TITLE :- NUMBER PLATE DETECTION BY GENERAL SURVEILLANCE CAMERAS

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OUR GUIDE :-

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Introduction

Problem Domain-

Unlike other countries, with a population of about 138 crores, India has a unique set of need for a Number Plate Detection System. In a country with third largest road network in the world, 60 percent of the population preferred road travel either by personal or a shared vehicle.

Road accident is the most unwanted thing to happen to a road user, but with so many vehicles running on the road accidents are bound to happen. According to a report by World Bank "There are 53 road accidents in India every hour and one death every four minutes, with most of them due to over speeding" making it the country with highest number of casualties in road accidents. A number plate detection system using general surveillance cameras can be used to monitor and identify the vehicles that exceed speed limit. This can eventually help minimize the number of road casualties.

In India over 2,00,000 cars are stolen every year. This can be reduced if cars are tracked using Number plate detection system, the law enforcement body can identify the route taken by a stolen vehicle and can help bring justice swiftly to such a vast nation.

Technology behind the title:-

Number Plate Detection system by using general surveillance cameras is an algorithm used to recognize the number plates automatically using the Optical Character Recognition(OCR) on images to read the number plate of vehicles. The algorithm takes the vehicle image as an input and gives the vehicle number as output.

It is a potential research area in smart cities and Internet of things. The rampant increase of vehicles necessitates the use of automated systems to maintain vehicle information for various purpose. The information is highly required for management of traffic as well as reduction of crime. It is an effective way for automatic vehicle identification.

Application:-

We use several image processing techniques in the pre-processing stage, after which number plate segmentation, contours are applied by border following and contours are filtered based on character dimensions and spatial localization. Finally we apply Optical Character Recognition (OCR) to recognize the extracted characters. The detected texts are stored in the database, further which they are sorted and made available for searching.

Importance:-

► To track vehicles within a specific area based on the license plates.

► To check if a vehicle is registered or licensed.

► Can be used by government bodies and local authorities to track outside visitors.

► Most cost-effective solution for car owners to manage their car park.

► Detection of stolen or searched vehicle.

Existing Work:-

A system was designed to identify the plate number of fast-moving vehicles using snapshots of pre-captured images of surveillance cameras. The design made use of an estimation algorithm parameter known as the novel kernel parameter for deblurring the plate number of the fast-moving vehicles.

A system was designed that automatically recognizes plate number using Raspberry Pi. The system proposes the implementation of an automated plate number recognition system using Optical Character Recognition (OCR) to interpret information on the images of a vehicle plate number using Raspberry Pi processor.

What is the problem?

- Vehicle number recognition by using existing general surveillance cameras

- the main objective of general surveillance and provide Vehicle license plate number recognition functionality. The most critical requirement is to use all existing general surveillance cameras (which are at approx. 3 to 4 meters of height and with 2MP/4 MP resolution of camera).

Why the problem occurs ?

► Traffic laws and equipment have been put in place to monitor and control traffic, including pedestrians, motor vehicle drivers and cyclists. As is well known, there are many traffic law violators in our country today and this has led to many accidents which have no effect.

► These traffic law breakers go about their business freely and confidently that they can never be caught because the appropriate systems are not put in place.

► Traffic gird locks, road accidents, and even being involved in a fatal accident have resulted in death due to the consequential consequences of breaking traffic laws.

How the problem create impact ?

- The increase in vehicular traffic on roads creates a high demand with advancement in technology for traffic management and monitoring. Traffic control and vehicle identification has become major problem in every country. Sometimes it becomes difficult to identify vehicles that violates traffic rules and drives too fast.

- It is not possible to catch fast moving vehicles that violate rules as it is difficult to retrieve the vehicle number. Hence, number plate recognition system will prove to be useful in such cases.
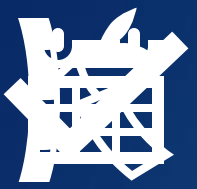
Real world events:- 1 (when , who, what impact)

WHEN :- 2015

WHO :- GEE-SERN HSU, SI-DE ZENG, CHUN-WEI CHIU, & SHENG-LUEN CHUNG.

WHAT IMPACT :- THE LICENSE PLATES CAN BE MUCH FASTER DETECTED WITH LOWER FALSE POSITIVES.

Real world events:- 2 (when , who, what impact)

When :- June 2011

Who :- Songke Li & Yixian Chen

What impact :- License Plate Recognition the Intelligent Transport System (ITS) as every vehicle has a number plate as part of its identity.

Project Objective

It has a wide range of application since the number is the primary , most widely accepted , human readable and mandatory identifier of motor vehicles.

To design an efficient automatic authorized vehicle identification system by using the vehicle number plate.

It helps to detect ,deter and disrupt criminalities at a local , force, regional and national level.

It provide assistance to the enforcement of the law as well as ensuring the continued safety of road users.

Literature review :- 1

Problem :-

Nowadays vehicular traffic on the roadways stimulate a huge demand in the technology for traffic monitoring and management. So manual tracking of vehicles running fast on the road is practically not feasible because it will be a waste of manpower and time.

Proposed System:-

to detect the vehicles, the system uses YOLO(you only look once) algorithm. The live CCTV footage is converted into frames, then passes from YOLO algorithm to detect the number plate.

Workflow:- image acquisition, vehicle detection, data set preparation, training the model, number plate localization, character segmentations, optical character recognition.

Experimental Result :- the result obtained by implementing the proposed work where the original image file in the dataset and the .xml files are saved in the separate folders in the same directory for both the test and train images.'

Benefit:-

- implementation of edge detection algorithms and the efficiency of localization is increased.
- The IMAGEAI framework is used which is much more efficient than YOLO object detection.

Improvement:-

- the algorithm poorly performed under bright illuminated environment, so we need to improve under bright illuminated.

Literature review :- 2

Problem :-

As a large number of vehicles are parked in the area of parliament and defense military, due to this The proposed system will be designed as for the automatic vehicle identification for the security purpose.

Proposed System :-

The system consists of a hardware section as well as software section. Whenever the vehicle comes into that, area the sensor senses the incoming vehicle by using IR sensors .The camera will be active to take the images of the vehicle, then sent to the MATLAB and those images are processed further to extract the number by the MATLAB.

Workflow:- binarization, edge detection, plate localization, character segmentation, character recognition.

Experimental Result :-

The system starts from an object detect sensor, whenever the vehicle is coming into the sensor area sensor will detect the vehicle and activate the camera.

Benefit :-

► It gives a very accurate and efficient record of all the motor vehicles.

► This automated system is easy to use and very transparent.

Improvement :-

► We need to improvement reduce the error rate of manual checking but automating the system.

Literature review :- 3

Problem :-

it has become very difficult to keep track of each and every vehicle for the purpose of traffic management and law enforcement.

Proposed System :-

the extraction of the vehicle number from the number plate and identifying its owner to alert him/her about their penalty by sending an SMS with the help of GSM (global system for mobile system) module

Workflow:- input image from webcam, covert image into binary, detect number plate, segmentation, number identification, save to file in given format.

Experimental Result :-

From the results it is observed that the proposed system successfully recognizes the vehicle number plate on the real time images.

Benefit :-

► This system also developed with Graphical User Interface for which the captured vehicle images and display the result on the desktop GUI screen.

Improvement :-

► only 10 character images, we are unable to capture accuracy of all the characters getting decoded, so we need to improve.

Literature Review :- 4

Problem :-

At the tolls, road conditions are a lot of varied and traffic is unstructured, there's lack of discipline and overladen vehicle movement is kind of natural.

Proposed System :-

The proposed method offers a base for imposing automatic wide variety plate detection, the usage of photo processing for toll collection at toll checkpoints. This device will assist in saving time in addition to assist in lowering congestion at toll checkpoints.

Experimental Result :-

The photograph processing method to put into effect the computerized toll collection with a purpose to lessen congestion and fraudulent behavior on the toll checkpoints.

Workflow:-Capture image, finding text region, segmenting the character, feature extraction, text recognition.

Benefits :- The proposed system will assist in lessen the human intervention at the toll collection areas.

Improvement :- Increased error rate in dim light and at night, which needs to be improved.

Literature Review :- 5

Problem :-

The number of vehicles has been significantly increased in the past year , so in order to efficiently manage the privately owned vehicles with the help of neurocomputing.

Proposed System :-

The main aim of the system is to design a deep learning model that could read the number plate of the fast moving vehicles on the road using the surveillance camera. Also, the system uses image AI library to make the process easier and efficient.

Experimental Result :-

The implementation of edge detection algorithms and the efficiency of localization is increased . Finally the IMAGEAI framework is used which is very much efficient than YOLO object detection . All the architecture of neural network can be implemented in IMAGEAI , the system is also trained for detection of cars and number plate localization . The parameters of neural network were optimized to enhance the performance of neural network and using this framework

Benefits :-

The code complexity get reduced.

Improvement:-

ANPR techniques carried out in India and their efficiency is very less , so we need to improve efficiency.

Literature review :- 6

Problem :-

The identification is also employed for managing parking facilities, monitoring and analysis of traveling time, and security systems such as observation of stolen vehicles and monitoring of unauthorized vehicles entering private areas.

Proposed System :-

The aim of the Automatic Number plate recognition (ANPR) is record keeping as record keeping is the very difficult job to do manually. In this system our most focus is on reducing the manual work in opening and closing of gate.

Result :-

The main goal of this work is to design and implement efficient and novel architectures for automatic number plate recognition (ANPR) system, which operates in high definition (HD) and in real time. In addition, a separate ANPR algorithm is developed and optimized, by taking advantage of technical features of digital image processing algorithms.

Benefit:-

The distance at which a vehicle plate could be identified using a specified lens at maximum zoom is provided in the work.

Improvement :- Increased the readable capacity by image processing
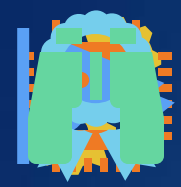
Proposed Work:

The proposed methodology consists of four major phases:

pre-processing,

detection,

recognition

searching

Explanation of proposed work :-

▶ The algorithm proposed of this system is specially designed to recognize the license plates of vehicles. First, system need to train on some collected number plate data and cross validate and repeat that process until machine get learned. When machine learned successfully then further processing will take place.

▶ The input of the system is the image of a vehicle captured by a camera. The captured image is taken from 2 – 3 feet away. That image is processed through Number Plate Extractor (NPE) with give its output to segmentation . Segmentation part take the extracted plate region and make further processing on it and separates the characters of image and store each character's data in a row matrix.

Finally, recognition part recognize the characters through the trained Neural Network and result the plate number.

Our project can benefit :-

Real time usage :-

▶ It can effectively differentiate the vehicles whether they are safe or not. So our project can benefit from being securely used as a user-friendly for public and un-trusted terminals.

▶ Where can our project be fitted for work :- some avenues for future work cloud include support for the security checking in the area of the parliament and defense military area and also used in the toll plaza, parking fee collection etc.

 Other aspects worth considering include keeping track of each and every vehicle for the purpose of traffic management and law enforcement.

Hardware Requirements:

► Hardware requirements for this development are :

► i5+ processor

► 8GB+ Ram

► 100GB+ SSD space.
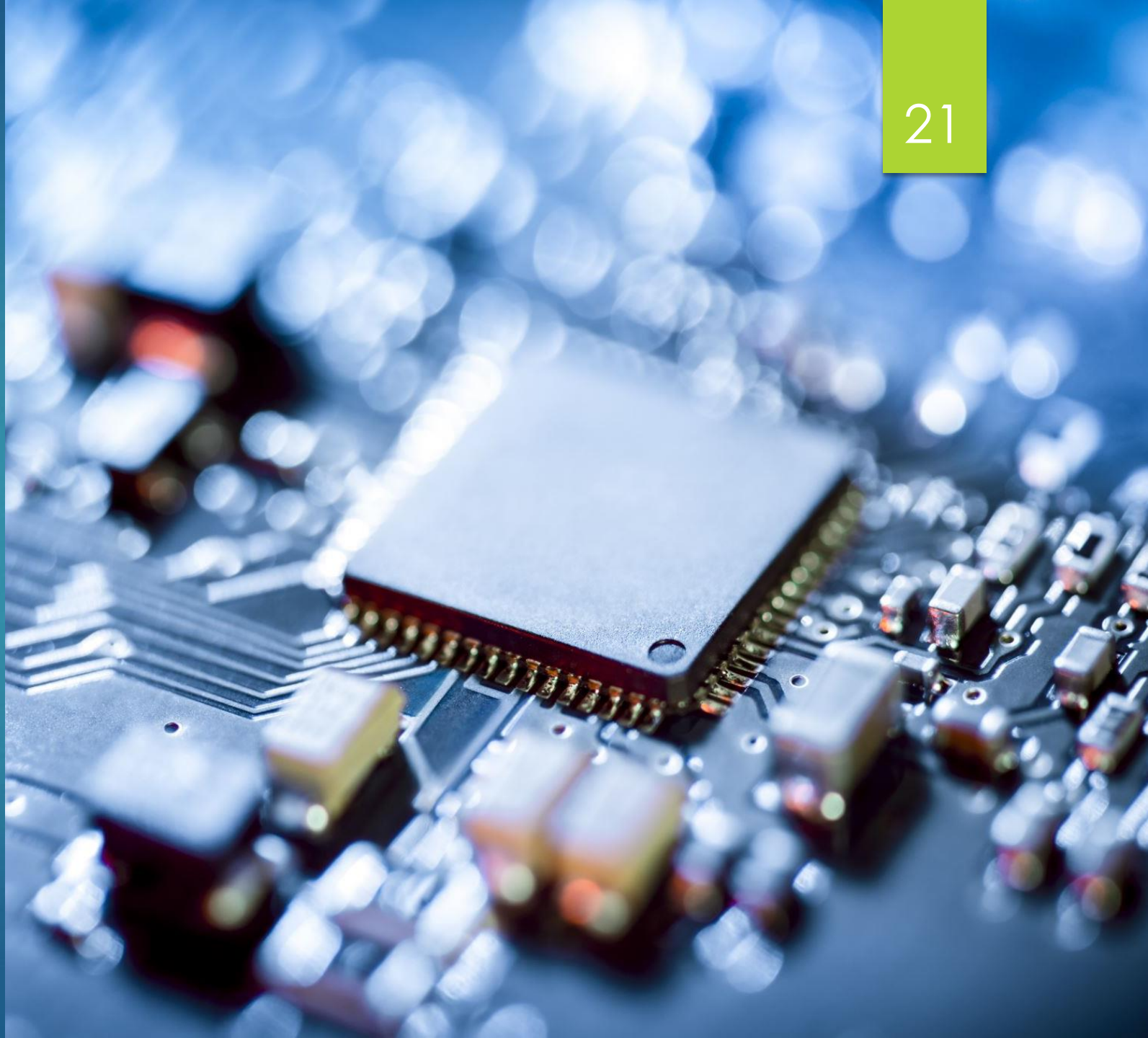
Software Requirements:

- ▶ Dataset: Images of Indian vehicles where the number plate is clearly visible.

- ▶ Operating System: Windows 11, spider ,VS code

- ▶ Programming language: Python3

- ▶ Libraries used: sys, glob, os, glob, NumPy, cv2, PIL, Py tesseract, re

Overall system architecture diagram:
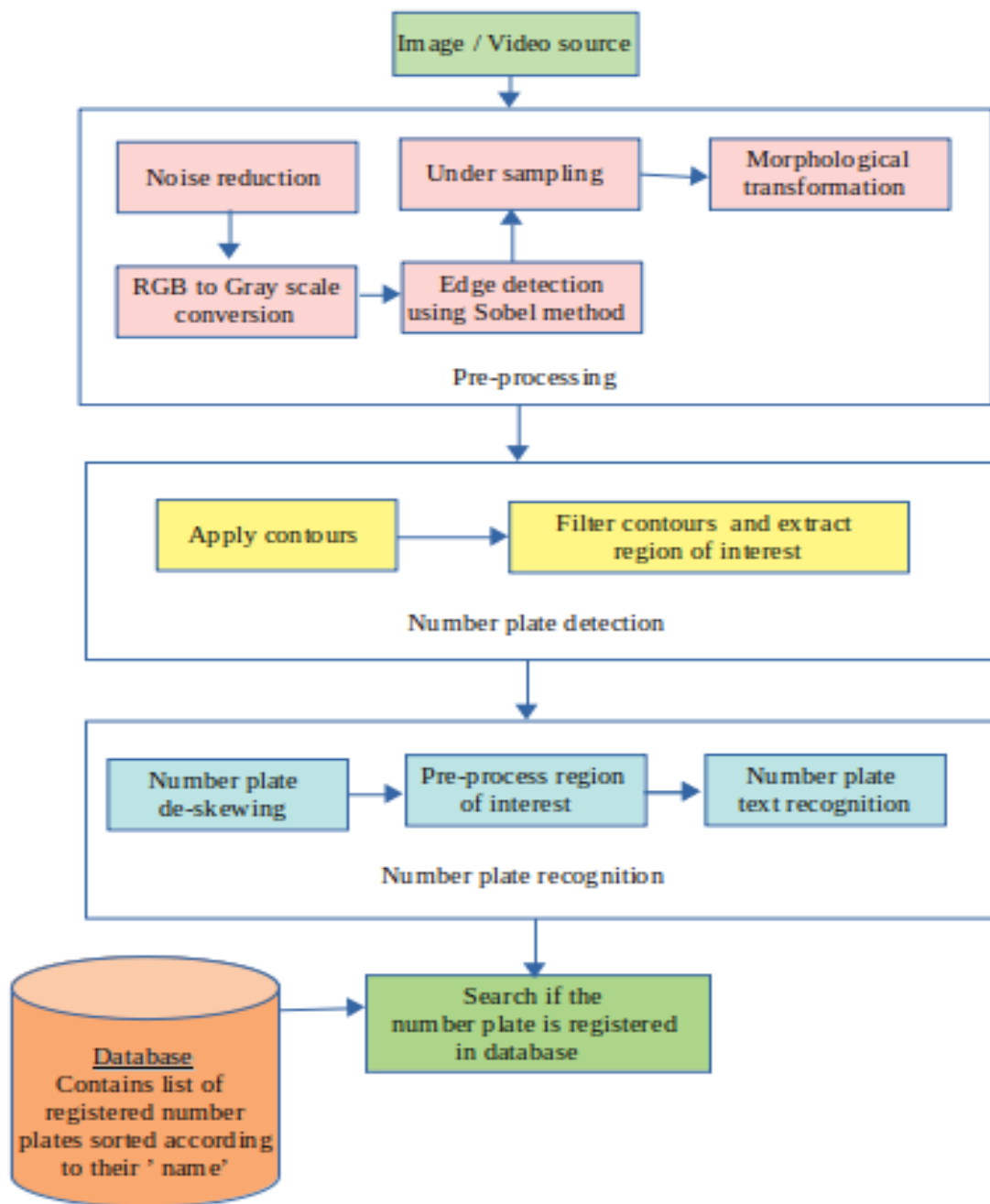
System architecture explanation

First of all, the image/video source we collected undergoes the pre-processing stage in which noise reduction is done , RCB to grey scale conversion takes place , edge detection using Sobel model and after that morphological transformation takes place.

In the detection stage counters should be applied after that filter counters and extract region of interest,

In recognition stage number plate de-skewing is done followed by number plate text recognition by the help of OCR tool from python.

After these steps searching and sorting algorithms should be followed in order to matching the number from the database.

Modules and explanation

► **Image Pre-processing :-**

Noise Reduction – We use Gaussian smoothing module for removing noise from the image. This serves well for further image processing steps.

RGB to grayscale conversion – RGB image is converted to grayscale image. This saves a lot of time during the convolution of image with Sobel filter.

Sobel method for edge detection – This works by calculating the gradient of image intensity at each pixel within the image. It finds the direction of the largest increase from light to dark and the rate of change in that direction.

Under-Sampling – This module is used to reduce the resolution of the image if it crosses a pre-defined threshold as image processing algorithm's work slow for high resolution images.

Morphological transformation – Top-hat and Black-hat filters are used to enhance bright objects in dark background and dark objects in bright background, respectively.

Modules and Explanation

▶ **Number Plate Detection :-**

Applying Counters – OpenCv is used for this, finding contours is basically finding a white object from a black background.

Contour tracing is the algorithm used for generating Contours. It is a link of equal intensity points along the boundary.

Filtering Contours and extracting region of interest – Contours are applied for small regions like sharp edges and noise outliers. For each contour, the following factors are considered such as minimum contour area, minimum contour width and height, minimum and maximum possible aspect ratios. This helps in filtering most of the unnecessary contours taking us to the next step i.e., Number plate detection.

Modules and explanation

▶ **Number Plate Recognition :-**

Number Plate De-skewing – Skew the amount of angle an image needs to be rotated to make it horizontal to the page. De-skewing is rotating the image by the same amount as its skew but in opposite direction. This helps in making the image and text horizontal to page.

Pre-processing region of interest – The image is resized before the recognition step. This is done as sometimes two contours get overlapped resulting in both contours getting recognized as separate characters.

Text Recognition – Py tesseract is the library used for Optical Character Recognition(OCR) in python. So finally it will recognize and read the texts in the image.

Modules and explanation

➤ **Time complexity:-**
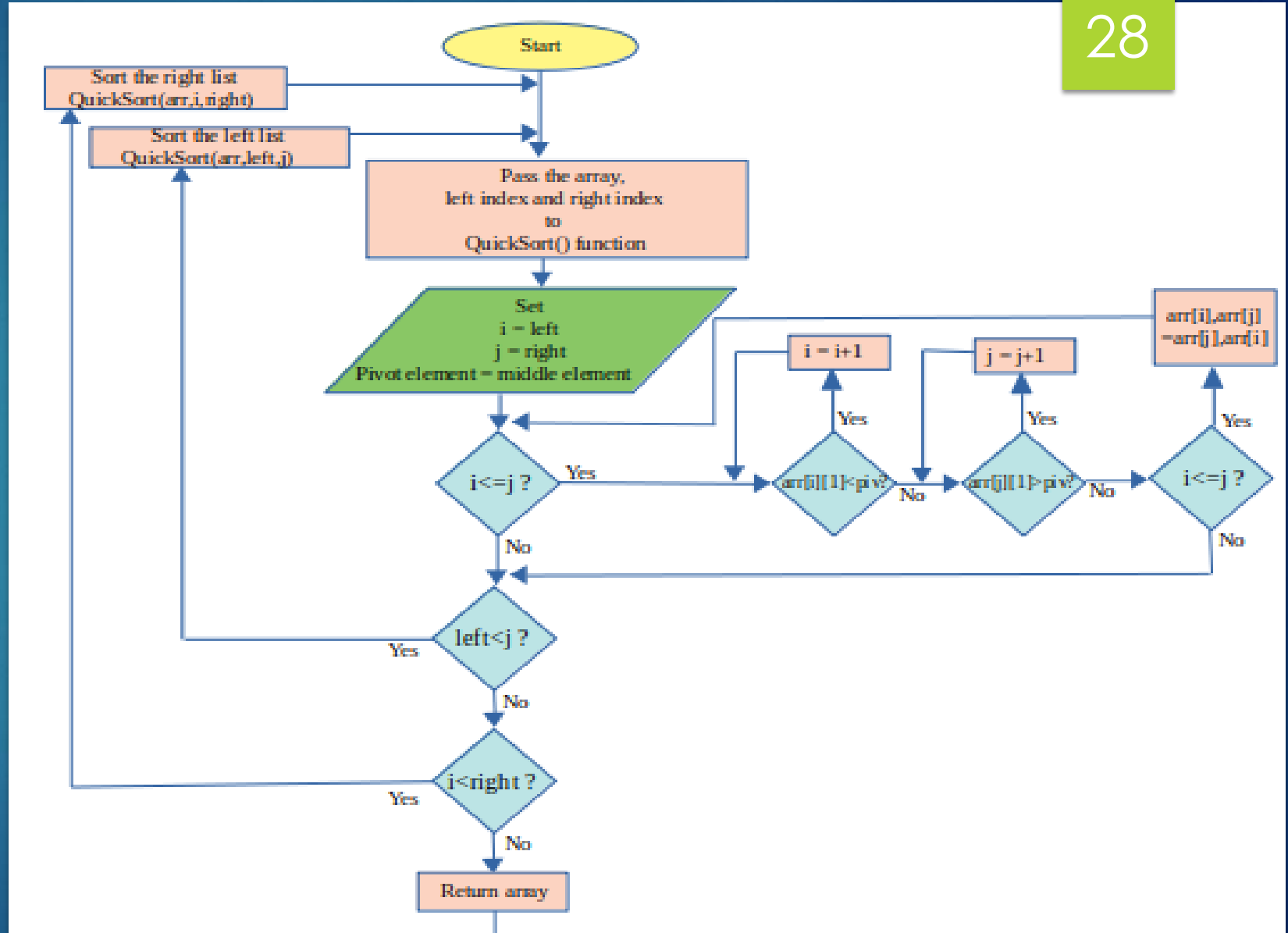Best case: O(n log(n))
Average case: O(n log(n))
Worst case: O(n^2).

➤ **Space complexity:-**
Best case: O(log(n))
Worst case: O(n)

Modules and explanation

▶ **Searching** :- Pass a modern picture and take after steps
1,2,3. Get the modern vehicle's enlistment number and check on the off chance that it is show within the database utilizing Double search strategy. Double look is another straightforward divide and overcome calculation that's performed on a sorted array/list. It works way better than linear search in case of more images within the dataset.

❑ **Time complexity** :-
It takes $O(\log(n))$ time complexity, when compared with linear search is much better, when they get larger.

❑ **Space complexity**: $O(1)$
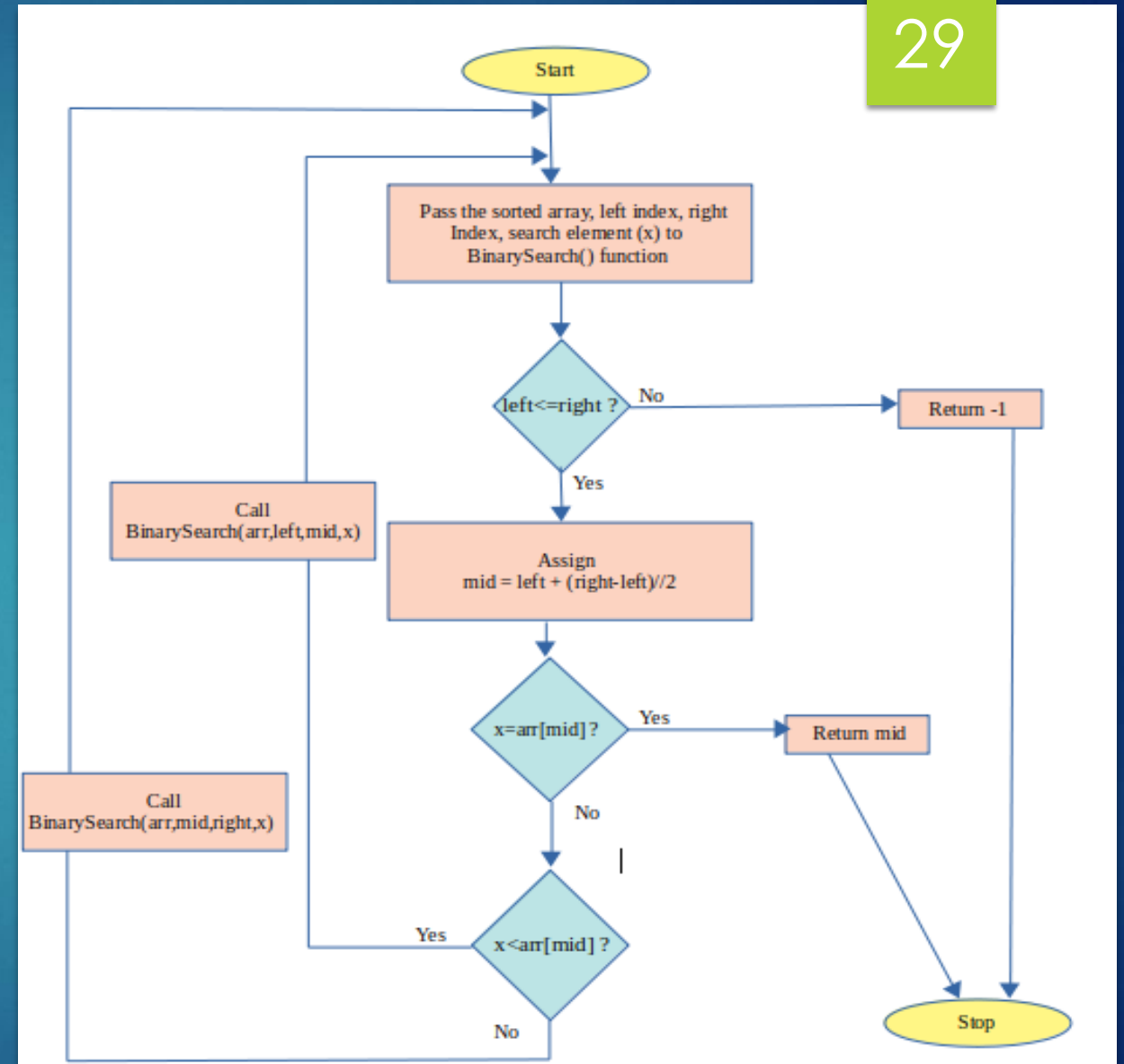
Project timeline chart

Review-0	Review-1	Review-2	Review-3	Completed
•Project Approval •Gathering information from research papers.	•Overall system architecture and working on algorithms	•Complete module split-up and Module implementation	•Finalized our project idea	Completing our project exhibition-2 with the help of our mentor

Contribution of each individual in whole project :-

- Shivam Kumar(20BCY10206) :- team lead, research, plagiarism checker

- Trilok Dhaked (20BCY10126) :- technical part, programming , research, ppt

- Omkar Wani (20BCY10226) :-

  research , ppt

- Ayush Raj (20BCY10205) :- research , ppt

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