IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 6, May 2023

Automatic License Plate Recognition (ALPR)

Girish Pathode, Anuj Singh, Shashank Kumar, Dr. D.M. Bhalerao
Department of Electronics & Telecommunication
Sinhgad College of Engineering, Vadgaon BK, Pune, India

Abstract: *The number plate recognition (NPR) system is one of the categories of smart transportation and detection mechanism (STDM). This is a combination of the technology in which the application enables the system to detect and automatically read the license id of number plate of vehicle from digitally captured images. Automatically capturing the license plate is the process of detecting and transforming the pixels data of a digital image into the plain text data or ASCII text of the number plate. Our project contains a method for the vehicle number plate recognition from the image using mathematical morphological operations (erosion, dilation). The main objective is to use and combine different morphological operations in such a way that the license plate of the certain vehicle can be detected and translated effectively. This is based on various operation such as image improvement, Gray scale transformation, Bilateral Filtering edge detection and getting the number plate from the picture of vehicle. After the completion of the above-mentioned steps, now the process of segmentation is being applied to detect the text present on number plate by making use of matching of template and OCR. This system is able to detect the license number accurately as well as quickly from the vehicle's picture.*

Keywords: Machine learning, ALPR, Software Development Life Cycle - Spiral Model, OCR-Optical character Recognition, KNN classifier, openCV2 image processing; computer vision; intelligent transportation system; smart vehicle technologies; object detection and tracking; Character and digit recognition.

I. INTRODUCTION

Every country uses their own way of designing and allocating number plates to their country vehicles. This license number plate is then used by various government offices for their respective regular administrative task like- traffic police tracking the people who are violating the traffic rules, to identify the theft cars, in toll collection and parking allocation management etc. In India all motorized vehicle are assigned unique numbers. These numbers are assigned to the vehicles by district-level Regional Transport Office (RTO). In India the license plates must be kept in both front and back of the vehicle. These plates in general are easily readable by human due to their high level of intelligence on the contrary; it becomes an extremely difficult task for the computers to do the same. Many attributes like illumination, blur, background color, foreground color etc. will pose a problem. Also, the License Plate Recognition (LPR) inIndia is difficult because the traffic rules are hardly obeyed and the number plate standards are not strictly practiced. Each one is adopting a different style leading to obtaining variation in parameters like, size of number plate and characters, location of number plate, type of font used, background (white background with black letters for non commercial vehicles and white background with yellow letters for commercial vehicles), different unwanted pictures etc. which makes the task of number plate localization very difficult. The main aim of this proposed system is to implement an efficient method to recognize license plates and extract text from them under Indian conditions. This work is carried over for on car number plates as well as on two wheeler number plates.

A typical example of an Indian license plate for car is shown in the figure 1 with the significance of each character (1. State Code, 2. District Code, 3.Type of Vehicle (car, two wheeler, commercial etc.) 4.Actual Registration Number).

Figure-1 Number Plate

DOI: 10.48175/IJARSCT-10167

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 6, May 2023

II. 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 three main factors: the growing number of cars on the roads, the rapid development of image processing techniques and the great quantity of real- life applications that this technology offers. Some of the most typical applications of ALPR systems are traffic law enforcement, automatic toll collection or parking lot access control. But this technology is also widely used for other, perhaps, more inspiring purposes like crimes resolution, as it helps to identify the cars of the offenders.

III. FUNCTIONAL REQUIREMENTS

Operating environment for the automatic number plate recognition system is as follows:

- Client Server System
- Tensorflow Environment.
- Platform: python 3

3.1 System Features (Functional requirements)

Client/Server System

The term client/server refers primarily to an architecture or logical division of Responsibilities, the client is the applications (also known as the front-end), and the server

Is a distributed system in which

- Some sites are client and others are servers Sites.
- All the data resides at the server sites. All applications execute.
- External Interface Requirements

Hardware Interfaces

- A computer or laptop in offices/institutes
- Mobile Phone
- Internet connectivity

Software Interfaces

Following are the software used for the

- Windows 7 or later version
- Linux 14.0 or later version
- OS X 10.5 Leopard or later
- Browser(Google Chrome/firefox/Internet Explorer

The GUI designed system***Communication Interfaces***

The communication interfaces that we will need for our project are as follows-

- High speed Internet connections.
- Good mobile network coverage.

3.2 Non functional Requirements

Non-functional requirements cover all the remaining requirements which are not covered by the functional requirements. They specify criteria that judge the operation of a system, rather than specific behaviour's. Some typical non-functional requirements are: ***Stability***

This allows the business to remain stable. The IT infrastructure is sustainable and guaranteed support the business operations for an estimated period into the future.

Confidentiality

The degree to which the software system protects sensitive data and allows only authorized access to the data. The system restart cycle must execute completely in less than 60 seconds.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 6, May 2023

Availability

The degree to which users can depend on the system to be up (able to function) during "normal operating times". Unless the system is non-operational, the system shall present a user with notification informing them that the system is unavailable.

Reliability

The extent to which the software system consistently performs the specified functions without failure. The data transmission process shall confirm the receiving terminal is in a ready state prior to the start of transmission.

Reusability

The extent to which a portion of the software system can be converted for use in another system. Application shall be developed to adhere to Graphics User Interface guidelines and standards.

Maintainability

The ease with which faults in a software system can be found and fixed. The system shall not be shut down for maintenance more than once in a 24-hour period. ***Scalability***

The degree to which the system is able to expand its processing capabilities upward and outward to support business growth. The business rules repository shall be scalable to manage an unrestricted number of additional rules. ***Security***

The extent to which the system is safeguarded against deliberate and intrusive faults from internal and external sources. Users must change the initially assigned login authentication information (password) immediately after the first successful login. The initial password may never be reused.

IV. LICENSE PLATE DETECTION

As we have developed a system that is based on spiral model the working of system is divided into 4 quadrant and the work flow is depends on quadrant but the important thing to is to discuss over the number plate As we know that this project is based on optimizing characters and numbers from number plate with the help of an image for the accuracy. Therefore, what should be the quality of the image? This is one of the priority question that should be solved first. Hence,

(1).Plate size: a plate can be of rectangular in size in a vehicle image.

(2).Plate BG-color: A plate can have different background colors based on vehicle authorization. We can see that a government vehicle number plate may be in different background than other vehicles.

(3).Screw: Problem is that a plate may have screw and that could be considered as a character.

Edge detection

Edge detection is fundamental method for feature detection or feature extraction. In general case the result of applying edge detection of algorithm is an object boundary with connected curves. It becomes very difficult to apply this method to complex images as it might result with object boundary with not connected curves. Different edge detection algorithm / operators such as Canny, Canny-algorithm, is used for edge detection.

V. ANALYSIS MODELS- SDLC MODEL TO BE APPLIED

Software Development Life Cycle (SDLC) is a process used by the software industry to design, develop and test high quality software. The SDLC aims to produce a high- quality software that meets or exceeds customer expectations, reaches completion within times and cost estimates. It is also called as Software Development Process. SDLC is a framework defining tasks performed at each step in the software development process. consists of a detailed plan describing how to develop, maintain, replace and alter or enhance specific software. The life cycle defines a methodology for improving the quality of software and the overall development process. SDLC Models There are various software development life cycle models defined and designed which are followed during the software development process. These models are also referred as Software Development Process Models". Each process model follows a Series of steps unique to its type to ensure success in the process of software development. For our project we are using Spiral model.

Spiral model is one of the most important Software Development Life Cycle models, which provides support for Risk Handling. In its diagrammatic representation, it looks like a spiral with many loops. The exact number of loops of the

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 6, May 2023

spiral is unknown and can vary from project to project. Each loop of the spiral is called a Phase of the software development process. The exact number of phases needed to develop the product can be varied by the project manager depending upon the project risks. As the project manager dynamically determines the number of phases, so the project manager has an important role to develop a product using spiral model. The Radius of the spiral at any point represents the expenses(cost) of the project so far, and the angular dimension represents the progress made so far in the current phase.

Below diagram shows the different phases of the Spiral Model:

Each phase of Spiral Model is divided into four quadrants as shown in the above figure. The functions of these four quadrants are discussed below-

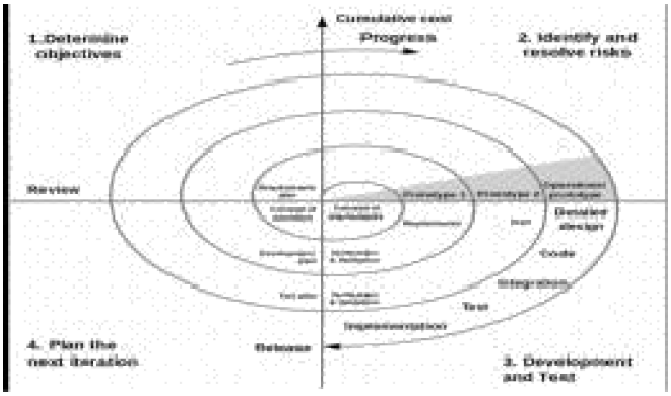


Figure-2- SDLC Spiral Model

Reference: - Issue-2 Volume-5 May 2022, IJARSCT.

Objectives determination and identify alternative solutions:

Requirements are gathered from the customers and the objectives are identified, elaborated and analyzed at the start of every phase. Then alternative solutions possible for the phase are proposed in this quadrant.

Identify and resolve Risks:

During the second quadrant all the possible solutions are evaluated to select the best possible solution. Then the risks associated with that solution is identified and the risks are resolved using the best possible strategy. At the end of this quadrant, Prototype is built for the best possible solution.

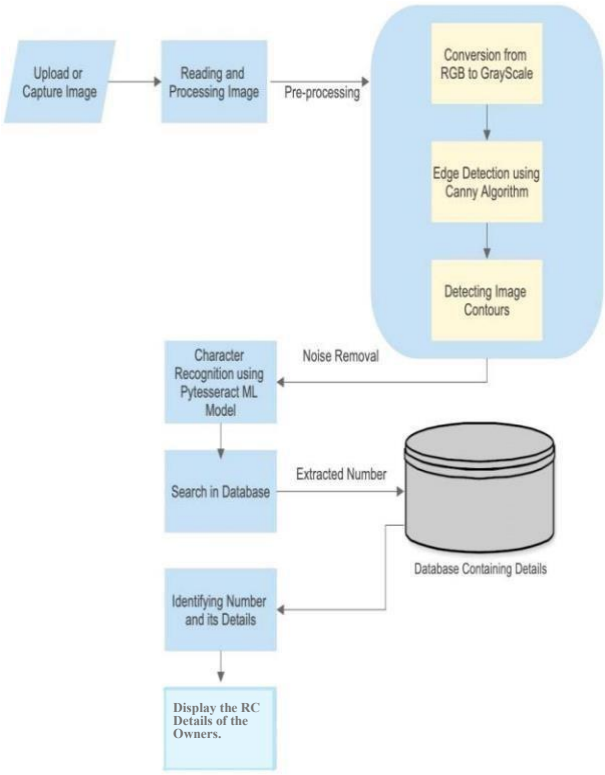
Develop next version of the Product:

During the third quadrant, the identified features are developed and verified through testing. At the end of the third quadrant, the next version of the software is available.

Review and plan for the next Phase:

In the fourth quadrant, the Customers evaluate the so far developed version of the software. In the end, planning for the next phase is started.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 6, May 2023



Reference: - Issue-2 Volume-5 May 2022, IJARSCT

Operating environment for the automatic number plate recognition system is as follows:

- Client Server System
- Tensorflow Environment
- Platform: python 3

Related work in number plate detection

There are different terminologies used for ALPR systems:

- Number plate Recognition (NPR)
- Automatic Number Plate Recognition (ANPR)
- License Plate Recognition (LPR)
- Automatic Vehicle Identification (AVI)
- Car Plate Recognition (CPR)

This paper provides a systematic review of the existing ALPR techniques. It covers the main features of ALPR systems by analyzing their performance summary, pros and cons accordingly. This research aims to advance the state of knowledge in smart vehicle technologies for future researchers .

Some ALPR systems may use simple image processing techniques, performed under controlled conditions for predictable license plate styles. However, dedicated object detectors-such as HOG, CNN, SVM and YOLO to name a few-are used by advanced ALPR systems. Further advanced and intelligent ALPR systems utilize state-of-the-art ALPR software based on Neural Network techniques with AI capabilities. Just like many other fields, computer vision and machine learning have applications in ALPR too. The

sheer diversity of license plate types across territories, states and countries makes ALPR challenging. The fact that any ALPR algorithm will need to work in real time further complicates Number Plate identification. Hence, utilizing ML, CV, AI techniques can relevantly empower ALPR.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 6, May 2023

V. CONCLUSION

In this paper, the Automatic License Plate Recognition system using vehicle license plate is presented. This system use image processing techniques for recognition of the vehicle from the database stored in the computer. The system works satisfactorily for wide variation of conditions and different types of number plates. The system is implemented and executed in Matlab and performance is tested on genuine images. This ALPR system works quite well however, there is still room for improvement. This ALPR system speed can be increase with high resolution camera. Which can be able to capture clear images of the vehicle. The OCR method is sensitive to misalignment and to different sizes, so we have to create different kind of templates for different RTO specifications. The statistical analysis can also be used to define the probability of detection and recognition of the vehicle number plate. At present there are certain limits on parameters like speed of the vehicle, script on the vehicle number plate, skew in the image which can be removed by enhancing the algorithms further

REFERENCES

[1] ShallyGupta , Rajesh Shyam Singh - july 2020-A Review Paper on Automatic Number Plate Recognition system.
[2] Naveed Mufti ,* and Syed Afaq Ali Shah - Automatic Number Plate Recognition:A Detailed Survey of Relevant Algorithms-July – 2021
[3] S. Shastry, Gunasheela G, T Dutt, Vinay D S and SR Rupanagudi - A novel algorithm for Optical Character Recognition (OCR), IEEE 2013.
[4] .Sukhpreet Singh Optical Character Recognition Techniques: A Survey, Journal of Emerging Trends in Computing and Information Sciences, Vol. 4, No. 6 June 2013.
[5] T. Naito, T. Tsukada, K. Yamada, K. Kozuka, andS. Yamamoto, Robust license plate recognition method for passing vehicles under outside environment, Trans. Veh. Technol., vol. 49, no. 6, pp. 23092319, Nov. 2000.
[6] Sarbjit Kaur, Sukhvir Kaur “An Efficient Approach for Number Plate Extraction from Vehicles Image under Image Processing”, International Journal of Computer Science and Information Technologies, Vol. 5 (3) , 2014, 2954-2959.
[7] Mr A. N. Shah, Ms A. S. Gaikwad. “ A Review- Recognition of License Number Plate using Character Segmentation and OCR with Template Matching “, International Journal of Advanced Research in Computer and Communication
[8] Engineering,Vol. 5, Issue 2, February 2016.
[9] M. Usman Akram, Zabeel Bashir, Anam Tariq and Shoab A Khan, Geometric Feature Points Based Optical Character Recognition, IEEE Symp. Industrial Elec. & App., Sept 2013.
[10] Dr Savita Gael and Savita Dabas, Vehicle Registration Plate Recognition System Using Template Matching, IEEE 97B-1 -4799-1 607-B/13, 2013.