHABET	TRIANGLE	SQUARE	CORNER	PORE	END	POSITION OF ENDS
0	0	0	0	1	0	0
1	1	0	1	0	3	LEFT, LEFT, RIGHT
2	0	0	1	0	2	LEFT, RIGHT
3	1	0	0	0	3	LEFT, LEFT, LEFT
4	0	1	2	1	2	RIGHT, BOTTOM
5	0	0	2	0	2	LEFT, RIGHT
6	0	0	0	1	1	RIGHT
7	0	0	1	0	2	LEFT, BOTTOM
8	0	1	0	2	0	0
9	0	0	0	1	1	LEFT
A	2	0	1	1	2	BOTTOM, BOTTOM
B	2	0	2	2	0	0
C	0	0	0	0	2	RIGHT, RIGHT
D	0	0	2	1	0	0
E	1	0	2	0	3	RIGHT, RIGHT, RIGHT
F	1	0	1	0	3	RIGHT, RIGHT, BOTTOM
G	0	0	2	0	2	LEFT, RIGHT, BOTTOM
H	2	0	0	0	4	TOP, TOP, BOTTOM, BOTTOM
I	2	0	0	0	4	LEFT, LEFT, RIGHT, RIGHT
J	0	0	1	0	2	LEFT, LEFT
K	0	1	0	0	4	TOP, TOP, BOTTOM, BOTTOM
L	0	0	1	0	2	TOP, RIGHT
M	0	0	3	0	2	BOTTOM, BOTTOM
N	0	0	2	0	2	TOP, BOTTOM
O	0	0	0	1	0	0
P	1	0	1	1	1	BOTTOM
Q	1	0	0	1	1	BOTTOM
R	2	0	1	1	2	BOTTOM, BOTTOM
S	0	0	0	0	2	LEFT, RIGHT
T	1	0	0	0	3	LEFT, RIGHT, BOTTOM
U	0	0	0	0	2	TOP, TOP
V	0	0	1	0	2	TOP, TOP
W	0	0	3	0	2	TOP, TOP
X	0	1	0	0	4	TOP, TOP, BOTTOM, BOTTOM
Y	1	0	0	0	3	TOP, TOP, BOTTOM
Z	0	0	2	0	2	LEFT, RIGHT

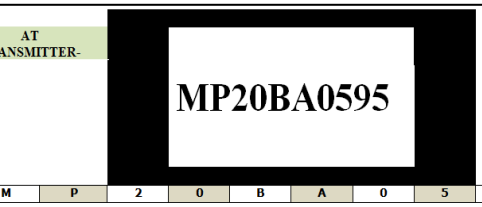
Table 1: Recognition of Alphabets or Numeric Digits from Image

F. Conversion of Alphabets or Numeric Digits into Binary Format & Vice Versa

Digit	S. No.	Binary of S. No.	Full Digit
0	1	1	00000001
1	2	10	00000010
2	3	11	00000011
3	4	100	00000100
4	5	101	00000101
5	6	110	00000110
6	7	111	00000111
7	8	1000	00001000
8	9	1001	00001001
9	10	1010	00001010
A	11	1011	00001011
B	12	1100	00001100
C	13	1101	00001101
D	14	1110	00001110
E	15	1111	00001111
F	16	10000	00010000
G	17	10001	00010001
H	18	10010	00010010
I	19	10011	00010011
J	20	10100	00010101
K	21	10101	00010101
L	22	10110	00010110
M	23	10111	00010111
N	24	11000	00011000
O	25	11001	00011001
P	26	11010	00011010
Q	27	11011	00011011
R	28	11100	00011100
S	29	11101	00011101
T	30	11110	00011110
U	31	11111	00011111
V	32	100000	00100000
W	33	100001	00100001
X	34	100010	00100010
Y	35	100011	00100011
Z	36	100100	00100100

Table 2: Conversion of Alphabets or Numeric Digits into Binary Format

AT TRANSMITTER-



M	P	2	0	B	A	0	5	9	5
23	26	3	1	12	11	1	6	10	6
00010111	00011010	00000011	00000001	00001100	00001011	00000001	00000110	00001010	00000111
00010111	00011010	00000011	00000001	00001100	00001011	00000001	00000110	00001010	00000111

AT RECEIVER-

00010111	00011010	00000011	00000001	00001100	00001011	00000001	00000110	00001010	00000111
00010111	00011010	00000011	00000001	00001100	00001011	00000001	00000110	00001010	00000111
23	26	3	1	12	11	1	6	10	6
M	P	2	0	B	A	0	5	9	5

Table 3:

Now this number is feed into the Android application or web site of RTO which will give the detail of the owner of the Vehicle. If the Character is not found it means the number plate is not following the rules of Traffic or there is no number in the plate or there is no plate.

G. Entropy Calculation

Let, the traffic in a given area is monitored for 10 days. All the digits are monitored and recorded in daily basis. Following table describes the frequency (repetition) of the digits. Their probabilities are also calculated.

S. No.	Digits	Frequencies per 10 days	Probabilities
1	A	70, 80, 83, 85, 86, 88, 90	7
2	B	70, 80, 83, 85, 86, 88, 91	7
3	C	60, 70, 85, 20, 15, 22	6
4	D	70, 80, 83, 85, 86, 88, 91, 20, 89, 90	10
5	E	21, 25, 5, 12, 20	5
6	F	10, 14, 18, 20, 29, 8, 6	7
7	G	17, 48	2
8	H	57, 61, 68, 11, 76	5
9	I	16, 98, 89, 23	4
10	J	26	1
11	K	25, 37	2
12	L	35, 45, 41	3
13	M	12, 15, 98, 54, 61	5
14	N	24, 28, 31, 83, 57, 84, 76, 68	8
15	O	21, 25, 5, 12, 20, 16, 98, 89, 23	9
16	P	21, 25, 5, 12	4
17	Q	10, 14, 18, 20, 29, 48	6
18	R	88, 91, 20, 89, 90, 80, 83, 85, 86, 88	10
19	S	25, 37, 16, 98, 31, 83, 57, 84, 76	9
20	T	71, 25, 58, 87, 65, 56, 15, 52	8
21	U	42, 25, 32, 12, 58, 58, 46, 53, 92	9
22	V	75, 48, 42, 17, 16	5
23	W	61, 25, 23, 32, 54, 86	6
24	X	78, 2	2
25	Y	5, 56, 32, 25, 45, 67, 82	7
26	Z	1, 15	2
27	0	62, 32, 20, 34, 80, 6, 9, 83, 21	9
28	1	8, 65, 3	3
29	2	45, 54, 75, 32	4
30	3	65, 85, 86, 97, 51, 16	6
31	4	32, 30, 75, 68, 84, 53, 12, 8, 40	9
32	5	67, 86, 35, 12, 9	5
33	6	9, 10, 15, 46, 54, 30, 38	7
34	7	78, 45, 53, 27, 73, 10	6
35	8	32, 28, 29	3
36	9	75, 48, 42, 17, 16, 46, 54, 30, 38	9

Table 4:

Now apply Probability theory on the above table.

	Proabability (PK)		log(Pk)	PK * log(Pk)
D	10	0.01	6.6438	0.066438
R	10	0.01	6.6438	0.066438
O	9	0.009	6.795801808	0.061162216
S	9	0.009	6.795801808	0.061162216
U	9	0.009	6.795801808	0.061162216
0	9	0.009	6.795801808	0.061162216
4	9	0.009	6.795801808	0.061162216
9	9	0.009	6.795801808	0.061162216
N	8	0.008	6.965725372	0.055725803
T	8	0.008	6.965725372	0.055725803
A	7	0.007	7.158368821	0.050108582
B	7	0.007	7.158368821	0.050108582
F	7	0.007	7.158368821	0.050108582
Y	7	0.007	7.158368821	0.050108582
6	7	0.007	7.158368821	0.050108582
C	6	0.006	7.380759361	0.044284556
Q	6	0.006	7.380759361	0.044284556
W	6	0.006	7.380759361	0.044284556
3	6	0.006	7.380759361	0.044284556
7	6	0.006	7.380759361	0.044284556
E	5	0.005	7.643791543	0.038218958
H	5	0.005	7.643791543	0.038218958
M	5	0.005	7.643791543	0.038218958
V	5	0.005	7.643791543	0.038218958
5	5	0.005	7.643791543	0.038218958
I	4	0.004	7.965716915	0.031862868
P	4	0.004	7.965716915	0.031862868
2	4	0.004	7.965716915	0.031862868
L	3	0.003	8.380750904	0.025142253
1	3	0.003	8.380750904	0.025142253
8	3	0.003	8.380750904	0.025142253
G	2	0.002	8.965708457	0.017931417
K	2	0.002	8.965708457	0.017931417
X	2	0.002	8.965708457	0.017931417
Z	2	0.002	8.965708457	0.017931417
J	1	0.001	9.9657	0.0099657
p =		0.21		p * log(p) 0.611300904
q = 1- p =		0.79	log(q) = 0.340072565	q * log(q) 0.268657327

Table 5:

IV. CONCLUSIONS & FUTURE WORKS

If there is a variety of Vehicles then the average of the characters (Entropy of p) detected is less. i.e. less Entropy means there is a large amount of variety of vehicles. Hence the ratio of vehicles accidents or crime may be greater. These are the sensitive areas and required a good monitoring. Large Entropy means there are more traffic load on the roads. It can help to design a model and then a good traffic system to develop the cities of India as the smart cities. Therefore Entropy of p should be high whereas Entropy of q should be less. The result of the localization process in the Base Paper gave Accuracy of 96.7% whereas the character recognition technique is 92.2% Accuracy.

The complete Automatic Number Plate Recognition System Gives the Accuracy given by

$$= \frac{96.7\,\% + 92.2\,\%}{2} = 94.45\%.$$

In the proposed technique the localization process is kept same as my base paper whereas the character recognition technique gives 100% Accuracy.

Now the complete Automatic Number Plate Recognition System Gives the Accuracy given by

$$= \frac{96.7\,\% + 100\,\%}{2} = 98.35\%.$$

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