Helmet Detection System

T.E. mini-project report submitted in partial

fulfilment of the requirements of the degree of

Information Technology

by

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CERTIFICATE

This is to certify that the T.E. mini-project entitled **"Helmet Detection System"** is a bonafide work of **"Jayesh Rane" (PID No.) (06) [TE IT 2], "Shravani Maliye" (PID No.) (36) [TE IT 2], and "Jayom Oza" (PID No.) (48) [TE IT 2]** submitted to University of Mumbai in partial fulfilment of the requirement for the award of the degree of "Information Technology" during the academic year 2019–2020.

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This mini-project synopsis entitled ***Helmet Detection System*** by ***Jayesh Rane, Shravani Maliye, Jayom Oza*** is approved for the degree of ***Information Technology*** from ***University of Mumbai***.

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1.----------

2.----------

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Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

The ANPR (Automatic Number plate Recognition) system is based on image processing technology. It is one of the necessary systems designed to detect the bike number plate. In today's world with the increasing number of bike rider's day by day it's not possible to manually keep a record of all the bike riders that don't wear a helmet. With the development of this system it becomes easy to keep a record and use it whenever required. The main objective here is to design an efficient automatic bike identification system by using bike's number plates images. The system first would capture the bike's image as soon as the bike reaches the Traffic Signal. After that, the captured image which is in RGB format is converted to grayscale format. The grayscale image is then binarized to convert it into an image which is in black and white format. Prewitt edge detection algorithm is used to extract edges from the grayscale image. The Extracted edges are then used for creating a bounding box around the number plate. Once the bounding box is created around the number plate, the other unwanted part from the image is removed and a cropped number plate image is obtained. The accuracy of Prewitt edge detection algorithm is greater as compared to other edge detection algorithms. The system is implemented and simulated on MATLAB and performance is tested on real images.

Keywords *— Gray-scale image, Image Binarization, Image Processing Number Plate Recognition, Prewitt.*

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List of Abbreviations

ACE Atharva College of Engineering

ANPR Automatic Number Plate Recognition

RGB Red Green Blue (colour model)

Chapter 1

Introduction

Automatic vehicle identification is an image processing technique of identifying vehicles by their number plates. Automatic vehicle identification systems are used for the purpose of effective traffic control. The ANPR work is generally framed into three steps: Number plate extraction, character segmentation and character recognition. From the entire input image, only the number plate is detected and processed further in the next step of character segmentation. In the character segmentation phase, each and every character is isolated and segmented. Based on the selection of prominent features of characters, each character is recognized, in the character recognition phase. Extraction of number plates is a difficult task, essentially due to: Number plates generally occupy a small portion of the whole image, difference in number plate formats, and influence of environmental factors. This step affects the accuracy of character segmentation and recognition work. Thus, this system can be accurate if the image of the number plate captured by the camera is clear and visible. The image used should be of very good resolution.

1.1 Motivation

Automatic Number Plate Recognition is a computer vision technology that efficiently identifies vehicle number plates from images without the need for human intervention. In recent years, it has become more and more important due to two main factors: the growing number of vehicles on the roads, the rapid development of image processing techniques. With the increasing number of vehicles in today's world it's not possible to manually keep a record of all the vehicles. There needs to be a traffic policeman standing 24*7 to note down the number. It's a time-consuming process and requires manpower. Furthermore, the data stored manually is not readable after a long time. So, to overcome all these limitations here we tried to develop a system which would automatically detect the number plate. This process also helps to get the correct result compared to manually one.

1.2 Problem Statement

As there is inadequacy in the Indian Transportation Engineering and Infrastructure, the road rules are violated and by the lack of monitoring capability, the number of accidents gets increased. The primary need is to identify the vehicles using their license plates. But there prevails a non - uniformity in the Indian License plates and infrastructure. The License plates may not be positioned in the correct position, according to the class of vehicles. This will lead to the misclassification of plate image in the vehicles. Presence of Unusual Characters in the License Plate may be misclassified as License Plate Character. License Plate Recognition systems have been implemented in many countries like the United States of America, Australia, Korea and few others. Strict implementation of license plate standards in these countries has helped the early development of License Plate Recognition systems. These systems use standard features of the license plates such as: dimensions of plate, border for the plate, colour and font of characters, etc. help to localize the number plate easily and identify the license number of the vehicle. In India, number plate standards are rarely followed. Wide variations are found in terms of font types, script, size, placement and colour of the number plates. In a 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.

1.3 Objectives

The objectives are as follows:

- To get the number plate of all the bike riders that don't wear a helmet.
- To create a system which is able to recognize the number plate of any type of vehicle.
- To extract information about the vehicles that do not follow traffic rules.
- To consider all the scenarios so that the system performs efficiently.
- To implement a system which can work in any kind of weather and lighting condition.
- To show the number plate at the final output of the system.

1.4 Scope

Number plate recognition is realized by acquiring images of either the front or the rear of vehicles with cameras and then by using image processing techniques to identify the license plates. It consists of three main stages. First one is Number Plate Identification & Localization. In this segment the visual of the scene is improved with the image processing. Second is Character Segmentation in which characters segmented from the detected number plate for retaining the useful information to the system so that further processing can take place. Third is OCR Optical Character Recognition in which text is transferred into encoded text information. For this purpose MATLAB's region-props library is used. MATLAB is a high-level language and interactive environment for numerical computation, visualization, and programming. Using MATLAB, you can analyse data, develop algorithms, and create models and applications. The language, tools, and built-in math functions enable you to explore multiple approaches.

Chapter 2

Review of Literature

Sr.No	PAPER TITLE	AUTHOR	PUBLICATION	EXPLANATION
1	Automatic Number Plate Recognition For Motorcyclists Riding Without Helmet	Yogiraj Kulkarni, Amit Kanthe, Shubhangi Bodkhe, Archana Patil	Ieee 2018	Additional Use Of Ocr For Number Plate Recognition.
2	Helmet Detection And License Plate Recognition Using Cnn	Emy Barnabas, Amritha B.J.	Iosrjen 2019	Motorcyclist Is Wearing A Helmet Or Not Is Detected Using Cnn. If The Motorcyclist Is Identified Without A Helmet, Then The License Plate Of The Motorcyclist Is Recognized Using Tesseract Ocr
3	Detection Of Non-helmet Riders And Extraction Of License Plate Number Using Yolo V2 And Ocr Method.	Prajwal M. J, Tejas K. B, Varshad V, Mahesh Madivalappa Murgod, Shashidhar R.	Ijitee 2019	The Objects Detected Are Person, Motorcycle/Moped At First Level Using Yolov2, Helmet At Second Level Using Yolov3, License Plate At The Last Level Using Yolov2. Then The License Plate Registration Number Is Extracted Using Ocr (Optical Character Recognition).

4	Matlab Programming Environment Based On Web	Liu Yu	Itoec 2018	In Order To Simplify The Programming Environment And Improve The Convenience, A Matlab Programming Environment Based On Web Is Proposed In This Paper.
5	Smart Vehicle Identification System Using Ocr	Kartikeya Jain, Tanupriya Choudhury, Nirbhay Kashyap	Ieee-cict 2017	The Proposed System Is Implementing The Ocr Technology To Park The Vehicles In Smart Way And Keep The Track Of The Vehicles Which Are Entering And Leaving. The System Will Capture The Image Of Number Plate Of The Vehicle Using The Ocr Process And Will Instantly Update The Database.

Chapter 3

Requirement Analysis

HARDWARE

- Processors

Minimum: Any Intel or AMD x86-64 processor

Recommended: Any Intel or AMD x86-64 processor with four logical cores and AVX2 instruction set.

- Disk

Minimum: 2.9 GB of HDD space for MATLAB only, 5-8 GB for a typical installation

Recommended: An SSD is recommended.

- RAM

Minimum: 4 GB

Recommended: 8 GB

SOFTWARE

- Offline/online MATLAB tool.

  MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation.

- The MATLAB language.
  This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs.

- The MATLAB mathematical function library.
  This is a vast collection of computational algorithms ranging from elementary functions like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix eigenvalues, Bessel functions, and fast Fourier transforms.

- Windows 8, 10, 64 bits

Chapter 4

Report on Present Investigation

4.1. Block diagram of System with Description

Fig 4.1 Block diagram of the system

The image of the violators will be passed on to this system and the pre-processing part would take place which includes: conversion of the image to grayscale followed by conversion into a black and white format. The Prewitt algorithm is applied for edge detection.

The image properties are studied and depending on the number of array elements, a bounding box is created around the Number Plate. The image is cropped depending on the region of interest and the cropped image is then returned to the output console.

4.2 Implementation

4.2.1 Algorithm/Flowchart

1. Read input as the image of the vehicle.
2. Convert image from RGB format to Grayscale format.
3. Binarize the image i.e. convert it into black and white.
4. Edge detection of the image using the Prewitt algorithm.
5. Measure properties of the image region.
6. Count the number of elements.
7. Create Bounding Box around the region of interest (i.e. Number Plate).
8. Crop the image to the required size.

9. Remove small unwanted objects from the cropped image.

10. Display the extracted Number Plate as the output.

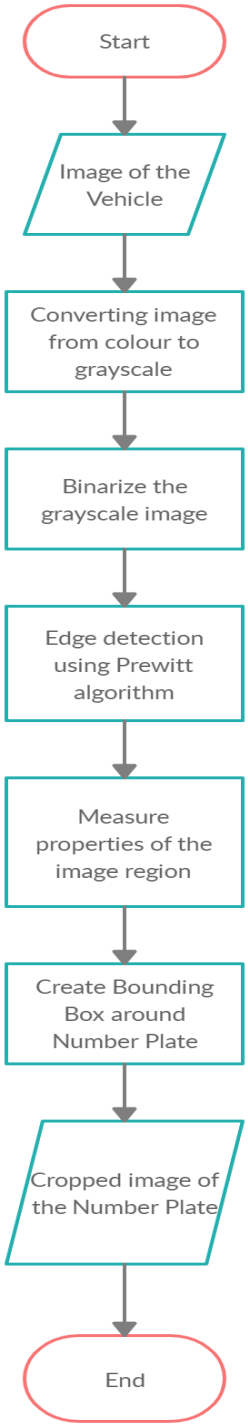

Fig 4.2 Flow chart of the system

4.2.2 Dataset

The dataset for this module includes random images taken from the internet. It includes images of cars as well as motorcycles to demonstrate the working of this module.

Fig 4.2.2 Dataset

4.2.3 Pseudo code

```
close all;
clear all;


im = imread('Number Plate Images/image4.png');
imgray = rgb2gray(im);
imbin = imbinarize(imgray);
im = edge(imgray, 'prewitt');

Iprops=regionprops(im,'BoundingBox','Area', 'Image');
area = Iprops.Area;
count = numel(Iprops);
maxa= area;
boundingBox = Iprops.BoundingBox;
for i=1:count
   if maxa<Iprops(i).Area
       maxa=Iprops(i).Area;
       boundingBox=Iprops(i).BoundingBox;
   end
end

im = imcrop(imbin, boundingBox);
im = bwareaopen(~im, 500);
 [h, w] = size(im);


imshow(im);
```

4.2.4 Screenshots of the output with description

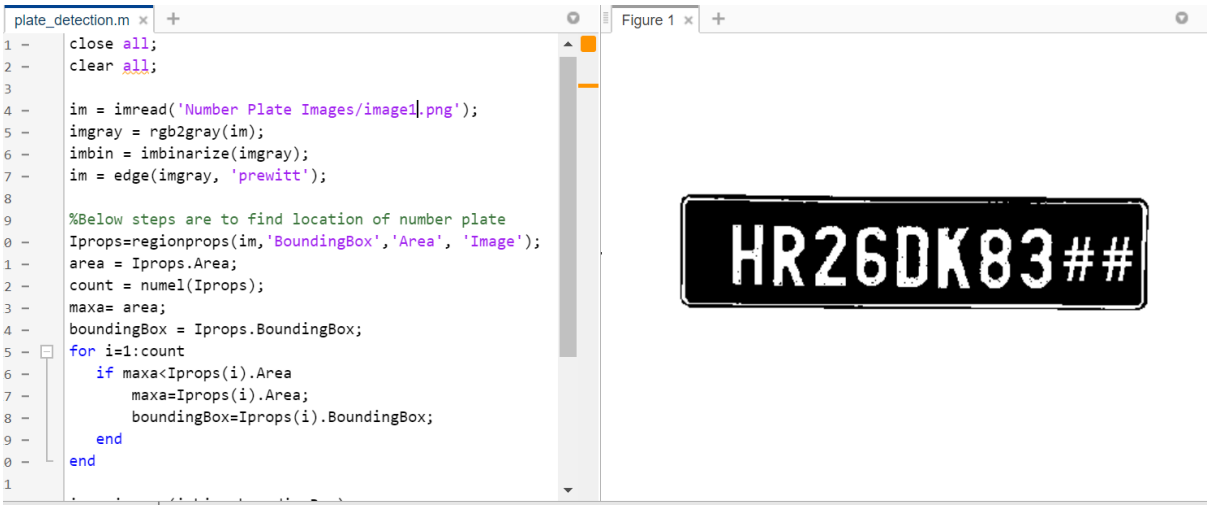

Fig 4.2.4a Output of a car

The above output is the number plate of a car extracted from the image of the car.

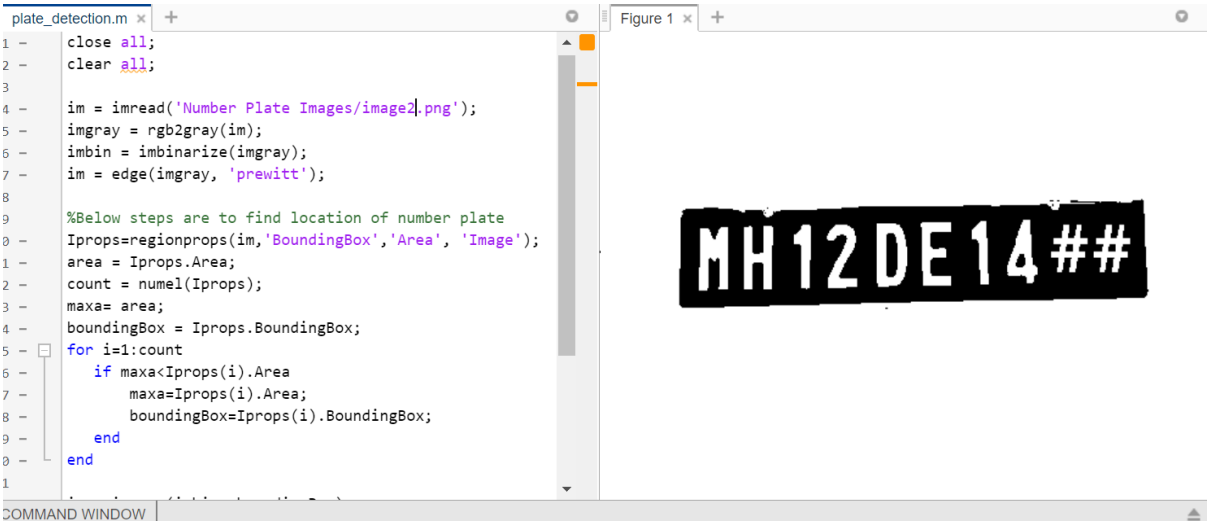

Fig 4.2.4b Output of a car

The above output is the number plate of a car extracted from the image of the car.

plate_detection.m

```
close all;
clear all;

im = imread('Number Plate Images/image4.png');
imgray = rgb2gray(im);
imbin = imbinarize(imgray);
im = edge(imgray, 'prewitt');

%Below steps are to find location of number plate
Iprops=regionprops(im,'BoundingBox','Area', 'Image');
area = Iprops.Area;
count = numel(Iprops);
maxa= area;
boundingBox = Iprops.BoundingBox;
for i=1:count
   if maxa<Iprops(i).Area
       maxa=Iprops(i).Area;
       boundingBox=Iprops(i).BoundingBox;
   end
end
```

Figure 1

Fig 4.2.4c Output of a Bike

The above output is the number plate of a bike extracted from the image.

plate_detection.m

```
close all;
clear all;

im = imread('Number Plate Images/image3.png');
imgray = rgb2gray(im);
imbin = imbinarize(imgray);
im = edge(imgray, 'prewitt');

%Below steps are to find location of number plate
Iprops=regionprops(im,'BoundingBox','Area', 'Image');
area = Iprops.Area;
count = numel(Iprops);
maxa= area;
boundingBox = Iprops.BoundingBox;
for i=1:count
   if maxa<Iprops(i).Area
       maxa=Iprops(i).Area;
       boundingBox=Iprops(i).BoundingBox;
   end
end
```

Figure 1

Fig 4.2.4d Output of a bike in tilted way

The above output is the number plate of a bike where the original image is captured in a titled way.

Chapter 5

Results and Discussion

On analysing the experiments that we conducted, we get the following results:

Using the Prewitt algorithm, we get the desired results. A proper cropped image of the number plate is obtained from the image of the vehicle. It provides an accuracy of about 89.95% which is quite sufficient.

MATLAB is a very efficient platform to build systems as it provides many built-in functionalities which eliminates the need of creating algorithms from scratch and the saved time can be used in fine-tuning the system to achieve greater accuracy and prediction. The functionalities provided by MATLAB are very easy to understand and can be implemented easily by either using the desktop version of MATLAB or the online editor.

This module uses the Prewitt algorithm for edge detection followed by a few lines of code which create a bounding box around the region of interest in the image. The run time of the system is a few seconds which is affordable considering the functions provided by our system. Our system works on black and white images which is obtained by a few steps of pre-processing. The output obtained by our system has been provided in the previous chapter.

Chapter 6

Conclusion

The existing system in context to safety regulations requires a lot of manual work which is prone to errors. In our proposed system, we try to solve this issue. ANPR is a very integral part of any helmet detection system. The ANPR will work on the images passed on by the previous system where we detect the people who do not wear helmets while riding motorcycles. The module in our project uses Prewitt algorithm which provides an accuracy of 89.95%. We tested our system on a few images and the results were quite promising. The Prewitt operator makes use of masks which are known as derivative masks. It provides two masks- one for detecting edges in the horizontal direction and another for detecting edges in the vertical direction. This method calculates the gradient intensity mathematically, and hence provides a much better accuracy as compared to other edge detection methods. Major advantage of using Prewitt operator is the simplicity it provides. This module was implemented on MATLAB editor. MATLAB editor provides a lot of built-in function which makes the process of coding very compact and easier to understand. The implementation and testing of algorithms can be done very efficiently.

References

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3. Prajwal M. J, Tejas K. B, Varshad V - “Detection Of Non-helmet Riders And Extraction Of License Plate Number Using Yolo V2 And Ocr Method.”Ijitee 2019
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