# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama", Belgaum-590 014, Karnataka.

An
Internship Report
On

## *"LICENSED NUMBER PLATE RECOGNITION USING OPENCV" USING MACHINE LEARNING*

Submitted in the partial fulfillment of the requirements for the award of the Degree of

**BACHELOR OF ENGINEERING**
**IN**
**INFORMATION SCIENCE AND ENGINEERING**


*Submitted by*

**HARSHITHA.G.N.**
**(1EW18IS033)**

*Under the Guidance of*

**Mrs.Bhavya. T.**
Asst.Prof Dept. of ISE,EWIT,
Bangalore


EAST WEST
INSTITUTE OF
TECHNOLOGY

**DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING**

## EAST WEST INSTITUTE OF TECHNOLOGY

BANGALORE - 560 091
2021-2022

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Sy. No.63, Off. Magadi Road, Vishwaneedam Post, Bangalore - 560 091
(Affiliated To Visvesvaraya Technological University, Belgaum)

## DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

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## CERTIFICATE

This is to certify that the Internship project work entitled "LICENSED NUMBER PLATE RECOGNITION USING OPENCV" presented by HARSHITHA.G.N. **(1EW18IS033)** , bonafide student of **EAST WEST INSTITUTE OF TECHNOLOGY**, Bangalore in partial fulfillment for the award of **Bachelor of Engineering** in **Information Science and Engineering** of **Visvesvaraya Technological University**,Belgaum during the year **2021-2022**. It is certified that all corrections/suggestions indicated have been incorporated in the report. The internship work has been approved as it satisfies the academic requirements in respect of internship work prescribed for the said degree.

| Signature of Guide | Signature of HOD | Signature of Principal |
|---|---|---|
| **Mrs.Bhavya.T** | **Dr. Suresh M B** | **Dr. K Channakeshavalu** |
| Asst.Prof , Dept. of ISE | Prof & Head, Dept. of ISE | Principal |
| EWIT, Bangalore | EWIT, Bangalore | EWIT, Bangalore |

**External Viva**

| **Name of the Examiners** | **Signature with date** |
|---|---|
| 1. _____ | _____ |
| 2. _____ | _____ |

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**External Viva**

| **Name of the Examiners** | **Signature with date** |
|---|---|
| **1.** _____ | _____ |
| **2.** _____ | _____ |

# CERTIFICATE FROM THE ORGANIZATION

**TechCiti Software Consulting Private Limited.**
**CIN:** U72900KA2018PTC117376 **D-U-N-S No. :** 86 14 54180
No. 22 23 24 25/101, BNR Complex, J.P. Nagar, Bengaluru, Karnataka 560078.
**Landline**: 080 4162 8482 **Email**: info@techcitisoftware.in **Website:** www.techcitisoftware.in

**Ref.No.TSCPL/2020-2021/HRD/INT3338**
**Date: 13th October, 2021**

TO WHOMSOEVER IT MAY CONCERN

We would like to inform you that Ms. **Harshitha G N** has successfully completed her internship with our company, she has been working on the project title **"Licensed Number Plate Recognition using Opencv"** (Domain : Machine Learning with Python) from 30.08.2021 to 29.09.2021 as "Software Developer – Intern".

We have found her to be a self –starter who is motivated, duty-bound and hardworking. She has worked sincerely on her assignments and her performance is at par excellence.

We wish her all the best for her future endeavors.

Sincerely,

**Manager**
Human Resources Department
**TechCiti Software Consulting Private Limited.**

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# DECLARATION

I,**HARSHITHA.G.N.,** Student of Seventh Semester B.E ,in the Department of Information Science and Engineering, **East West Institute of Technology,** Bangalore hereby declare that the internship entitled **"LICENSED NUMBER PLATE RECOGNITION USING OPENCV" using MACHINE LEARING** has been carried out by me and submitted in partial fulfillment of course requirements for the award ofdegree in **Bachelor of Engineering** in **Information Science and Engineering** discipline of **Visvesvaraya Technological University**,Belgaum during the academic year **2021- 2022.**Further,the matter embodied in internship report has not been submitted previously by anybody for the award of any degree or diploma to any other university.

**Place: Bangalore** **NAME: HARSHITHA.G.N.**

**Date: 30-08-2021** **USN: 1EW18IS033**

# ABSTRACT

The Advanced number plate identification of vehicles may be large, so transportation and patrol can use the technique it is easy to trace based on the pictures and scan the number plate vehicles. This application is employed for traffic people and a toll gate, check post to watch the violent activity of the folks and that they will ready to take image and create compliant. Advanced recognition of vehicle number plate is often wont save the capture pictures. The number plate identification is done with using the KNN machine learning algorithm. Based on this algorithm and OpenCV library package it is possible to trace the number plate images . This project used Machine learning algorithm to predict the number plate identification. Using this algorithm, it is possible to predict the numbers as well as the characters. Previous system could predict only numbers but in this, it is possible to predict both using ML concepts. The capturing images is blur and it is not clear also in that case this algorithm will predict the number plate result. Using this machine learning and open-cv library packages is used for processing images and finally we can detect the number plate.

# ACKNOWLEDGEMENT

I am grateful to our institute **East West Institute of Technology** with its ideals and inspiration for having provided us with the facilities, which has made this project a success

I would like to express my gratitude to **Dr. K Channakeshavalu**, **Principal, EWIT** for providing us with all the facilities that helped me to carry out the work easily.

I express my sincere thanks to **Dr. Suresh M B, Professor and Head, Dept. of ISE, EWIT** for his valuable guidance and support.

I would like to express my sincere thanks to my internship guide **Mrs. Bhavya. T, Asst. Professor, Dept. of ISE, EWIT** for her valuable guidance, encouragement in carrying out the internship work.

I would like to express my sincere gratitude to my supervisor **Ms.Kasthuri** for providing his invaluable guidance, comments and suggestions throughout the course of the internship. During the period of my internship work. I have received generous help from many quarters, Without the help of them, it was impossible to finish my work.

Finally, I express sincere thanks to my parents. well-wishers and friends for their moral support, encouragement that help me in completing the internship work.

**HARSHITHA.G.N.**
**(1EW18IS033)**

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# CONCLUSION

In this project used Machine learning algorithm to predict the number plate identification. Using this KNN algorithm, we are going to predict the numbers as well as the characters. Previous system we can predict only numbers but in this we can predict both using ML concepts. We have the datasets with all the images in comma separated value format. The capturing images is blur and it is not clear also in that case we can use this algorithm it will predict the number plate result. Using this machine learning and open-cv library packages is used for processing images and finally we can detect the number plate. This project is mostly useful for transportation and patrol people to identify the crime person and they can easily track the exact people

# FUTURE ENHANCEMENT

The automatic vehicle license plate recognition, it is possible to recognize vehicle registration numbers through digital image processing. This technology is unfortunately not a one-size-fits-all solution and needs optimization from region-to-region. To allow a uniform evaluation of different approaches, the proposed algorithms needs to be tested using complex datasets provided various factors as diversity in number plate styles, colors, fonts, sizes, orientations/tilt/skewed, occlusions, obscure characters and other physical conditions, camera resolution, shutter speed, lightening/illumination aids, coverage capability for number plate extraction from the real time complex scenes, fast moving vehicles and to maintain low processing times and increase recognition capabilities in real time scenarios. A real-time video scene is recommended for the tests rather than using pre-taken still images.

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# CHAPTER 1

# INTRODUCTION

In the traffic control and security management framework, License plate recognition methodology plays a vital role, which manages more responsibility for high security. Identifying the moving vehicle's number plate is a complex task, because of the existence of noise and differing illumination and angles. So we need to execute the system with enhanced techniques and methods for accurate and reliable detection of license plate numbers.

Owning a vehicle today is not merely a symbol of luxury but has become a necessity. However, considering vehicles, any catastrophic situation can take place. Therefore there is always an urgent need to arrange appropriate measures to increase the safety, security as well as monitor the vehiclesto avoid any mishelp. It would help us in the situations such as: Instantaneously obtain vehicle details using image processing. Automatically notify the user if there are traffic violations registered to the vehicle. For this purpose, in this work, Automated Vehicle License Plate Detection using KNN method is introduced, which identifies the license plate accurately. Here, preprocessing is the initial step, which is done with the help of median filtering approach. After preprocessing, next we need to extract the license plate, from the image according to the characteristics of license. The license numbers were recognized from the extracted license plate with the help of character segmentation approach, further it is learned and recognized accurately by making use of the machine learning technique, which is termed as KNN classifier.

Automatic Number Plate Recognition can be used to store the images captured by the cameras as well as the text from the license plate, Automatic Number Plate Recognition or ANPR is a technology that uses pattern recognition to 'read' vehicle number plates.The Advanced number plate identification of vehicles may be large, so transportation and patrol can use the technique it is easy to trace based on the pictures and scan the number plate vehicles. This application is employed for traffic people and a toll gate, check post to watch the violent activity of the folks and that they will ready to take image and create compliant. Advanced recognition of vehicle number plate is often wont saved the capture pictures. In this project we are using number plate identification with KNN machine learning algorithm. Based on this algorithm and OpenCV library package we can trace the number plate images.

# CHAPTER 2

# COMPANY PROFILE

## 2.1 AN OVERVIEW OF THE ORGANIZATION

TechCiti is a vast comprehensive information technology services and solutions platform that digitally transforms business operations, enhances customer engagement and augments operational efficiency for its customers all over the world. TechCiti offers an integrated portfolio of products, solutions and services.It serves more than 1500 customers ranging from Fortune 500 companies to emerging start-ups.TechCiti Technologies Private Limited has evolved as one of the leading Managed Service Provider (MSP's) in APAC region. While TechCiti Software Consulting Private Limited has evolved in providing a comprehensive suite of solutions and services ranging from customised software and web development , software and web application testing . We have achieved key milestones in expanding our satisfied customer base through-out APAC region. Our teams have a unique blend of functional and operational knowledge, along with technical expertise and result-oriented management experience ranging from Application Development to end to end IT Implementation projects. Our organization derives its strength from its strong leadership team focused on inspiring an environment of entrepreneurial culture seeped in delivering exceptional value to the customers.

Through a well-defined development, support and quality framework, TechCiti consults companies on their technology road map and implements, supports and maintains business-critical applications and the underlying infrastructure. The company brings along in-depth expertise and robust experience in IT Infrastructure Management, Digital Experience Management, Digital Networking, Automation solutions, Cloud services, performance management, Cloud Security Solutions, Global Network Software Solutions , customized web ,product and application development , technology consulting , web- publishing and maintenance-services.

**OUR VISION**

Our vision is to enable people and organizations realize their potential reinventing their engagement in defining the future using - technology.

**OUR MISSION**

Our mission is to achieve the leading position as a distinguished & absolute end-to-end information technology infrastructure & service provider.

## 2.2 OPERATIONS OF THE ORGANIZATION

The operation of the company is associated with providing managed services and software development.We offer a wide range of services to build a solution that is right our clients business needs. We have a satisfied client base throughout PAN India and Asia Pacific locations . We are associated with many Multi National as well as Fortune 500 companies namely Versa Networks, Tekion, Vimeo , Dr.Reddy's , TechMahindra , BVG India ,Riverbed India Pvt Ltd., HPE , Indian Institute of Science (IISC) and many more . A Business Unit of Techciti Technologies Pvt.Ltd. named TechCiti Software Consulting Pvt.Ltd. is an service and application development based organization .Customized Software development involves product development or application development for the other companies based on their own requirements as well as inhouse ERP Software development which we sell to the other companies on subscription basis .We have been building cross-channel Services & solutions for clients and organizations who are just expanding into more than one channel. TechCiti Software Consulting Pvt.Ltd. also offers technology consulting ,application maintenance & support.

## 2.3 OBJECTIVES OF THE ORGANIZATION

- To emerge as a global leader in the field of software solutions and services.
- To sustain a leadership position and gain market share in our existing product or service offerings and continuously upgrading them by adapting to new technologies.
- To continuously benchmark and partner with the global leaders to usher in futuristic products and services.
- To be a good corporate citizen by inculcating high degree of ethics in its business practices

## 2.4 STRENGTHS AND STRATEGIES

- A commitment to our core values has helped us build long – term ,value centric relationship with customers.
- Continuously re-skilling, training and building the capabilities of our employees to be future-ready.
- "Future proofing" your business by making the required business model changes and building innovative alliances within an ecosystem of strategic partners.

## 2.5 PRODUCTS AND SERVICES OFFERED BY THE ORGANIZATION

- Managed Services – Managed services include :
  - Infrastructure Management Services
  - Data Centre Management Services
  - Managed Network Services
  - Managed Security services
  - Managed customer experience
  - Consulting Services
  - Cloud Services
  - Managed Collaboration and Productivity Services
  - Digital Infrastructure and Networking Services
  - Digital Infrastructure Security
  - Technical Support & Services
- Enterprise Software Solutions
- Web Application Development
- Application Maintenance & Support
- Cloud Web Services

## 2.6 DEPARTMENTS

Each department consists different teams working on specific domains. Each team consists of employees who have different roles and responsibilities to handle.

The main departments in TechCiti are:

- Software Development Department
- IT Department
- Sales and Marketing Department
- Human Resource Department
- Accounts and Finance Department

**Software Development Department**: The Development team involves in the process of conceiving, specifying, designing,programming,documentating,testing and bug fixing involved in creating and maintaining applications ,frameworks or other software components.

The software development team consists of :

- Requirement Analysts
- Project Managers
- Developers
- Product Consultants

**Requirement Analysts**: They work to figure out the customer needs, gather project requirements, and draw up the technical specifications that would be used by their developers in order to define the time frame they need to implement the project.

**Project Managers**: Project managers make sure that the project is delivered timely and it corresponds to your vision and requirements. They spend their working time ensuring each stage of development goes according to plan and all the timeframes and requirements are met. For this reason, project managers read the technical documentation. After that, they draw up a project plan and split it into stages,usually called sprints (periods of time allocated to complete a specific work). However, this process may differ depending on what methodology your team sticks to.

As soon as all the preparations are done, project managers proceed to their main duties: monitoring the entire process of development and coordinating actions of other team members.

**Developers**: The developers are responsible for the front-end and back-end development.

**Front-end Developers:**They turn your prototype into a working website. They create the client-side of the site and make sure the product looks great on any device as well as works stable on any browser.

**Back-end Developers** : They create the server-side of the website to breathe life into the functionality. Also, these specialists may be involved in database creation and CMS development. There is a myriad of programming languages for this purpose.

**Full-Stack Developers** :These developers can deal with both front-end and back-end.

Product Consultant: The product consultant team is responsible to customize and personalize the software applications as per the client needs.

**IT Department** : The role of an IT department within an organization is to design, maintain, and support an organization's information technology infrastructure, thus allowing the organization to leverage both information and technology in an efficient, productive and secure manner.

**Sales and Marketing Department** : A strong sales team is crucial to the success of a company because the sales department is responsible for making sales, growing your business and retaining existing customers. Ultimately, the most important function of your sales department is maintaining relationships with your customers. The sales team plays the crucial role of selling the products to the customers and contributing to the revenue growth of the company .

**Human Resource Department** : The HR department comprises of HR Manager and HR Executives . They are responsible for recruiting, screening, interviewing and placing work force in an organization . They also handle employee relations, payroll, benefits, and training. HR managers plan, direct and coordinate the administrative functions of an organization.

**Accounts and Finance Department** : The accounting department is responsible for recording and reporting the cash flow transactions of a company. This department has some key roles and responsibilities, including accounts receivable, accounts payable, payroll, financial reporting, and maintaining financial controls.

Each department has various sub-divisions where each division in the department performs their particular tasks assigned for providing good services to the customers.

As a part of your internship , you will be working as a Software Developer intern as a part of our the Development Team , which comprises of 32 people.

# CHAPTER 3

# SYSTEM ANALYSIS

## 3.1 EXISTING SYSTEM

License Plate Recognition is a crucial task due to the non-uniformity in license plates and the illumination conditions. Most of the developed techniques work under specific conditions such as image capturing angle, illumination, stationary background. All the given LPR techniques vary on the basis of processing time, required computational power and accuracy. Since the absence of any standard, these techniques are incomparable but an efficient path for specified requirements can be judged. In the current system, the License Plate Recognition (LPR) system is one of the most important criterion's of mass surveillance method. LPR systems are generally composed of three steps namely:

- Plate extraction
- Character Segmentation
- Recognition.

## 3.2 PROPOSED SYSTEM

Automatic Number Plate Recognition using an efficient OCR engine like Pytesseract along with major and vast libraries of OpenCV for image processing. As we have seen so far ANPR covers as a solution to most of the problems we have posed. We would like to dig a bit deeper now and highlight the scope of the project and the extent to which we can push the boundaries.The main issue that is usually recognized when it comes to number plate detection is the noise that is added to the image in the process of capturing the image or due to the environment around, taking that into consideration we can say that using our system, we can implement it in all environments, be it rain or even in the dark.Usually when any new system is proposed to possible clients, their main concern is the addition of new features into their existing system. Keeping this in mind we can sayfor sure that our system can be integrated to the preexisting infrastructure of most clients.

Traffic control, security management system and License plate recognition methodology plays crucial role, which ensures high security. It is the need of the hour to implement this technology with improved strategies for exact and authentic identification of license plate numbers. For this cause in this project Automated Vehicle License Plate Detection using Tesseract OCR method is initiated, which recognize the license plate accurately.

Here, preprocessing is the initial step, which is done with the help of median filtering method. Followed by preprocessing, the license plate need to be extracted from the image based to the features of license.

The license numbers were detected from the extracted license plate with the help of character segmentation method, and then it is studied and recognized exactly by making use of the machine learning technique, which is termed as Tesseract OCR. The whole structure of the research proposal is done in python simulation environment, which confirms that the proposed research technique gives an accurate detection, when compared with the current research techniques.

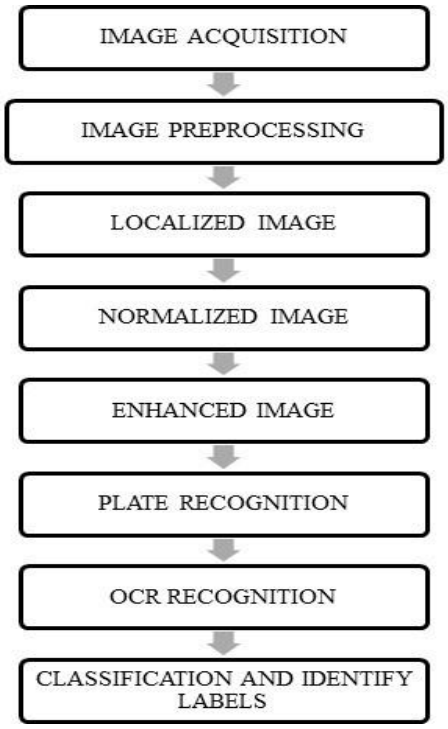


**FIG 3.1: PROPOSED SYSTEM OF LICENSED NUMBER PLATE RECOGNITION.**

## 3.2.1 ADVANTAGES OF THE PROPOSED SYSTEM

- To perform successful and efficient preprocessing on the raw RGB image
- To exploit the high performance and effectiveness of OpenCV and Pytesseract frameworkto detect and recognize LP of vehicles,to improve our system reliability.
- To correctly determine the number plate based on Indian Number plate Standards.

## 3.3 FEASIBILITY STUDY

Feasibility is nothing but determining or finding the project is doing well or not.The steps involves in this process is called feasibility study. In other words it is the method of processing the functional requirements of user and uses of the resources and managing of those resources with the time. This study is used to understand and analyze whether the created system is working feasible or not.Once the requirement specification is done then development will be moved to next level that is design.In design phase lots of solutions will be presented. But the best solution among all the solutions will be chosen, this is the biggest responsibility of the developer for the further development.

### 3.3.1 Technical Feasibility

As name indicates it consider software equipment and tells about the technical feasibility like whether the system fulfilling the user needs by giving desire and expected outputs, whether the system running in all the environments. And it gives response time of the system and the speed of the process. Here developer have to make sure the programming languages that he chosen is to be understand to a common or normal person. Here it is very important that, whatever decision the developer takes, he make sure that it should be flexible, that means front and backend should be flexible and it should work and support in all the environment.

### 3.3.2 Economic Feasibility

Economic feasibility is the most commonly used method or technique for analyzing or estimate the effectiveness of a proposed system. Further it is also known as fare/profit analysis. The approach is to calculate the profit and the savings and proposed system will be compare with the fare. The decision of design and implementation of the system is taken and made if there is any chance of being selected. There will be a continuous attempt that boost the accuracy in every step or level of system life cycle.

# CHAPTER 4

# SOFTWARE REQUIREMENT SPECIFICATION

## 4.1 INTRODUCTION

This chapter describes about the requirements. It specifies the hardware and software requirementsthat are required in order to run the application properly. The Software Requirement Specification (SRS) is explained in detail, which includes overview of dissertation as well as the functional and non-functional requirement of this dissertation.

A SRS document describes all data, functional and behavioral requirements of the software under production or development. SRS is a fundamental document, which forms the foundation of the software development process. It is the complete description of the behavior of a system to be developed. Requirement Analysis discusses the conditions to be met for a new or altered product. Requirement Analysis is critical to the success to a development project. Requirement must be documented, measurable, testable, related to in identified business needs or opportunities, and defined to a level of detail sufficient for system design.

The SRS functions as a blueprint for completing a project. The goal of preparing the SRS documentis to:

- ❖ Facilitate communication between the customer, analyst, system developers, maintainers.
- ❖ To form a foundation for the design phase.
- ❖ Support system testing facilities.
- ❖ Controlling the evolution of the system.

### 4.1.1 FUNCTIONAL REQUIREMENT

Defines in detail how the system must respond to the various kinds of input that is given to the system. It also talks about the expected system behavior under certain conditions.

In this system following are the functional requirements:

**1. Mobility:** The device identifying the License plate should be movable to capture the LPon the go

**2. Convenience:** The system will make it efficient to access for vehicles and preventcongestion at entry and exit points

**3. User-Interface:** The system shall provide an easy-to-use user-interface.

**4. Transparency:** Users should be able to possess a general knowledge and understandingof the ALPR process.

**5. Flexibility:** The system shall be flexible in that it allows a variety of formats to ingrate the scanning of characters.

**6. Accuracy:** The system shall accurately convert the image to characters

**7. Uniqueness:** The system is trained to handle unique and varying types of number plates

**8. Documentation and Assurance:** The design, implementation, and testing proceduresmust be well documented so that the confidence is ensured.

**9. Cost-effectiveness:** Should be affordable and efficient.

## 4.1.2 NON-FUNCTIONAL REQUIREMENTS

Non-functional requirements are the requirements which are not directly concerned with the specific function delivered by the system. They specify the criteria that can be used to judge the operation of a system rather than specific behaviors. Non-functional requirements are requirements that are not specifically concerned with the functionality of a system. They normally place restrictions on the product being developedand the development process. Non-functional requirements may be regarded as parameters of functionality in that they determine how quickly, how accurately, how reliably, how securely, etc.,functions must operate.

Some of the ALPR non-functional requirements are as follows:

- The system may issue a receipt to remove any papers printed and make it a green initiative
- The system must be working at 100% peak efficiency
- When checking the database for errors, a 100% scan of the data is required, rather than selectingsample set.
- A process must be devised to support normal precinct business hours
- The system should provide documentation to inform users of system functionality and any change to the system.

## 4.2 SYSTEM REQUIREMENTS:

### 4.2.1 HARDWARE REQUIREMENTS:

| | | |
|---|---|---|
| OS (Operating System) | : | Windows 10 |
| Processor | : | Intel I5 2.1 Ghz. |
| Storage | : | 100 GB. |
| RAM | : | 4 GB |

### 4.2.2 SOFTWARE REQUIREMENTS:

| | | |
|---|---|---|
| Programming Language | - | Python 3x |
| Front End or Web Technologies | - | HTML5,CSS, BOOTSTRAP4 |
| Web Frame works | - | Django 2x |
| IDE (Integrated Development Environment) | - | PyCharm IDE Community Edition 2021.2.3 |
| APIs | - | NumPy, Pandas, Sklearn, Matlib |
| Technology used | - | Machine Learning |
| Database | - | SQLite |

#### 4.2.2.1 HTML

HTML is the Hyper Text Markup Language it is used for creation of websites or web pages. For creation of website/web pages we are using Cascading Style Sheet (CSS) it is used to create styles for your web pages like font, color, animation and JavaScript it is used for validation purpose.Web browser get HTML file from a web server and we can see the website page in any type of browsers. HTML describes the structure of a web page and it is the tag based language.

#### 4.2.2.2 CSS

CSS is used for while creating web page adding style in that in a simple and easiest way. CSS explanation "Cascading Style Sheet". **C**ascading **S**tyle **S**heets, also known as CSS, it is simple style-based language to make website attractive.

### 4.2.2.3 BOOTSTRAP 4

Bootstrap is an open-source framework used to develop the responsive web applications or responsive designs. Responsive means application should be runs on smaller screens like mobile phones and tablets. Every element of the HTML document gets stacked when the page gets smaller or minimized. By default, bootstrap takes 12 columns of width with equal separation of the columns that means every column having same size. But you can alter the default values and you can make layouts, design according to your requirements using  tag.Bootstrap provide grid system for all kind of devices such as normal,medium and short which can help to run the app on every devices. Further it provide some stylish buttons, forms, tables and so on. Bootstrap 4 is the newest version with some additional features compare to previous versions. In this project bootstrap 4 is used for the front development along with the Django framework.

### 4.2.2.4 MACHINE LEARNING

Machine learning is the type of AI in this it will learn automatically without having the user knowledge(Ex.Robot-in that if we feed the data based on that it will follow instructions and experience by own,we don't need to insist each and every time.)

Machine learning has three types:

Supervised Learning- Name itself denotes it is a supervisor technique. We can simply say it is a labelled data we know both input and o/p based on that we are going to predict the accuracy. It has two types

- Classification-Discrete or categorical values
- Regression-Continuous values

Unsupervised learning- It is the unlabelled data, it has only input features. Based on the input data itself we need to find and predict the output. It has two types

Clustering Association

Reinforcement Learning- It is trial and error method

### 4.2.2.5 DJANGO

Django is high level web framework in python which is developed and maintain by DSF (Django Software Foundation). Now a days Django widely in used because of its more built-in functionalities.

There are some famous and well-known companies and apps are using Django for the development of their websites and those companies and apps are Google, Instagram, Disqus, Spotify, You Tube, Pinterest, It is used in web development in python. It supports templates and static files that means you can easily render the HTML pages by putting all the HTML files in the directory called 'templates' and similarly you can place all the files related to styles like CSS and JS will be placed inside the directory called 'static'. In this project Django is used for the front-end development. Further Django provide more features as compared to other frameworks and those features are given below.

- Built in localhost server
- Built in administration facility
- High security
- Rapid development
- Outstanding documentation

### 4.3.2.6 PANDAS

Pandas is the library for the python language which is used for understand and analysis of data. It provides some data pattern to analyze using different way process.

# CHAPTER 5

# THEORETICAL BACKGROUND

## 5.1 DIGITAL IMAGE PROCESSING

Signal processing is a discipline in electrical engineering and in mathematics that deals with analysis and processing of analog and digital signals , and deals with storing , filtering , and other operations on signals. These signals include transmission signals , sound or voice signals , image signals , and other signals e.t.c.

Out of all these signals , the field that deals with the type of signals for which the input is an image and the output is also an image is done in image processing. As it name suggests, it deals with the processing on images.The digital image processing deals with developing a digital system that performs operations on an digital image.

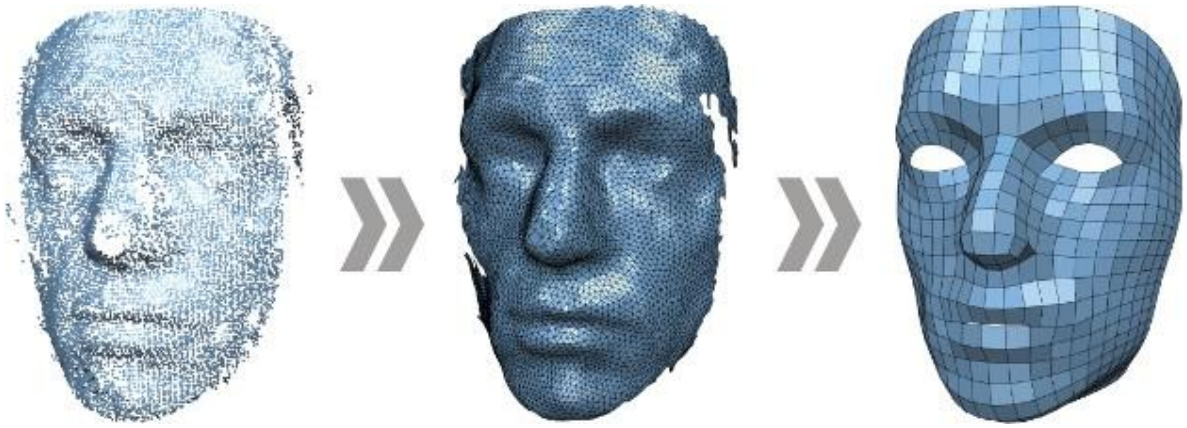

**FIG 5.1: DIGITAL IMAGE PROCESSING**

Since capturing an image from a camera is a physical process. The sunlight is used as a source of energy. A sensor array is used for the acquisition of the image. So when the sunlight falls upon the object, then the amount of light reflected by that object is sensed by the sensors, and a continuous voltage signal is generated by the amount of sensed data. In order to create a digital image , we need to convert this data into a digital form. This resultsin an two dimensional array or matrix of numbers which are nothing but a digital image

## 5.1.1ADVANTAGES OF DIGITAL IMAGE PROCESSING

- Digital images can be processed by digital computers.
- Important features such as edges can be extracted from images which can be used in industry.
- Images can be given more sharpness and better visual appearance.
- Minor errors can be rectified.
- Image sizes can be increased or decreased.
- Images can be compressed and decompressed for faster image transfer over the network.
- Images can be automatically sorted depending on the contents they have.
- Unrecognizable features can be made prominent.
- Images can be smoothened.
- It allows robots to have vision.
- It allows industries to remove defective products from the production line.
- It allows weather forecasting.
- It is used to analyse cells and their composition.
- It is used to analyse medical images.

## 5.1.2 PROBLEMS ASSOCIATED WITH DIGITAL IMAGE PROCESSING

- It is very costly depending on the system used, the number of detectors purchased.
- Time consuming
- Lack of qualified professional

## 5.2 OPTICAL CHARACTER RECOGNITION

Optical character recognition or optical character reader (OCR) is the electronic or mechanical conversion of images of typed, handwritten or printed text into machine-encoded text, whether from a scanned document, a photo of a document.

Widely used as a form of data entry from printed paper data records – whether passport documents, invoices, bank statements, computerized receipts, business cards, mail, printouts of static-data, or any suitable documentation – it is a common method of digitizing printed texts so that they can be electronically edited, searched, stored more compactly, displayed on-line, and used in machine processes such as cognitive computing, machine translation, (extracted) text-to-speech, key data and text mining. OCR is a field of research in pattern recognition, artificialintelligence and computer vision.

**FIG 5.2 OPTICAL CHARACTER RECOGNITION.**

Early versions needed to be trained with images of each character, and worked on one font at a time. Advanced systems capable of producing a high degree of recognition accuracy for most fontsare now common, and with support for a variety of digital image file format inputs. Some systems are capable of reproducing formatted output that closely approximates the original page includingimages, columns, and other non-textual components.

### 5.2.1 USES OF OCR

- Data entry for business documents, e.g. check, passport, invoice, bank statement and receipt
- Automatic number plate recognition
- In airports, for passport recognition and information extraction
- Automatic insurance documents key information extraction
- Traffic sign recognition
- Extracting business card information into a contact list
- More quickly make textual versions of printed documents, e.g. book scanning for Project Gutenberg
- Make electronic images of printed documents searchable, e.g. Google Books
- Converting handwriting in real time to control a computer (pen computing)
- Defeating CAPTCHA anti-bot systems, though these are specifically designed to prevent OCR. The purpose can also be to test the robustness of CAPTCHA anti-bot systems.
- Assistive technology for blind and visually impaired users.

## 5.3 Database

A database is a collection of information that is organized so that it can be easily accessed, managed and updated. Computer databases typically contain aggregations of data records or files, containing information about sales transactions or interactions with specific customers.

In a relational database, digital information about a specific customer is organized into rows, columns and tables which are indexed to make it easier to find relevant information through SQL or NoSQL queries. In contrast, a graph database uses nodes and edges to define relationships between data entries and queries require a special semantic search syntax.

.Typically, the database manager provides users with the ability to control read/write access, specify report generation and analyze usage. Some databases offer ACID (atomicity, consistency, isolation and durability) compliance to guarantee that data is consistent and that transactions are complete.

### 5.3.1 MYSQL DATABASE

SQL is a domain-specific language used in programming and designed for managing data held ina relational database management system, or for stream processing in a relational data stream management system.SQL is used to communicate with a database. According to ANSI (American National Standards Institute), it is the standard language for relational database management systems.SQL statements are used to perform tasks such as update data on a database, or retrieve datafrom a database.

## 5.4 OPENCV

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code.

The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, trackcamera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc. OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding 18 million. The library is used extensively in companies, research groups and by governmental bodies.

Along with well-established companies like Google, Yahoo, Microsoft, Intel, IBM, Sony, Honda, Toyota that employ the library, there are many startups such as Applied Minds, Video Surf, and Zeitera, that make extensive use of OpenCV. OpenCV's deployed uses span the range from stitching streetview images together, detecting intrusions in surveillance video in Israel, monitoring mine equipment in China, helping robots navigate and pick up objects at Willow Garage, detection of swimming pool drowning accidents in Europe, running interactive art in Spain and New York, checking runways for debris in Turkey, inspecting labels on products in factoriesaround the world on to rapid face detection in Japan.

It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS. OpenCV leans mostly towards real-time vision applications and takes advantage of MMX and SSE instructions when available. A full-featured CUDA and OpenCL interfaces are being actively developed right now. There are over 500 algorithms and about 10 times as many functions that compose or support those algorithms. OpenCV is written natively in C++ and has attempted interface that works seamlessly with STL containers.

## 5.5 TESSERACT ENGINE

An open-source OCR engine that has gained popularity among OCR developers. Even though it can be painful to implement and modify sometimes, there weren't too many free and powerful OCR alternatives on the market for the longest time. Tesseract began as a Ph.D. research project in HP Labs, Bristol. It gained popularity and was developed by HP between 1984 and 1994. In 2005 HP released Tesseract as an open-source software. Since 2006 it is developed by Google.

Tesseract is an open source text recognition (OCR) Engine, available under the Apache 2.0 license.It can be used directly, or (for programmers) using an API to extract printed text from images. It supports a wide variety of languages. Tesseract doesn't have a built-in GUI, but there are several available from the 3rdParty page. Tesseract is compatible with many programming languages and frameworks through wrappers that can be found here. It can be used with the existing layout analysis to recognize text within a large document, or it can be used in conjunction with an externaltext detector to recognize text from an image of a single text line.

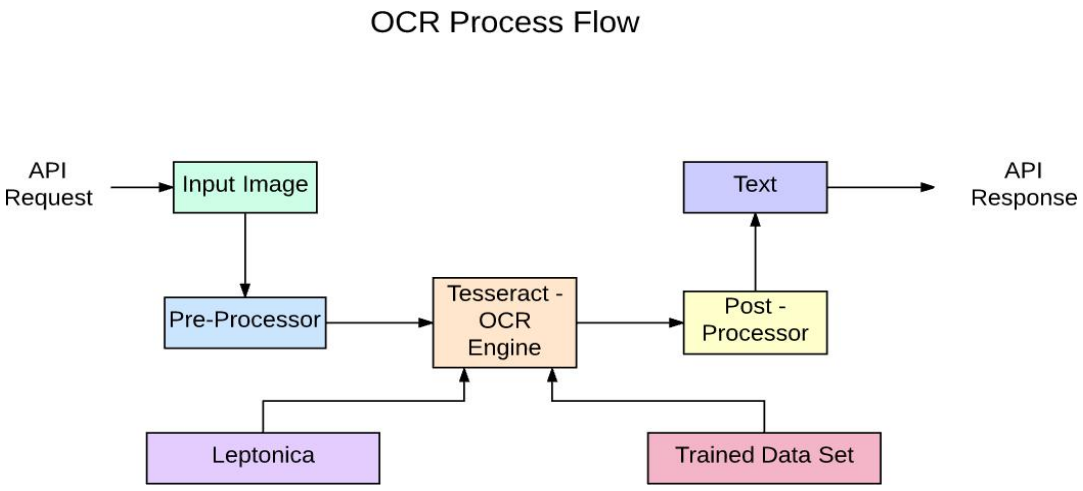


**FIG 5.3:TESSERACT ARCHITECTURE.**

# CHAPTER 6

# SYSTEM DESIGN

## 6.1 MODULARIZATION DETAILS

For detecting number plate, we are going to use two modules

- RTO Module
- Crime Department Module

### 6.1.1 FUNCTIONAL REQUIREMENTS

Functional requirements of the system tells about the functional part of the system and it contains computation, practical details, manipulation and operations on data and some more unique functionalities of the system. It actually tells about the system what supposed do. Here we can see how and what the kind of outputs and results are generating and what kind of services it providing to the end users.The functional requirements of the system tells about the cost of the system and it also tells about reliability of the system that means the services provided by the system is fulfilling the user needs or not and the output which is getting from the system is expected output or not will be studied.It also gives the complete functionality of the subsystems of a system and a document of high level statements will be maintained in which all the above points will be completely and clearly explained in detail. The document may include some key points or functional requirements such as safety and security, quality, manufacturability, usability, performance, reliability and environmental friendliness and so on.

### 6.1.2 NON-FUNCTIONAL REQUIREMENTS

Non functional requirements of the system is nothing but it describe the standard which is used to conclude the operations of the system. In other words non functional requirements of the system is defined as the constraints, rules, guidelines and the procedure applied on the functional requirements is called non functional requirements. It tells about how a system is should be present, that means it gives the plan about the architecture of the system. It is also called as “quality attributes” and it is divided into two types, first one is execution and another one is evolution.The first type of non functional requirements that is execution contains security and safety, usability which can be seen at the run time. Whereas the second type contains scalability, extensibility, maintenance and testing.

## 6.2 DATABASE DESIGN

**6.2.1 RTO:** The below screenshot is for the database design of an RTO module where while registering in this module the user can provide with their information like the employee id,name,gender,mail,password.

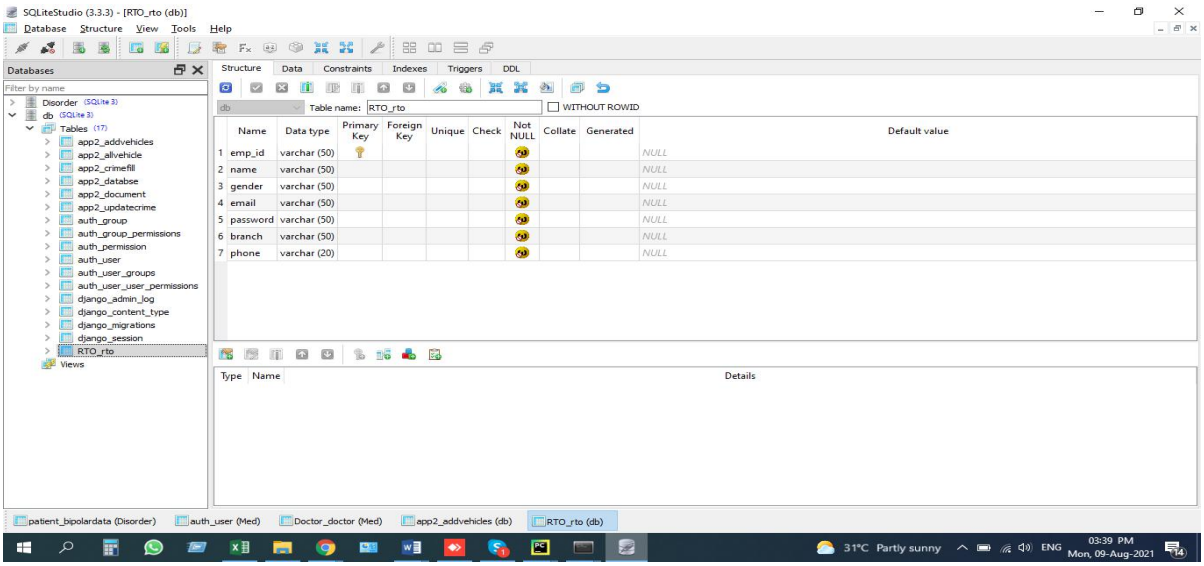


**FIG 6.2.1 DATABASE DESIGN OF RTO DATABASE.**

**6.2.2 ADD VEHICLE:** The below screenshot is for the database design to add a new vehicle to identify its details like the vehicles owners name,address.

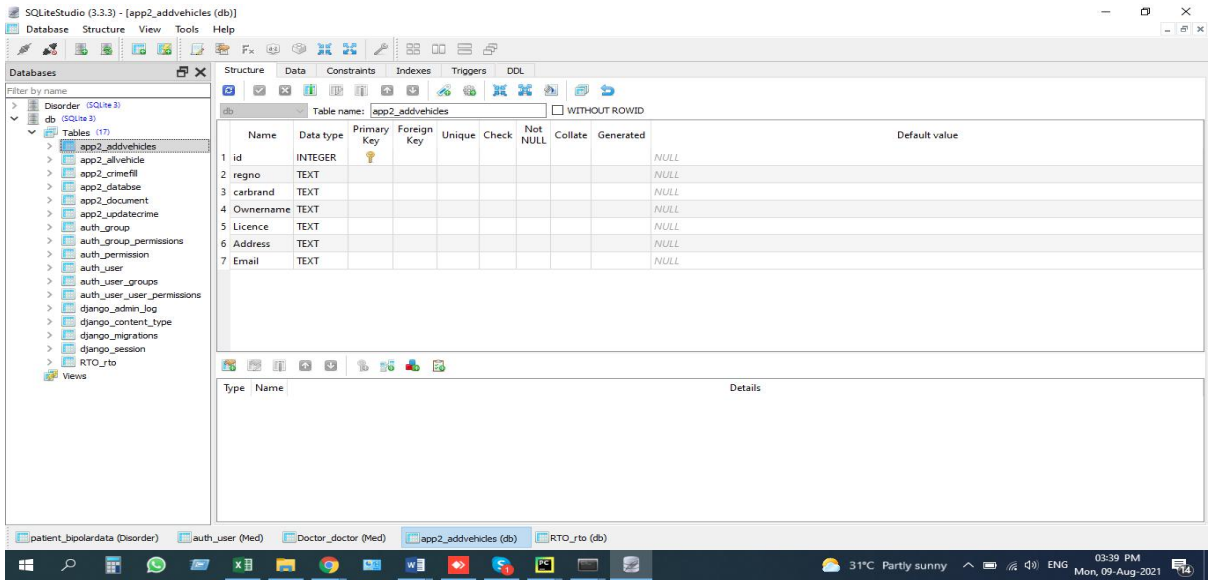


**FIG 6.2.2 DATABASE DESIGN TO ADD A VEHICLE**

**6.2.3 USER:** The below screenshot is for database design of user module where the user while registering to the vehicle number plate identification for the first time provides their personal details and required information.

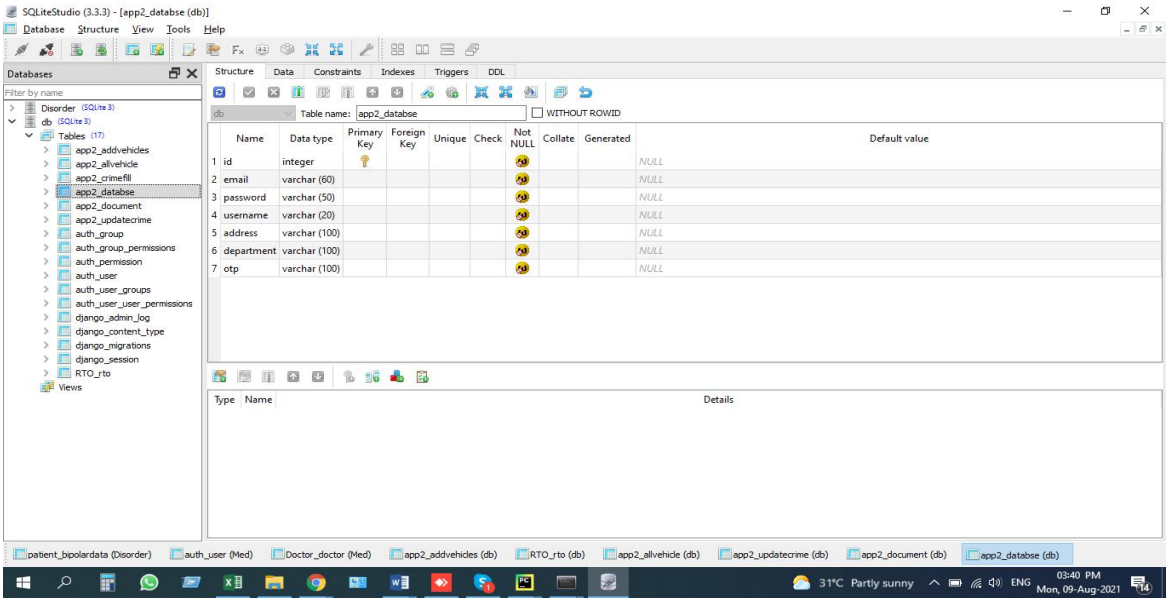


**FIG 6.3.3 DATABASE DESIGN FOR USER.**

## 6.3 DATA FLOW DIAGRAM

Data Flow Diagram is a graphical representation of a process or system of the data. It consists of various method like data process and sources of data and all the description to understand the data in easiest way.DFD is type of the modelling tools.DFD is used to identify the data relationship in different ways by using event diagrams, activity diagrams, transition diagrams and class diagrams.

There are four kind of system components:

- Processes
- External Entities
- Data Flow
- Data Stores

## 1. Data Flow

Data in a system moves in a definite way that is from starting to ending process. The data flow is a store of data indicating the movement of the data within the system. Data flow must be inputs to or outputs from processes. They must contain data and all data flows should be labelled indicating what data is flowing.

If the data flow is showing an input, then the arrow should point towards the process. But in case the data flow is showing an output then the arrow should point away from the process.

## 2.Process

Processes transform input into outputs. They are the activities related to the work or action of the data to get the data process output. The data flow leaving a process is always Processes transform input into outputs. s. The data flow leaving a process is always the method data related to the action

**3.External Entities** External entities is the relationship between the stored data information and all sources of the data. When the system we are considering accepts data from another system to provide data to it, that other system is the external entity.

## 4.Data Store:

Data store could be thought of, as the 'memory' of the system. Any place that data accumulates is a data store. A data store must have at least one data flow pointing towards it, or one away from it. The data store must have a label which is placed between the two parallel lines.

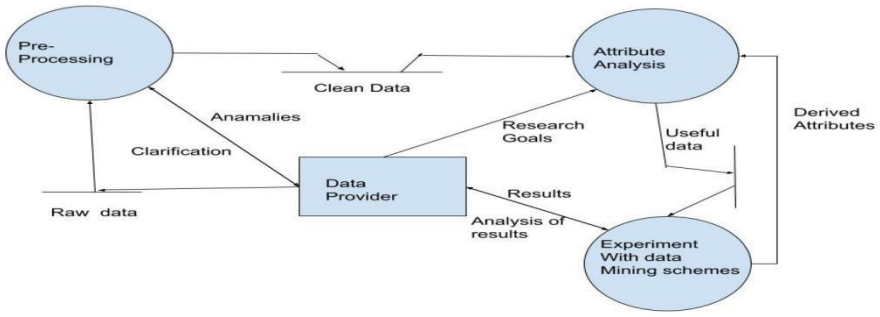


**FIG 6.3: DATA FLOW DIAGRAM.**

# CHAPTER 7

# IMPLEMENTATION

The k-nearest neighbours algorithm (k-NN) is considered as a non-parametric method in the pattern recognition, which is utilized for classification and regression. In both these scenarios, the input has the k closest training samples in the feature space. The output works on whether k-NN is utilized for classification or regression:

- In k-NN classification, the output is assumed as a class membership. An object is segregated by its neighbour's majority vote, then the object is being allotted to the class, which is most common between its k nearest neighbours (k is a positive integer, typically small). If k = 1, then the object is simply allotted to the last of that single nearest neighbour.
- In k-NN regression, the output is the property value for the object. This value is the average of the values of its k nearest neighbours
- KNN is a kind of instance-based learning, or lazy learning, where the functions approximated locally and here entire calculation is delayed until the classification process. The k-NN algorithm is considered as a simplest method of the entire machine learning algorithms.

Character recognition is the final stage in vehicle license plate detection and recognition,where it reads the individual characters and numbers.Single elements on the license plate should be classified and examined.This examination is termed as Optical Character Recognition(OCR) with KNN.

## 7.1ALGORITHM TO RECOGNIZE THE NUMBER PLATES

The sequence of processes associated with Number plate recognition is given below. The fileupload process is initiated by the data owner entity.

**Input**: Uploading the image file from camera

**Output**: Vehicle number plate in characters

- Read the original image or Capture the image
- Resize the image
- Convert it to grayscale.

- Apply Bilateral Filter. A bilateral filter is a non-linear, edge preserving, and noise-reducing smoothing filter for images. It replaces the intensity of each pixel with a weighted average of intensity values from nearby pixels.
- Identify and store the Canny edges. The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images.
- Find the contours in from the edges detected and sort the top 30 contours
- Get the perimeter of each contour and select those with 4 corners.
- Mask all other parts of the image and show the final image.
- Read the text using Tesseract OCR
- Standardize the text to Indian number plate format.
- Stop

On upload of the image file to the system, the number plate recognition system performs itsfunctions to provide the output.

# CHAPTER 8

# SNAPSHOTS

**8.1 HOME PAGE:** The below screenshot is of the home page designed where the home page displays the login or register option for the user.

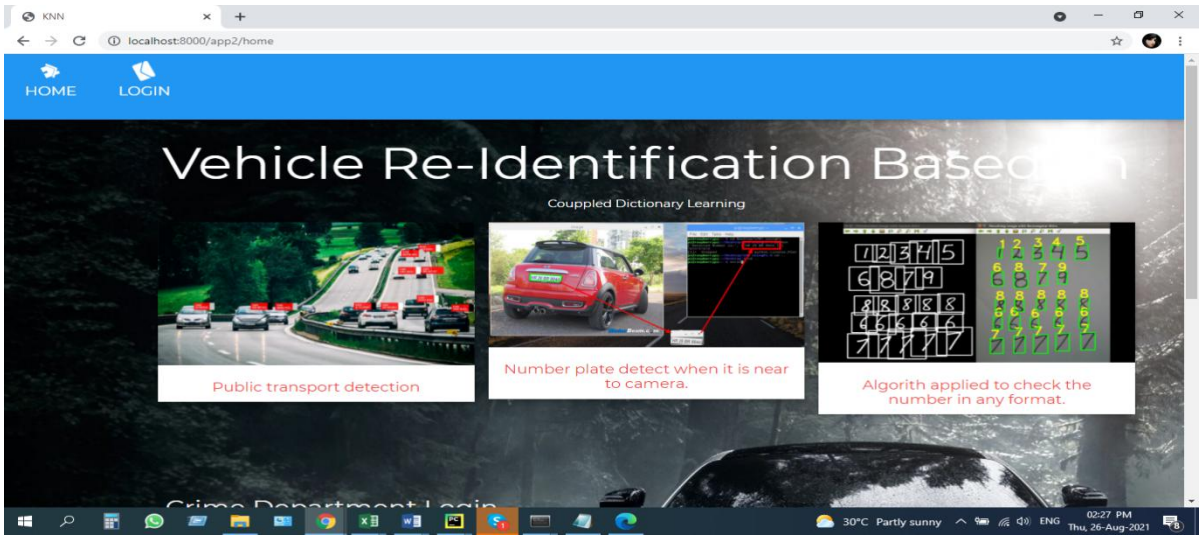


**FIG8.1 HOME PAGE DESIGN FOR LOGIN AND SIGNUP ACTIVITY.**

**8.2 LOGIN:** The below screenshot is of the login page where the user can enter his/her mail-id and password and other details provided during the registration.

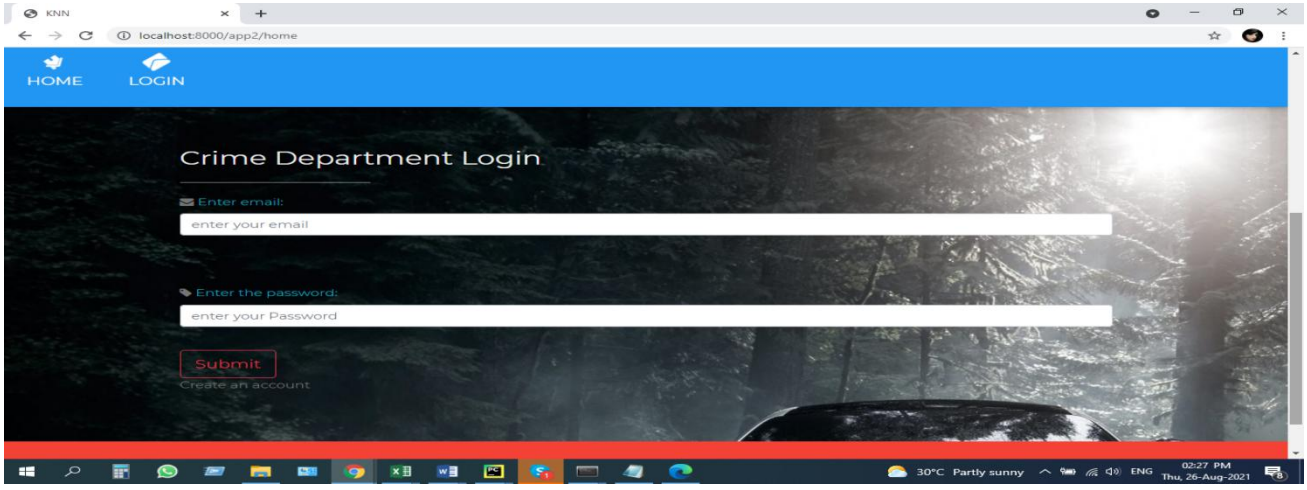


**FIG8.2 LOGIN PAGE DESIGN FOR USER TO LOGIN.**

**8.3 OTP:** The below screenshot is for the otp verification which the user receives the otp to their registered mail-id at the time of login.

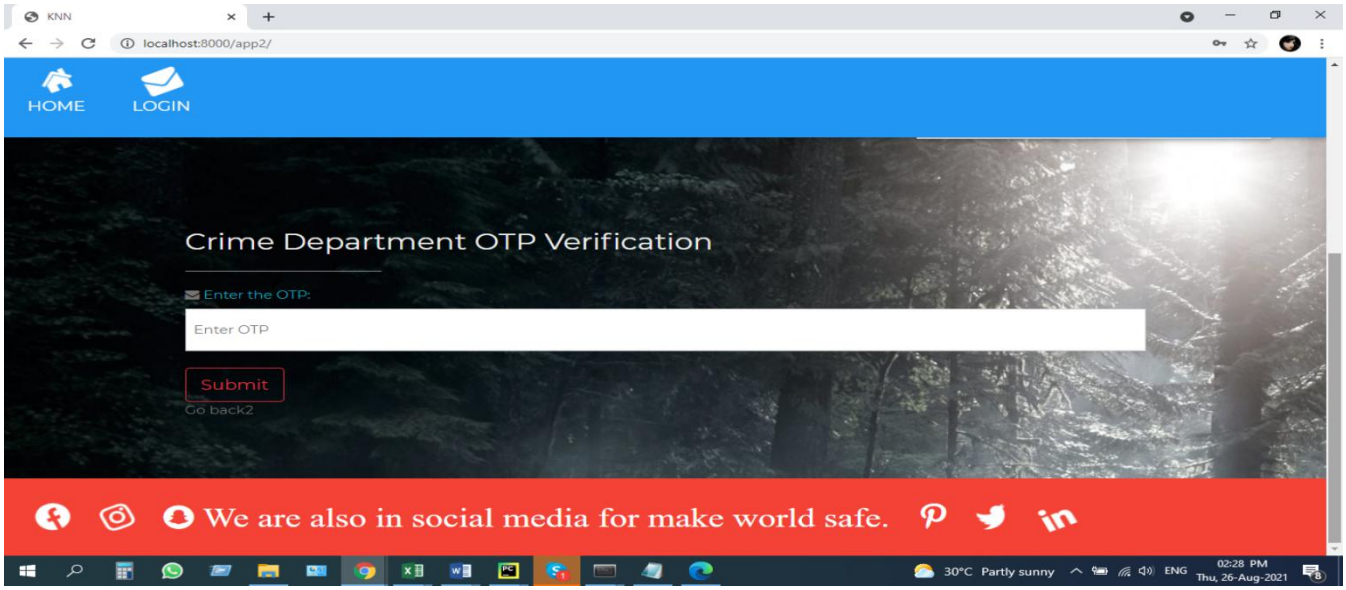


**FIG8.3 OTP VERIFICATION FOR USER AFTER LOGIN.**

**8.4 UPLOAD:** The below screenshot allows the user to upload the image of the vehicle whose license plate is to be recognized after successful OTP verification.

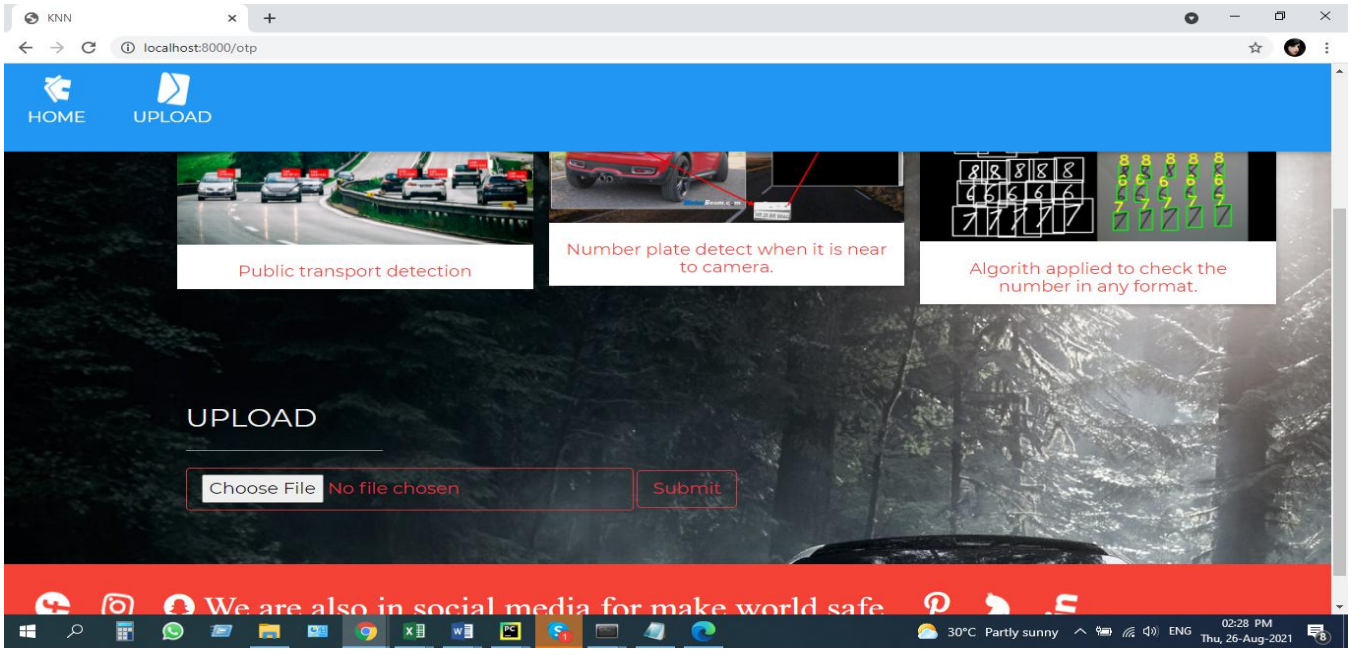


**FIG8.4 UPLOAD THE IMAGE TO DETECT THE NUMBER PLATE..**

**8.5 OUTPUT:** The below screenshot displays the output of the uploaded vehicle image and the vehicle plate number.

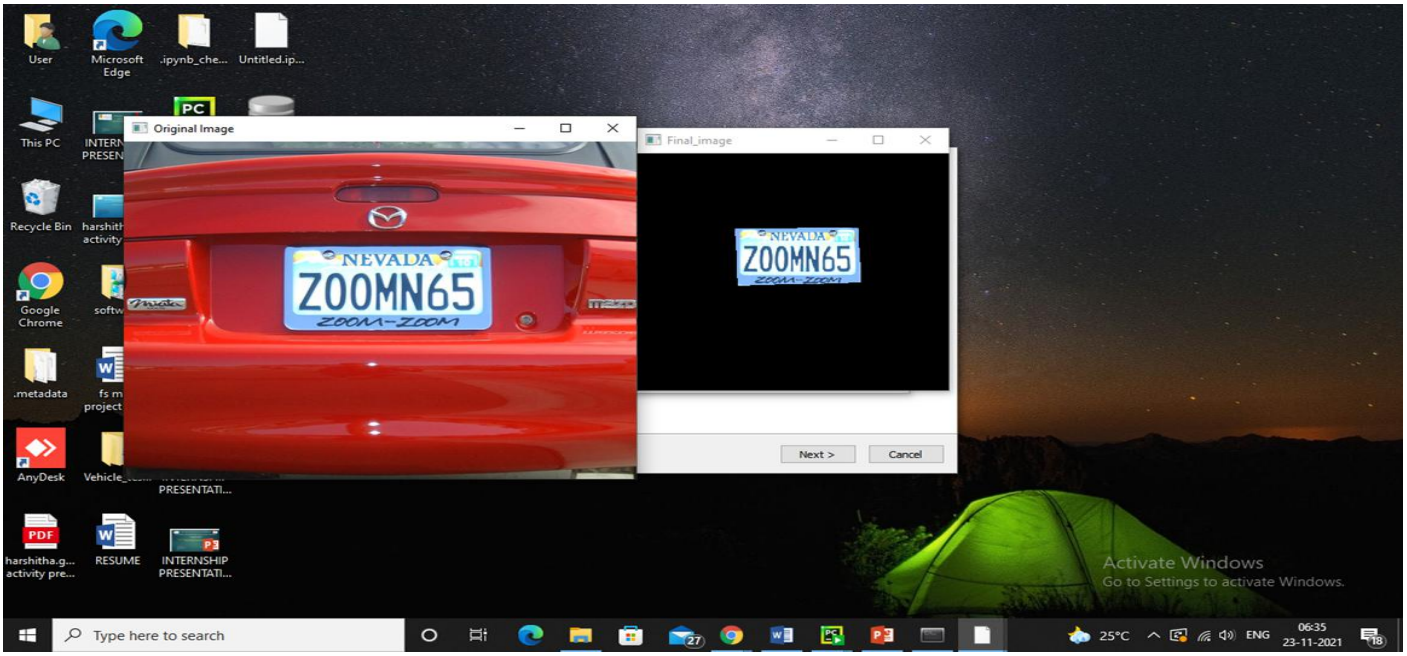


**FIG8.5:THE FINAL IMAGE WHICH DETECTS THE CROPPED IMAGE OF THE VEHICLES NUMBER PLATE.**