

3.1 Automatic License Plate Recognition System

ALPR system plays important role in real life applications. ANPR recognizes a vehicles plate number from an image by digital camera. The main and the most important portion of this system is the software model. The software model use series of image processing techniques which are implemented in MATLAB.

LPR usually is used for detection of some special vehicles. This feature is mostly focus on the vehicles listed in the blacklist, such as the vehicle fled after the accident, or reported as stolen. As long as the relevant information of license plate is input into dataset, LPR will automatically lead to find out the vehicle information. Once the vehicle information found, the systems will feedback it to police station.

The techniques of the license plate recognition have been developed for many years. With the hardware and software improved, the accuracy of license plate recognition has been improved to some extent.

But the current accuracy still cannot satisfy all the requirements of the traffic department concerned. The license plate extraction is not a simple process, as under some situations, it is easy for people to judge but it will be very hard for computer to do it. [1]

3.1.1 ALPR System

The ALPR algorithm is broadly divided into following parts:-

- 1- Capture image.
- 2- Send to the server.

- 3- Pre-processing.
- 4- Plate region extraction.
- 5- Character segmentation.
- 6- Character recognition.
- 7- Comparison with database.
- 8- Indicate result.

There are various steps in this approach and these are implementation in MATLAB

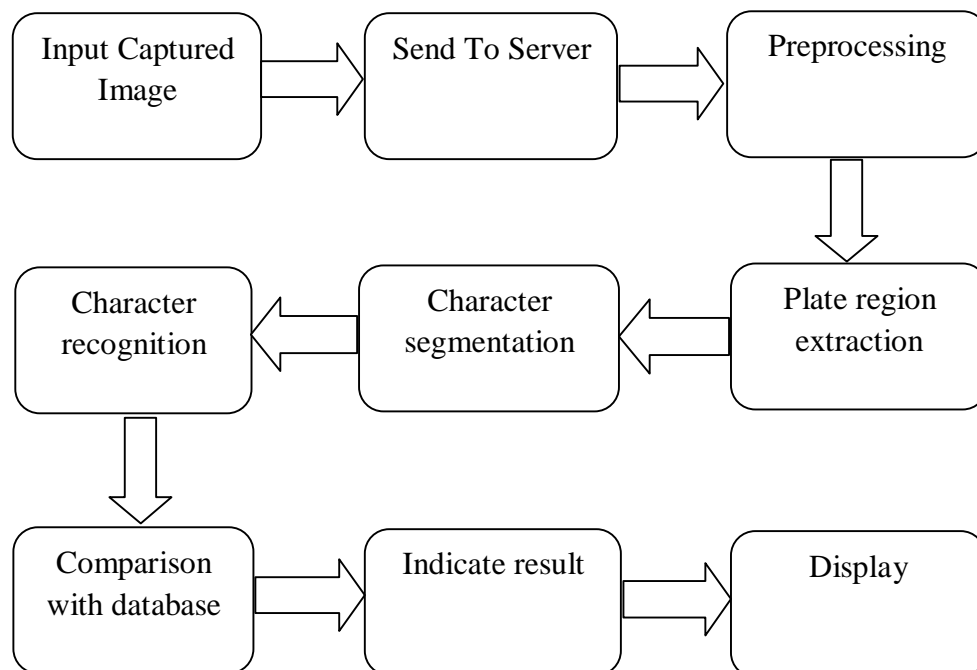


Figure 3-1: Flow Chart of the ALPR System

3.2 Capture Image (Image Acquisition)



Figure 3-2: Example of a Typical Traffic Stop

The first step is the capturing of an image using electronic devices such as optical (digital/video) camera to capture the acquired images. For this project, vehicle images will be taken with digital camera placed on the dashboard or on the police car bumper.

The images will be stored as color JPEG format on the camera. Next, we might proceed in using the MATLAB function to convert the vehicle JPEG image into gray scale format input of the system is the image captured by camera. The distance between image and the camera should be 3-4 meters. [2, 3]

3.3 Sending the Image to the Server

After capturing the image by the camera in the police car it is send using a client-server URL based connection, in the meaning of uploading the picture into a specific URL for it to be processed, and the result is show in the same URL.

The server client connection could be established using a 3rd generation mobile connection, the client could upload the picture in about 5 – 10 sec.

After the image is send to the server it is prepared to be processed, the database is made by MYSQL.

3.3.1 MySQL

MySQL is a relational database management system (RDBMS)it was the world's second most widely used RDBMS, and the most widely used open-source RDBMS.It is named after co-founder Michael Widenius's daughter, The SQL acronym stands for Structured Query Language. The MySQL development project has made its source code available under the terms of the GNU General Public License, as well as under a variety of proprietary agreements.MySQL is a popular choice of database for use in web applications, and is a central component of the widely used LAMP open source web application software stack (. LAMP is an acronym for "Linux, Apache, MySQL, Perl/PHP/Python." Free-software-open source projects that require a full-featured database management system often use MySQLApplications that use the MySQL database include: TYPO3, MODx, Joomla, WordPress, phpBB, MyBB, Drupal and other software. MySQL is also used in many high-profile,

large-scale websites, including Google, Facebook, Twitter, Flickr, and YouTube. On all platforms except Windows, MySQL ships with no graphical user interface (GUI) tools to administer MySQL databases or manage data contained within the databases. Users may use the included command line tools, or install MySQL Workbench via a separate download. Many third party GUI tools are also available.

We use MySQL in this research to create a LP information database and ticket archive and store information to them, also, to connect the MATLAB to the database and display the result into a web page.

3.4 Pre-Processing

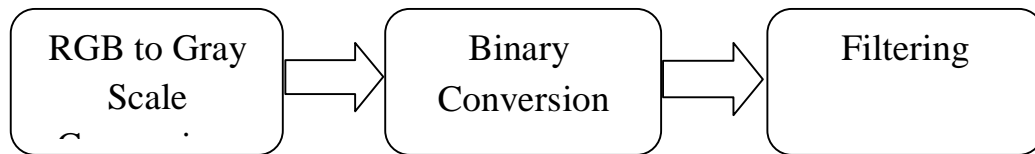


Figure 3-3: Flow Chart of The Pre-Processing Steps

Image Pre-processing is the initial stage to image processing require for enhancement and restorations. The process involves processes which improve the image quality for computational by eliminating noises, highlighting edges of the captured image in real-time or stored in memory/hard disk). In the pre-processing, an image passes through the following procedure gray scaling, binary conversion and filtering.

3.4.1 Gray Processing

It involves conversion of color image into a gray image. The method is based on different color transform. According to the R, G, B value in the

image, it calculates the value of gray value, and obtains the gray image at the same time.

Gray scale is often used in image processing and image analysis. Images acquired by camera always reflect the camera settings; among many include color and hue, essentially an image can be in its natural form or slightly altered, colored images are complex in space and time, it is therefore important images are complex in space and time, it is therefore important to convert colored images to gray scale to reduce time and

Space complexity. The basic concept of gray conversion is to eliminate hue and saturation image while maintaining its luminance. [2]



Figure 3-4: Gray Conversion

3.4.2 Binary Image

Binary image is a digital image whose pixels have only two possible intensity values. They are normally displayed as black and white. Numerically, the two values are often 0 for black, and either 1 or 255 for white. Binary conversion is important as it improves the quality and extracts information from an image. Binary images are less complex because of their reduced complexity



Figure 3-5: Binary Image

3.4.3 Median Filtering

When images are acquired there is lot of noises present in image

We have used median filtering technique to reduce the noise. We have used 3×3 masks to get eight neighbors of a pixel and their corresponding gray value.

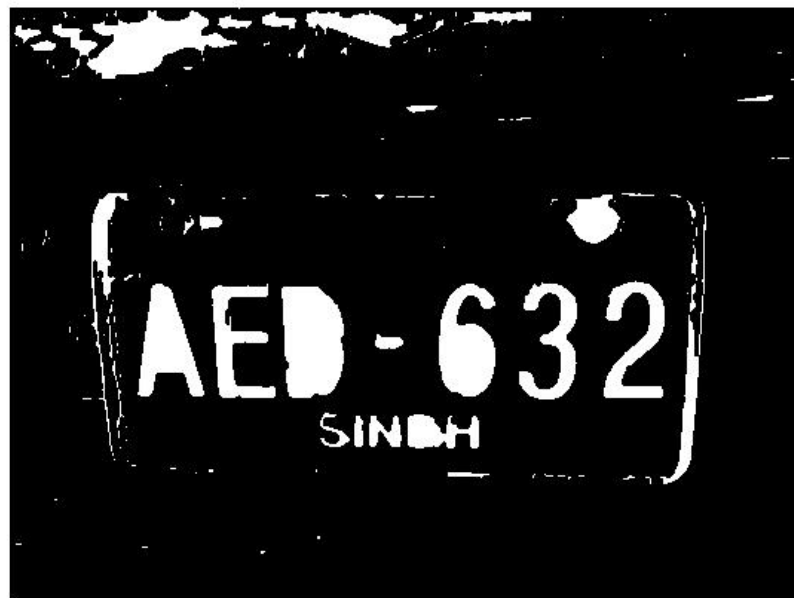


Figure 3-6: Example of Median Filtration

3.5 Plate Region Extraction

The third step of the ANPR algorithm is the extraction of the number plate in an image. Find the row and column value of that image, then modify the image by using the command (imresize), giving the input Image with values from 400 to not a number (NaN).

```
f=imresize(f,[400 NaN]);
```

The values of (400) is determined after a several attempts to find the best size of the image to extract the characters from, in the case of using the values (300) the characters could be extracted but not in all cases and in the case of the value (500) the characters couldn't be extracted properly.

After that it saves the image in another variable, assign the location and display the image, find the row and column for modified image, create one dummy image in the size of modified image row and column, and find the each and every pixel value if the pixel value is greater than 150 means put the value 1 in dummy image else put 0 in dummy image, then apply median filter for that image. Find the regionprops of the image means it will calculate the centroid, boundary and etc then we have some condition based on that condition we apply the further commands.

```
g=medfilt2(g,[3 3]);  
gdiff=mat2gray(gdiff); % Converting the class to  
double.  
F=imfill(out1,'holes');
```

3.6 Character Segmentation

In this step get the output of extracted number plate using labelling points, and then separate each character and split the each and every character in the number plate image by using split and also find the length of the numberplate, then find the correlation and database if both the value is same means it will generate the value 0-9 and A – Z and finally convert the value to string to be compared with the characters database show below in figure 3-6, and display it in edit box, and also store the character in some text file on the hard disk.

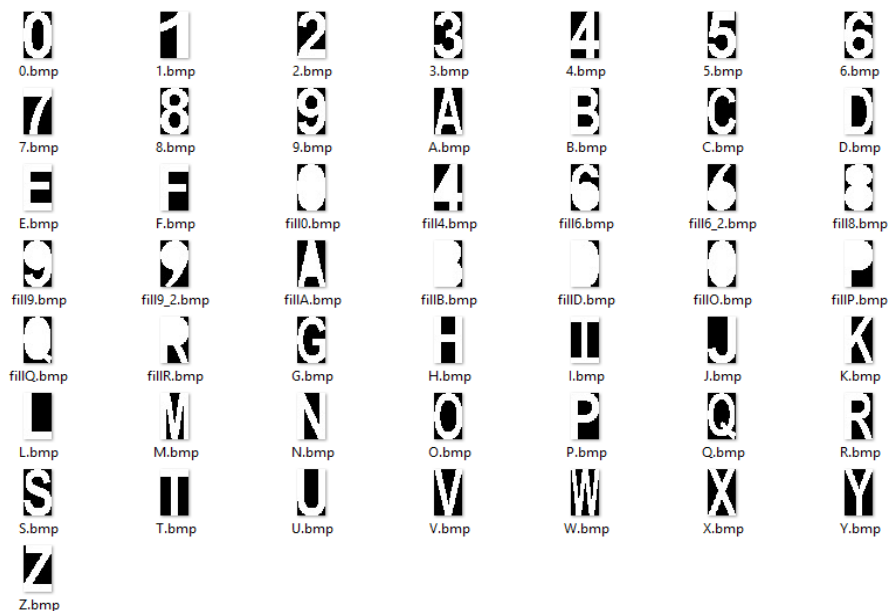


Figure3-7: Characters Data Base

3.7 Character Recognition

Template matching method is used for Character recognition and the resulting data is then used to compare with the records on a database using cross correlation technique for comparing the extracted letter's matrix with the stored letters matrix database , so as to come up with the specific information of which letter is the extracted letter.

3.8 Implementation

In this project we have implemented the server part of the system, which designed by creating a MATLAB code for our algorithm that has the input of a LOS license plate image, typically from the cam mounted on the dash board or the pumper of the police car, but in this case they are stored on the local hard drive.

After feeding the image to the software algorithm developed by MATLAB by using graphical user interface, the image goes through a series of conversions & digital image processing technique as mentioned earlier.

Then after extracting the characters from the input image it is stored into a texted in preparation to be send to the database in the server.

The MATLAB then connect with the database using MySQL, and store the result of the algorithm into a text file, MySQL compare the result with the stored database and output the result into web page to be easy for the user to review it and get the needed information.