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# Chapter 1

## Introduction

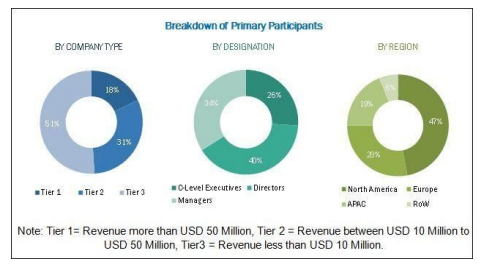
### 1.1 Motivation

In this project, a Digital Image Processing-based prototype is developed. Actions such as Image Acquisition, enhancement that is pre-processing, Segmentation of the license plate and then application of OCR (Optical Character Recognition) is applied to store the number on text form. The plate number is displayed as text on the terminal .

It is seen that the security forces and authorities face problems whenever security forces chase a vehicle or they can’t catch a vehicle which broke traffic rules. Authorities find it very hectic on a busy day to log the vehicle numbers manually in a parking lot. So, in order to make the entire process autonomous, we can install this system so as to automatically detect the vehicle which breaks the traffic rules, take a picture of it and store the number in the database so as to fine the respective owner afterwards. The system can be used in parking so as to take the picture of the vehicle and log the vehicle number in the database (or the cloud, if connected to the internet). This technology reduces the unnecessary hectic manual work required on any busy day, saves the labour cost and is far more efficient than humans. The number of any vehicle once obtained as text, can be displayed, saved in the database or can be searched through the entire database for the details.

**1.2**Preliminary investigation

Automatic Number Plate Recognition systems are a proven solution for various security forces and administrative authorities around the world. The automatic number plate recognition (ANPR) system market in 2016 was valued at USD 1.78 Billion and is expected to reach USD 3.57 Billion by 2023, at a CAGR (Compound Annual Growth Rate) of 9.74% between 2017 and 2023. The base year considered for the study is 2016 and the forecast period is between 2017 and 2023. The research methodology used to estimate and forecast the ANPR system market begins with capturing data on key vendor revenue through secondary research. The vendor offerings are considered to determine the market segmentation. This report provides a detailed analysis of the ANPR system market based on type, component, application, and geography. After arriving at the overall market size, the total market has been split into several segments and subsegments, which have been verified through the primary research by conducting extensive interviews of people holding key positions such as CEOs (Chief Executive Officers), VPs (Vice Presidents), directors, and executives. Market breakdown and data triangulation procedures have been employed to complete the overall market engineering process and arrive at the exact statistics for all segments and subsegments. The breakdown of profiles of primaries is depicted in the figure below:



# Chapter 2

## Literature Review

### Previous Work

Many developments in Digital Image Processing have been utilized in various fields with advances in Optical Character Recognition Technology as well. Various techniques of employing digital image processing have been developed in recent years. In the 2000s, OCR was made available online as a service (WebOCR), in a cloud computing environment, and in mobile applications like real-time translation of foreign-language signs on a smartphone. The best application of this technology would be to create a reading machine for the blind, which would allow blind people to have a computer read text to them out loud. Various commercial and open source OCR systems are available for most common writing systems, including Latin, Cyrillic, Arabic, Hebrew, Indic, Bengali (Bangla), and Devanagari, Tamil, Chinese, Japanese, and Korean characters. The OCR engine used here is Tesseract OCR. Tesseract is an optical character recognition engine for various operating systems. It is free software, released under the Apache License.Originally developed by Hewlett-Packard as proprietary software in the 1980s, it was released as open source in 2005 and development has been sponsored by Google since 2006. In 2006, Tesseract was considered one of the most accurate open-source OCR engines then available. The Tesseract engine was originally developed as proprietary software at Hewlett Packard labs in Bristol, England and Greeley, Colorado between 1985 and 1994, with some more changes made in 1996 to port to Windows, and some migration from C to C++ in 1998. A lot of the code was written in C, and then some more was written in C++. Since then all the code has been converted to at least compile with a C++ compiler. Very little work was done in the following decade. It was then released as open source in 2005 by Hewlett Packard and the University of Nevada, Las Vegas (UNLV). Tesseract development has been sponsored by Google since 2006. Tesseract was in the top three OCR engines in terms of character accuracy in 1995. It is available for Linux, Windows and Mac OS X. However, due to limited resources it is only rigorously tested by developers under Windows and Ubuntu.

* 1. **Existing System**

Few Inconveniences of the Current Framework are

1) Constant human mediation.

2) High cost.

3) More Manpower is required.

* 1. Proposed System

The proposed system overcomes the above Disadvantages and apart from them has the beneath specified benefits. 1.Automated framework requiring less labour. 2.Number is displayed and with some modification can be stored in a database or be searched or processed. 3.The featured number plate is automatically cropped and displayed separately. In one of the papers by Anisha Goyal and Rekha Bhatia, from Department of CSE ,Punjabi University Regional Centre for Information Technology and Management, Mohali, Punjab, India, they proposed that till now, all the LPR systems have been created using neural networks. They proposed to execute the system using Gabor filter, OCR and Vision Assistant to make the system quicker and more proficient. A different recognition strategies have been produced and number plate recognition systems are today used in different movement and security applications, for example, parking, access and border control, or tracking of stolen autos. In another paper by Amr Badr, Mohamed M. Abdelwahab, Ahmed M. Thabet, and Ahmed M. Abdelsadek, proposed that Automatic recognition of car license plate number became a very important in our daily life because of the unlimited increase of cars and transportation systems which make it impossible to be fully managed and monitored by humans, examples are so many like traffic monitoring, tracking stolen cars, managing parking toll, red-light violation enforcement, border and customs checkpoints. This paper mainly introduces an Automatic Number Plate Recognition System (ANPR) using Morphological operations, Histogram manipulation and Edge detection Techniques for plate localization and characters segmentation. Artificial Neural Networks are used for character classification and recognition. In the third paper by Hamed Sanghaei, an automatic and mechanized license and number plate recognition system is proposed that can extract license plate number of the vehicle passing through a given location using image processing algorithms. The resulting data is applied to compare with the records on a database. Experimental results reveal that the presented system successfully detects and recognizes the vehicle number plate on real images. This system can also be used for security and traffic control.

* 1. History

Digital Image Processing means processing digital image by means of a digital computer. We can also say that it is a use of computer algorithms, in order to get enhanced image either to extract some useful information. One of the first applications of digital image was in the newspaper industry, when pictures were first sent by submarine cable between London and New York. Introduction of the Bart lane cable picture transmission system in the early 1920s reduced the time required to transport a picture across the Atlantic from more than a week to less than three hours. Specialized printing equipment coded pictures for cable transmission and then reconstructed them at the receiving end. Some of the initial problems in improving the visual quality of these early digital pictures were related to the selection of printing producers and the distribution of intensity levels. In fact ,digital images require so much storage and computation power that progress in the field of digital image processing has been dependent on the development of digital computers and of supporting technologies that include data storage, display and transmission. The digital image is composed of a finite number of elements, each of which has a location and values. These elements are referred to as picture elements, image elements, pixels or pels. Pixels used to denote the element of a digital image. The process of acquiring an image of the area containing the text, pre-processing that image, extracting the individual characters , describing the character in the form suitable for computer processing & recognizing those individual characters are Digital Image Processing. Digital image processing techniques began in the late 1960s and early 1970s to be used in medical imaging, remote Earth resource observations and astronomy. The invention in the early 1970s of computerized axial tomography (CAT) also called computerized tomography (CT) is one of the most important events of image processing in medical diagnosis. Computerized axial tomography is a process in which a ring of detectors encircles a patient and an X-Ray source, concentric with a detector ring, rotates about the patient. The X-ray passes through the object and is collected at the opposite end by the corresponding detectors in the ring. As the source rotates, this procedure is repeated. Image processing methods have successfully restored blurred pictures that were the only available records of rare artefacts lost or damaged after being photographed. Image processing methods have successfully restored blurred pictures that were the only available records of rare artefacts lost or damaged after being photographed

# Chapter 3

## Problem Statement

### Drawbacks of Existing System

### Traffic laws and devices are put in place to monitor and control traffic, including pedestrians, motor vehicle drivers, and cyclists. As is well known, there are several traffic law offenders in our country today and this has led to several accident incidents without any repercussion being meted out. These traffic law breakers go about their business freely and confidently knowing that they may never be caught because the appropriate systems have not been put in place. The resultant consequence of breaking traffic laws has led to traffic gird locks, road accidents, and even death when involved in a fatal accident.

### C:\Users\ADMIN\Downloads\WhatsApp Image 2022-09-17 at 11.13.42 PM.jpeg

### It is seen that the security forces and authorities face problems whenever security forces chase a vehicle or they can’t catch a vehicle which broke traffic rules. Authorities find it very hectic on a busy day to log the vehicle numbers manually in a parking lot.

### Solution To Above Problem

In order to make the entire process autonomous, we can install this system so as to automatically detect the vehicle which breaks the traffic rules, take a picture of it and store the number in the database so as to fine the respective owner afterwards. The system can be used in parking so as to take the picture of the vehicle and log the vehicle number in the database (or the cloud, if connected to the internet). This technology reduces the unnecessary hectic manual work required on any busy day, saves the labour cost and is far more efficient than humans. The number of any vehicle once obtained as text, can be displayed, saved in the database or can be searched through the entire database for the details. This project is so versatile that it can be used as an entire application once converted to a software or can be used as a part of any big project.

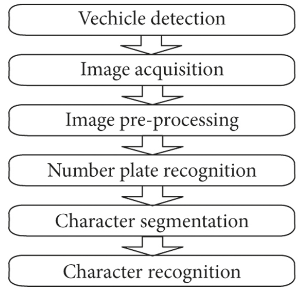
# Chapter 4

## Project Description

In this section you should explain your project in detail

### Overview of the project

* + 1. Flowchart



### 

### 4.1.2Project objective

### ● Image Acquisition

### ● Image Enhancement and pre-processing to improve the quality of the image and convert the image to binary scale so as to use it in contour extraction

### ● Extract the number plate region from the binary image and display it separately.

### ● Apply optical character recognition to display the license plate number from the picture as text.

### Details of processing

### ● Basics of Digital Image Processing : The image of a vehicle whose number plate is to be recognised is taken from a digital camera which is then loaded to a local computer for further processing. OpenCV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision.

### In simple language it is a library used for Image Processing. It is mainly used to do all the operations related to Images. Python, being a versatile language, is used here as a programming language. Python and its modules like Numpy, Scipy, Matplotlib and other special modules provide the optimal functionality to be able to cope with the flood of pictures. To enhance the number plate recognition further, we use a median filter to eliminate noises but it not only eliminates noise. It concentrates on high frequency also. So it is more important in edge detection in an image, generally the number plates are in rectangular shape, so we need to detect the edges of the rectangular plate. Image Processing mainly involves the following steps: 1. Image acquisition: This is the first step or process of the fundamental steps of digital image processing. Image Acquisition is the capturing of an image by any physical device (in this case the primary camera of the computer) so as to take the input as a digital image in the computer.

### 2. Image Enhancement: Image enhancement is among the simplest and most appealing areas of digital image processing. Basically, the idea behind enhancement techniques is to bring out detail that is obscured, or simply to highlight certain features of interest in an image. Such as, changing brightness & contrast etc. In this step the quality or rather the clarity of the input image is enhanced and the image is made clear enough to be processed.

### 3. Morphological Processing: Morphological operations apply a structuring element to an input image, creating an output image of the same size. The image is converted to a binary image, making it more to apply structural extraction to the image and extract any structure related to a particular mathematical model from it, in this case a license plate.

### 4. Segmentation: Segmentation procedures partition an image into its constituent parts or objects. In general, autonomous segmentation is one of the most difficult tasks in digital image processing. A rugged segmentation procedure brings the process a long way toward a successful solution of imaging problems that require objects to be identified individually Representation: Representation and description almost always follow the output of a segmentation stage, which usually is raw pixel data, constituting either the boundary of a region or all the points in the region itself. Choosing a representation is only part of the solution for transforming raw data into a form suitable for subsequent computer processing. Description deals with extracting attributes that result in some quantitative information of interest or are basic for differentiating one class of objects from another

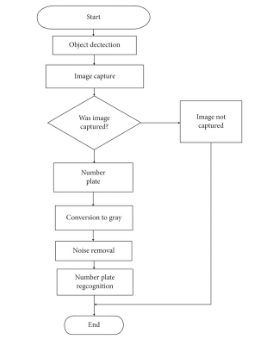
### 5. Recognition: Recognition is the process that assigns a label, such as, “Plate” to an object based on its descriptor

# Chapter 5

## Implementation Details

### Methodology

### 5.1.1 Working Algorithm



● The primary camera of the computer is accessed and the image is clicked after any key is pressed, when the vehicle is in the frame.

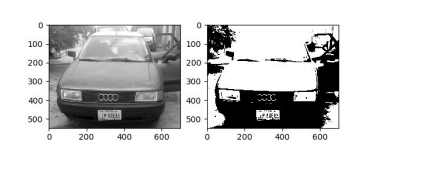
● The input image is then fed in the system, for further processing.

● The Morphed image and the input image and the morphed image is then displayed when any key is pressed. The Morphed image is obtained after morphological transformation

. ● After pressing one more key, the segmented plate is displayed from the morphed image in a new window which is performed using contour extraction on the morphed image

. ● The final step involves performing optical character recognition on the segmented plate using the Tesseract library known as pytesseract in python. The vehicle number is displayed on the terminal and the plate region is highlighted in a new image in a new window, after pressing one more key.

The morphed image may look like :



# Chapter 6

## Conclusion And Future Enhancements

#### 6..1 conclusion

The project is designed so that we can understand the technology used in now-a-days Automatic license plate systems and OCR systems used in most of the developed countries like Germany, France, Singapore, Japan, etc. It is seen that security forces all over the world face problem to locate or register vehicle number to track any culprit. It is also seen that technology can greatly help us in this situation by solving it

#### 6.2 Future Enhancements

As a future work the developed system would be concentrated upon increasing the accuracy of text localization and graphics removal in caption text images. It can be evaluated using various other available image data bases and using various other classifiers. The proposed methods can be further improvised and applied for automatic mixed mail sorting.

Also the future enhancements may include a direct notification or a charge bill for offending the traffic rules.

## References

* + 1. Websites:-

1)SmartIndiahackathon

2) Studocu

3) Hindawi

[2] Literature works

yAmr Badr

Mohamed M. Abdelwahab

Ahmed M. Thabet

Ahmed M. Abdelsadek

Anisha Goyal

Rekha Bhatia

(Department of CSE ,Punjabi University Regional Centre for Information Technology and Management, Mohali, Punjab, India)