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Remarked Vehicle Detection and Identification

Sachu Alex[1*], Krishnendu S.[2], Shoby Ann Sunny[3], Sudhi G. K.[4], Imthiyas M.P. [5]

[1] Dept. Name, Name of College/School/Institute, Name of University, City, Country [font size 10]
or
[1,2,3,4,5]Dept. of CSE, St. Thomas College of Engineering & Technology, Chengannur

Corresponding Author: sachulx@gmail.com

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***Abstract*—**The objective of the project is to design an efficient automatic vehicle identification system using cameras. There exists a number of vehicles on road. In the modern world the criminal misappropriation using vehicles are becoming a greatest challenge. In the existing system, vehicle identification is done manually and the information is passed through vehicle authorities through communicating devices. So in order to overcome such disadvantage we need a automatic vehicle identification system. Automatic vehicle identification at signal point using number plate to identify the vehicle and informs to vehicle department authorities. The system detects and extracts the number plate of all vehicles in traffic signal and email or messages regarding the vehicle are send to vehicle authorities probably within 10 km radius so that immediate actions can be initiated against any remarked vehicles according to the data received. Thus this can be used as a real time system for vehicle identification

***Keywords*—**location, camera, vehicle, traffic signal

I. INTRODUCTION

The purpose of our system is to detect remarked vehicles There exists large number of vehicles on the road. There are several solutions available in traditional systems for number Plate Recognition. But most of these systems work onlyunder restricted conditions, such as fixed light, limited vehicle speed, designated routes, and stationary backgrounds. In Indian roads, the number Plate Recognition system should have the ability to identify number Plates in dynamic conditions.

In order to solve these types of problems and to make vehicle identification easier we propose Remarked vehicle detection and identification system. The system used along with traffic signal can detect all the vehicles in traffic signal by detecting the license plates and is stored in the data base. Identified vehicle information's are sent to vehicle authorities through email or messages so that immediate actions can be initiated against any remarked vehicle. So in case of some criminal misappropriations we can detect the vehicle location by identifying the signal it has passed. Number plates for private car and motorised vehicles letterings. Private vehicles have black lettering on a white back ground. Commercial vehicles have a yellow background and black text.

Number plate of remarked vehicles are detected and image processing is done on images from video footage for extracting the number plates. Recognised characters in the number plate are compared with the data provided in the data base. The identification and detection of vehicle is done at signal point.

Rest of the paper is organized as follows, Section I contains the introduction of Remarked vehicle detection and identification, Section II contain the related work, Section III contains various methods and techniques used for Remarked vehicle detection and identification, Section IV contains the conclusion of our project.

II. PROPOSED SYSTEM

In the modern world the criminal misappropriation using vehicles are becoming a greatest challenge. In the existing system, vehicle identification is done manually and the information is passed to vehicle authorities using communication devices. So in order to overcome these disadvantages we propose our system.

The proposed system is remarked vehicle identification system for identifying remarked vehicles. The entire system make use of image processing technique. Thus the system help identifying remarked vehicles and monitoring the fraudulent behaviour at signal point. Since the overall project is an integration of two different systems the social relevance of the system is more important.

In this technology a camera will be working to take the video footage of all vehicles at signal point. The video footage will then extract the vehicle number. The brightness and contrast must be clear and the number plate must be in the format according given by the Indian government

III. REMARKED VEHICLE DETECTION AND IDENTIFICATION

This module deals with vehicle identification system. Vehicle identification is becoming a greatest challenge to Motor Department Authorities these days. Even in the recent cases of missing vehicles, terrorist attacks, smuggling, kidnapping, outdated vehicle insurance and so on. the police authorities are unable to track the vehicles used by criminals. These situations marks the importance of an automatic vehicle identification system.

Fig 1 is a flowchart that depicts the working of vehicle identification system. The camera placed at the signal point takes the video footage of all vehicles. This video is then converted into frames. By using image processing techniques the number plate is extracted from this frames and is stored into the database. Then vehicle numbers are then compared as remarked, it sends the remarked vehicle information to motor vehicle authorities through email

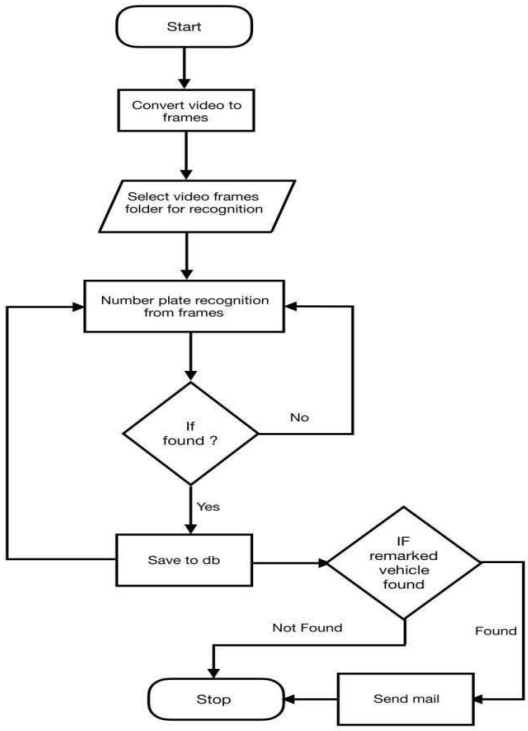

Figure 1 *Flow Chart*

A. Training of Datasets

Once a network has been structured for a particular application, that network is ready to be trained. To start this process the initial weights are chosen randomly. Then, the training, or learning, begins.

There are two approaches to training - supervised and unsupervised. Supervised training involves a mechanism of providing the network with the desired output either by manually "grading" the network's performance or by providing the desired outputs with the inputs. Unsupervised training is where the network has to make sense of the inputs without outside help. The vast bulk of networks utilise supervised training. Unsupervised training is used to perform some initial characterisation on inputs. However, in the full blown sense of being truly self learning, it is still just a shining promise that is not fully understood, does not completely work, and thus is relegated to the lab. Here we use supervised learning for training datasets because Supervised

learning is where you have input variables and an output variable and you use an algorithm to learn the mapping function from the input to the output. The aim is to approximate the mapping function so that when we have new input data we can predict the output variables for that data.

a. Supervised Training

In supervised training, both the inputs and the outputs are provided. The network then processes the inputs and compares its resulting outputs against the desired outputs. Errors are then propagated back through the system, causing the system to adjust the weights which control the network. This process occurs over and over as the weights are continually tweaked. The set of data which enables the training is called the "training set." During the training of a network the same set of data is processed many times as the connection weights are ever refined.

The current commercial network development packages provide tools to monitor how well an artificial neural network is converging on the ability to predict the right answer. These tools allow the training process to go on for days, stopping only when the system reaches some statistically desired point, or accuracy. However, some networks never learn. This could be because the input data does not contain the specific information from which the desired output is derived. Networks also don't converge if there is not enough data to enable complete learning. Ideally, there should be enough data so that part of the data can be held back as a test. Many layered networks with multiple nodes are capable of memorising data. To monitor the network to determine if the system is simply memorising its data in some no significant way, supervised training needs to hold back a set of data to be used to test the system after it has undergone its training. (Note: memorisation is avoided by not having too many processing elements.)

If a network simply can't solve the problem, the designer then has to review the input and outputs, the number of layers, the number of elements per layer, the connections between the layers, the summation, transfer, and training functions, and even the initial weights themselves. Those changes requiredto create a successful network constitute a process wherein the "art" of neural networking occurs. Another part of the designer's creativity governs the rules of training. There are many laws (algorithms) used to implement the adaptive feedback required to adjust the weights during training. The most common technique is backward-error propagation, more commonly known as back-propagation. These various learning techniques are explored in greater depth later in this report.

Yet, training is not just a technique. It involves a "feel," and conscious analysis, to insure that the network is not over trained. Initially, an artificial neural network configures itself with the general statistical trends of the data. Later, it continues to "learn" about other aspects of the data which may be spurious from a general viewpoint. When finallythe systemhas been correctly trained, and no further learning is needed, the weights can, if desired, be "frozen." In some systems this finalised network is then turned into hardware so that it can be fast. Other systems don't lock themselves in but continue to learn while in production use.

This system is trained using datasets of different sized characters (A-z and 0-9). The sizes of characters used for training are as shown in fig 2

Figure 2 *Different Sizes of Training Data*

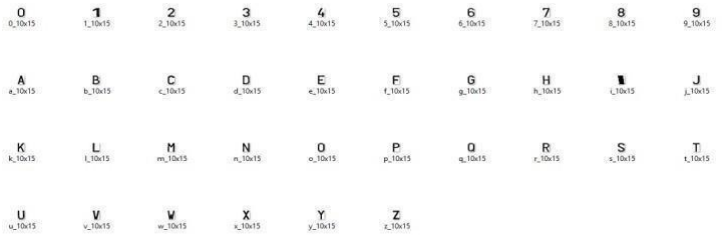

Figure 3 *Training Dataset*

b. How Neural Network Differ from Traditional Computing and Expert Systems

Neural networks offer a different way to analyse data, and to recognise patterns within that data, than traditional computing methods. However, they are not a solution for all computing problems. Traditional computing methods work well for problems that can be well characterised. Balancing chequebooks, keeping ledgers, and keeping tabs of inventory are well defined and do not require the special characteristics of neural networks.

Traditional computers are ideal for many applications. They can process data, track inventories, network results, and protect equipment. These applications do not need the special characteristics of neural networks. Expert systems are an extension of traditional computing and are sometimes called the fifth generation of computing. (First generation computing used switches and wires. The second generation occurred because of the development of the transistor. The third generation involved solid-state technology, the use of integrated circuits, and higher level languages like COBOL, Fortran, and "C". End user tools, "code generators," are known as the fourth generation.) The fifth generation involves artificial intelligence.

B. Number Plate Detection

The camera placed at the signal point continuously takes the video footage of all vehicles passing through the camera. This video footage is then converted into frames using FFMPEG. Then the number plates are extracted from these frames using image processing techniques.

The following are the different methodologies of image processing used for number plate extraction.

a. Edge Detection and Rank Filtering

Edge detection techniques rework pictures to edge pictures cashing on the changes of grey tones within the pictures. Edges are the sign of lack of continuity, and ending. As a results of this transformation, edge image is obtained without encountering any changes in physical qualities of the main image. An object incorporates various components of various colour levels. An Edge in an image is a significant local change in the image intensity, usually associated with a discontinuity in either the image intensity or the first derivative of the image intensity. Discontinuities at intervals causes the image intensity either 'Step edges', where the image intensity abruptly changes from one value on one side of the discontinuity to a different value on the other facet, or 'Line Edges', where the image intensity abruptly changes value but then returnsto the starting value within some short distance. Steps in Edge Detection contain 3 steps specifically Filtering, Enhancement and Detection.

The summary of the steps in edge detection is as follows:

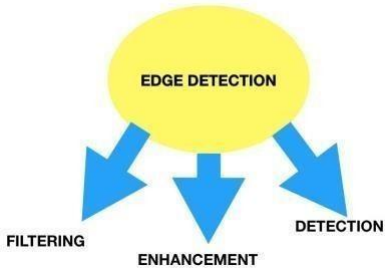

Figure 4 *Edge Detection*

As from Fig 3, pictures are typically corrupted by random variations in intensity values, called noise. Some common forms of noise are salt and pepper noise, impulse noise and Gaussian noise. Filtering is finished to scale back noise ends up in a loss of edge strength. In order to facilitate the detection of edges, it is essential to determine changes in intensity in the neighbourhood of a point. Enhancement emphasises pixels wherever there's a big change in native intensity. Frequently, threshold provides the criterion used for detection.

Three often edge detection strategies used for comparison are:

Roberts Edge Detection Sobel Edge Detection Prewitt edge detection

We apply the Sobel Detection, in which the Sobel operator performs a 2-D spatial gradient measurement on an image and thus, it emphasises regions of high spatial frequency that correspond to edges. Typically it's accustomed realise the approximate absolute gradient magnitude at every purpose in associate degree input grayscale image. The operator consists of a combination of 3x3 convolution kernels. The value of one kernel is simply equal to value of the other rotated by90o.This is very similar to the Roberts Cross operator. The convolution masks (in present system) area unit as shown below.

Msk = [0 0 0 0 0;
0 1 1 1 0;
0 1 1 1 0;
0 1 1 1 0;

0 0 0 0 0;];

The convolution masks of the Sobel detector and also the output is as shown in above Fig.

Gx

-1	0	+1
-2	0	+2
-1	0	+1

Gy

+1	+2	+1
0	0	0
-1	-2	-1

Figure 5 *3x3 convolution kernels*

b. Horizontal and Vertical Rank Filtering

Horizontally and vertically orientating rank filters are typically accustomed to find clusters of high density of bright edges within the space of the quantity plate. The breadth of the horizontally orientating rank filter matrix is far larger than the peak of the matrix (w h ≫), and the other way around for the vertical rank filter (w h ≪). This convolution matrix is used to find the gradient magnitude by setting up a certain threshold value. To preserve the world intensity of a picture, it is necessary to each pixel be replaced with an average pixel intensity in the area covered by the rank filter matrix. In general, the convolution matrix ought to meet the subsequent condition.

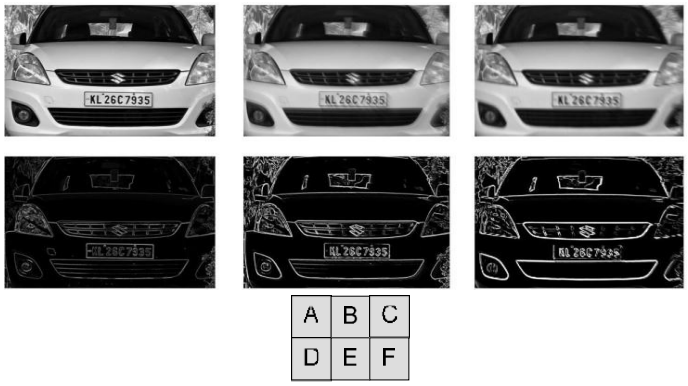

Figure 6 *a.Original Image b.Horizontal Rank Filter c.Vertical Rank Filter d.Sobel Edge Detection e.Horizontal Edge Detection f.Vertical Edge Detection*

c. Heuristic Analysis and Priority Selection of Number Plate

In general, the captured photograph will contain many range plate candidates. Because of this, the detection rulecontinually clips many bands, and a number of other plates from every band. There is a predefined value of maximum number of candidates, which are detected by analysis of projections. By default, this value is equals to nine. There are several heuristics, which are used to determine the cost of selected candidates according to their properties. These heuristic are chosen and hoc throughout the sensible experimentations. The recognition logic types candidates in line with their value from the foremost appropriate to the smallest amount appropriate. Then, the foremost appropriate candidate is examined by a deeper heuristic analysis. The deeper analysis undoubtedly accepts, or rejects the candidate. As there's a requirement to investigate individual characters, this sort of study consumes huge quantity of processor time. The basic construct of study will be illustrated by the subsequent steps:

(a) Detect possible number plate candidates.

(b) sort them per their price (determined by a basic heuristics).

(c) Cut the primary plate from the list with the most effective price.

(d) phase and analyse it by a deeper analysis (time consuming).

(e) If the deeper analysis refuses the plate, come back to the step three.$w-1$ $h-1$

m

$[i, j] = 1.0$

d. Deskewing Mechanisms

$$\sum \sum_{i=0\ j=0}^{hr}$$

Where w and h are dimensions of the matrix. The following photos show the results of application of the rank and edge
The captured rectangular plate can be rotated and skewed in many ways due to the positioning of vehicle towards the camera. Since the skew significantly degrades the recognition abilities, it is important to implement additional mechanisms, which are able to detect and correct skewed
plates. The fundamental downside of this mechanism is to work out in associate angle, below that the plate is inclined. Then, deskewing of therefore evaluated plate may be completed by a trivial transformation. It is necessary to grasp the distinction between the "sheared" and "rotated" rectangular plate. The number plate is associating object in three-dimensional house that is projected into the two- dimensional photograph throughout the capture. The positioning of the thing will generally cause the skew of angles and proportions.

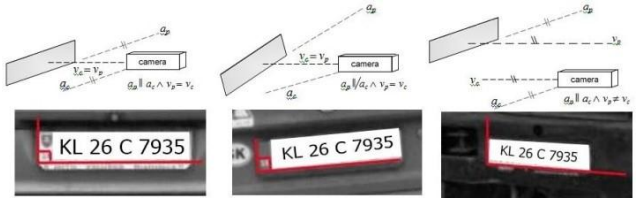

Figure 7

a.Number plate captured under the right angle b.Rotated plate

c.Sheared plate

e. Principles of Plate Segmentation

The next step when the detection of the number plate could be a segmentation of the plate. The segmentation is one among the foremost vital processes within the automatic number plate recognition, because all further steps rely on it. If the segmentation fails, a character can be improperly divided into two pieces, or two characters and can be improperly merged together. We can use a horizontal projection of number plate for the segmentation, or one of the more sophisticated methods, such as segmentation using the neural networks. If we tend to assume solely one-row plates, the segmentation is a process of finding horizontal boundaries between characters. The second part of the segmentation is associate improvement of segments. The section of a plate contains besides the character additionally undesirable parts like dots and stretches still as redundant area on the perimeters of character. There is a requirement to eliminate these parts and extract solely the character.

f. Segmentation of Plate Using Horizontal Projection

Since the segmented plate is deskewed, we can segment it by detecting spaces in its horizontal projection. We often apply the adaptive threshold filter to reinforce a part of the plate before segmentation. The adaptive thresholding is employed to separate dark foreground from light background with non- uniform illumination. We use this projection to work out horizontal boundaries between segmental characters.

Figure 8 *Number plate after application of the adaptive thresholding*

g. Extraction of Characters from Horizontal Segments

The section of plate contains besides the character additionally redundant house and different undesirable parts. We perceive underneath the term "segment" the part of number plate determined by a horizontal segmentation rule. Since the section has been processed by associating adaptive threshold filter, it contains only black and white pixels. The neighbouring pixels are classified along into larger items, and one of them is a character. Our goal is to divide the section into the many items, and keep only one piece representing the regular character.

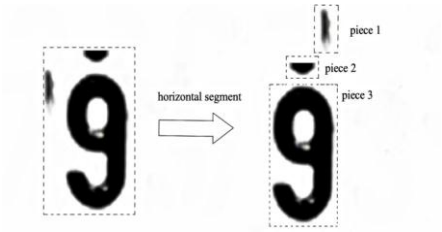

Figure 9 *Horizontal segment of the number plate contains several groups (pieces) of neighbouring pixels.*

h. Heuristic Analysis of Piece

The piece is a set of pixels in the local coordinate system of the segment. The segment usually contains several pieces. One of them represents the character other represents redundant parts, that ought to be eliminated. The goal of the heuristic analysis is to find a piece, which represents character. The piece chosen by the heuristics is then regenerate to a monochrome bitmap image. Each such image corresponds to one horizontal segment. These pictures are thought- about as associating output of the segmentation section.

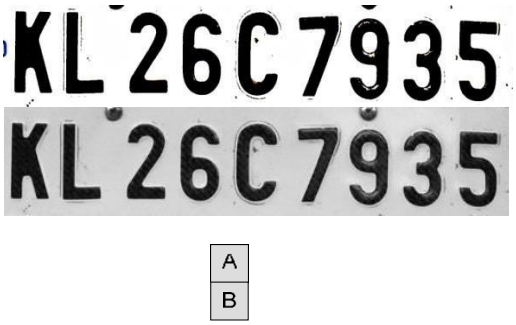

Figure 10 *The input a and output b example of segmentation phase of the ANPR recognition process.*

i. Normalisation of Character

In order to improve the brightness and contrast of processed image segments normalisation is done. The characters contained in the image segments must be then resized to uniform dimensions. After that, the feature extraction algorithm extracts appropriate descriptors from the normalised characters. There are various method used in the process of normalisation. Normalisation can be done in three steps:

- Normalisation of brightness and contrast
- Histogram Normalisation
- Normalisation of dimensions and resampling

1. Normalisation of Brightness and Contrast

The brightness and contrast characteristics of segmented characters are varying due to different light conditions during the capture. Because of this, it's necessary to normalise them. There are many different ways, but this section describes the three most used: histogram normalisation, global and adaptive thresholding. Through the histogram normalisation, the intensities of character segments are redistributed on the histogram to obtain the normalised statistics. Techniques of the global and adaptive thresholding are used to obtain monochrome representations of processed character segments. The monochrome (or black white) representation of image is more appropriate for analysis, because it defines clear boundaries of contained characters.

2. Histogram Normalisation

The histogram normalisation is a method used to re-distribute intensities on the histogram of the character segments. The areas of lower contrast will gain a higher contrast without affecting the global characteristic of image. The goal of the histogram normalisation is to obtain an image with normalised statistical characteristics.

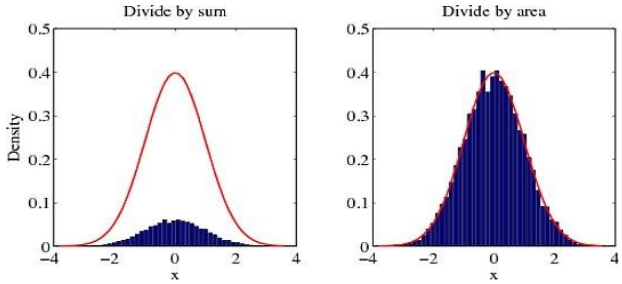

Figure 11 *Normalised Histogram*

(i) Global Thresholding

The global thresholding is an operation, when a continuous grey scale of an image is reduced into monochrome black & white colours consistent with the worldwide threshold worth. Let 0,1 be a grey scale of such image. If a value of a certain pixel is

above the threshold t , the new value of the pixel will be zero. Otherwise, the new value will be one for pixels with values above the threshold, 't'.

(ii) Adaptive Thresholding

The number plate can be sometimes partially shadowed or non uniformly illuminated. This is most frequent reason why the global thresholding fail. The adaptive thresholding solves several disadvantages of the global thresholding, because it computes threshold value for each pixel separately using its local neighbourhood.

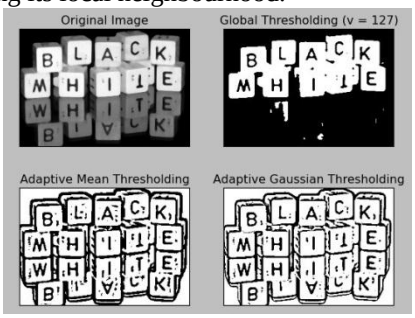

Figure *12 Application of global thresholding and adaptive thresholding on original image*

3. Normalisation of Dimensions and Resampling

Before extracting feature descriptors from a bitmap illustration of a personality, it's necessary to normalise it into unified dimensions. We understand under the term "resampling" the process of changing dimensions of the character. As original dimensions of normalised characters are usually higher than the normalised ones, the characters are in most cases down sampled. Usually higher than the normalised ones, the characters are in most cases down sampled.

When we down sample, we reduce information contained in the processed image. There are several methods of resampling, such as the pixel-resize, bilinear interpolation or the weighted- average resampling. We cannot determine which method is the best in general, because the successfulness of particular method depends on many factors. For example, usage of the weighed-average down sampling in combination with a detection of character edges is not a good solution, because this type of down sampling does not preserve sharp edges (discussed later). Because of this, the problematic of character resampling is closely associated with the problematic of feature extraction. We will assume that m´ n are dimensions of the original image, and m¢´ n¢ are dimensions of the image after resampling. The horizontal and vertical aspect ratio is defined as/ x r = m¢ m and / y r = n¢ n , respectively.

(i) Weighted Average Downsampling

In contrast with the nearest-neighbour method, the weighted- average downsamping considers all pixels from a corresponding group of pixels in the original image.

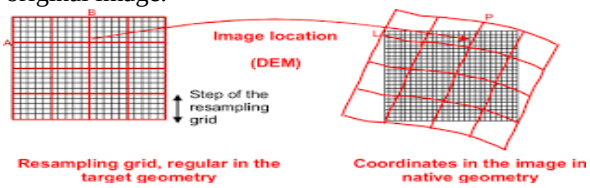

Figure *13 Resampled Image*

j. Feature Extraction

Information contained in a bitmap representation of an image is not suitable for processing by computers. Because of this, there is need to describe a character in another way. The description of the character should be invariant towards the used font type, or deformations caused by askew. In addition, all instances of the same character should have a similar description. A description of the character is a vector of numeral values, so-called "descriptors", or "patterns":

$$x = (x_0, \ldots, x_{n-1}) \quad (1)$$

Generally, the description of an image region is based on its internal and external representation. The internal representation of an image is based on its regional properties, such as colour or texture. The external representation is chosen when the primary focus is on shape characteristics. The description of normalised characters is based on its external characteristics because we deal only with properties such as character shape. Then, the vector of descriptors includes characteristics such as number of lines, bays, lakes, the amount of horizontal, vertical and diagonal or diagonal edges, and etc. The feature extraction is a process of transformation of data from a bitmap representation into a form of descriptors, which are more suitable for computers.

If we tend to associate similar instances of an equivalent character into the categories, then the descriptors of Characters from

an equivalent category ought to be geometrically closed to every alternative within the vector area. This is a basic assumption for successfulness of the pattern recognition process. This section deals with various methods of feature extraction, and explains which method is the most suitable for a specific type of character bitmap. For example, the "edge detection "method should not be used in combination with a blurred bitmap.

Figure *15 Features extracted from captured image*

Thus by using the above methodologies each character in the number plate is extracted. This extracted characters is compared with the trained dataset and the equivalent character is recognised. Hence the number plate is extracted and is stored into the database.

C. Reporting to Authorities

When any remarked vehicles passes through the signal point, the system detects the vehicle and compares the detected vehicle number with remarked database. Then, if the number matches the vehicle information's like vehicle number, location, date and time is send to vehicle authorities through email.

Figure *16 Received Vehicle informations*

IV. CONCLUSION

The objective of the paper is to analyse the major problems facing by human life. Vehicle identification is a biggest challenge to vehicle authorities these days. This problem is clearly analysed and an alteration to the existing system is formed. In the existing system the vehicle authorities need to manually detect the vehicle, which is a tedious process. Since this is an inefficient system, the vehicle authorities fail to report the vehicle on time. The proposed system detects and identifies the number plate of each vehicle passing through the system and if any remarked vehicle is passed through the system, it is easily identified and the vehicle information's such as vehicle number, vehicle location date and time is send to vehicle authorities through email. One of the limitation of the project is the difficulty in detecting the hiding In future manipulations of vehicles using number plates can be reduced by the proposed system.

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Authors Profile

Sachu Alex, currently the final year Computer Science and Engineering student of St. Thomas College of engineering and technology, Chengannur, Kerala, India. His areas of interests are robotics, system programming, and debugging.

Krishnendu S. currently the final year Computer Science and Engineering student of St. Thomas College of engineering and technology, Chengannur, Kerala, India. Her areas of interests are image processing and networking.

Shoby Ann Sunny, currently the final year Computer Science student of St Thomas College of engineering and technology, Chengannur Kerala, India. Her area of interest includes image processing, and networking.

Sudhi G.K. currently the final year Computer Science student of St. Thomas College of engineering and technology, Chengannur Kerala, India. His areas of interests are algorithm analysis, Multimedia and graphics.

ImthiyasM.P. obtained the Bachelor of Technology(B. Tech) f rom Cochin University of Science and Technology and Master in Engineering(ME) from Anna University. He is currently working as Head of the Department - Computer Science and Engineering at St. Thomas College of Engineering and Technology, Kozhuvalloor - Chengannur. His area of interests are Wireless Sensor Networks, Multimedia Communication, Image processing and Robotics.