EC4509 PROJECT-1 PHASE-1 REPORT

LICENSE PLATE DETECTION

SUBMITTED BY:

Narapu reddy Siva Sankar reddy (201114038)

Kamani Sampreeth(201114004)

Kallepally Shanth kumar(201114039)

Kadari Harish(201114017)

Kombattula Rohit(201114066)

UNDER THE GUIDANCE OF:

Dr. Vijayshri Chaurasia

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY, BHOPAL

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ABSTRACT

Automatic number plate recognition (ANPR) is an image processing technology which uses number (license) plate to identify the vehicle. The objective is to design an efficient automatic authorized vehicle identification system by using the vehicle number plate.

Vehicle Identification has become very important in today's scenario. These days 'organizations are more concern about maintaining security. Many vehicles enters in and leave the organization so it is very important to maintain their record. It is a tedious and time consuming task for a human to keep record of all the vehicles. So it arise a need for developing an automatic system which can keep the record of all the vehicle entering and leaving the organization.

Automatic Number Plate Recognition system is used in various areas nowadays such as automatic toll collection, Border crossings, parking system, Traffic control, stolen cars tracking, maintaining traffic activities and law enforcement etc.

The developed system first detects the vehicle and then captures the vehicle image. Vehicle number plate region is extracted using the image segmentation in an image. Optical character recognition technique is used for the character recognition.

Chapter 1 : Introduction

1.1 Identification of Need

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

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

1.2 Preliminary Info

Automatic Number Plate Recognition systems are a proven solution for various security forces and administrative authorities around the world. The automatic number plate recognition (ANPR) system market in 2016 was valued at USD 1.78 Billion and is expected to reach USD 3.57 Billion by 2023, at a CAGR (Compound Annual Growth Rate) of 9.74% between

2017 and 2023. The base year considered for the study is 2016 and the forecast period is between 2017 and 2023. The research methodology used to estimate and forecast the ANPR system market begins with capturing data on key vendor revenue through secondary research. The vendor offerings are considered to determine the market segmentation. This report provides a detailed analysis of the ANPR system market based on type, component, application, and geography. After arriving at the overall market size, the total market has been split into several segments and subsegments, which have been verified through the primary research by conducting extensive interviews of people holding key positions such as CEOs (Chief Executive Officers), VPs (Vice Presidents), directors, and executives. Market breakdown and data triangulation procedures have been employed to complete the overall market engineering process and arrive at the exact statistics for all segments and subsegments. The breakdown of profiles of primaries is depicted in the figure below:

The traffic management application accounted for the largest market share in 2016. The increasing demand for ANPR systems in urban areas due to high traffic congestion is driving the growth of the ANPR system market for traffic management applications. The market for the electronic toll collection application is expected to grow at the highest rate between 2017 and 2023. The increasing adoption of vehicles and stringent government regulations by various countries for implementing electronic toll collection systems is driving the growth of the ANPR system market.

Europe held the largest share of the ANPR system market in 2016, and it is expected to grow at a moderate CAGR between 2017 and 2023. The market in APAC (Asia-Pacific) is estimated to grow at the highest rate during the forecast period. The demand for ANPR systems in APAC is expected to be driven by increasing public infrastructure and highways.

Inconsistency in number plate designs is the restraint for the ANPR market. Number plates differ in terms of their size or fonts in every part of

the globe; due to which, it becomes difficult to construct an algorithm that would read all fonts without any discrepancy.

The automatic number plate recognition market is expected to exhibit high growth in near future across the globe, some of the major driving factors contributing to the growth are rising acceptance of smart parking concept in developed as well as developing countries and infrastructure growth in emerging countries. However, development of a shared platform for exchange of data from distinct sources and technological advancements are some of future trends of automatic number plate recognition market during the forecast period.

The emergence of the Automatic Number Plate Recognition concept was mainly focused upon monitoring the vehicles. Various countries of the world face crimes of several types and vehicular based crimes were on the rise due to ease of escape through vehicles. Curbing of such crimes had become necessary and hence the use of ANPR systems integrated into the security systems have proved to be of great use.

1.3 Feasibility Study

Detailed investigation has really helped in knowing the feasibility of various Software and hardware components as well as the overall project model in terms of technical, operational and economical respects. Thus, this project is feasible in all aspect.

Chapter 2 : Literature Survey

2.1 Previous Work

Many developments in Digital Image Processing have been utilized in various fields with advances in Optical Character Recognition Technology as well. Various techniques of employing digital image processing have been developed in recent years. In the 2000s, OCR was made available online as a service (WebOCR), in a cloud computing environment, and in mobile applications like real-time translation of foreign-language signs on a smartphone. The best application of this technology would be to create a reading machine for the blind, which would allow blind people to have a computer read text to them out loud. Various commercial and open source OCR systems are available for most common writing systems, including Latin, Cyrillic, Arabic, Hebrew, Indic, Bengali (Bangla), and Devanagari, Tamil, Chinese, Japanese, and Korean characters.

The OCR engine used here is Tesseract OCR. Tesseract is an optical character recognition engine for various operating systems. It is free software, released under the Apache License. Originally developed by Hewlett-Packard as proprietary software in the 1980s, it was released as open source in 2005 and development has been sponsored by Google since 2006.

In 2006, Tesseract was considered one of the most accurate open-source OCR engines then available. The Tesseract engine was originally developed as proprietary software at Hewlett Packard labs in Bristol, England and Greeley, Colorado between 1985 and 1994, with some more changes made in 1996 to port to Windows, and some migration from C to C++ in 1998.

A lot of the code was written in C, and then some more was written in C++. Since then all the code has been converted to at least compile with a C++ compiler. Very little work was done in the following decade. It was

then released as open source in 2005 by Hewlett Packard and the University of Nevada, Las Vegas (UNLV). Tesseract development has been sponsored by Google since 2006. Tesseract was in the top three OCR engines in terms of character accuracy in 1995. It is available for Linux, Windows and Mac OS X. However, due to limited resources it is only rigorously tested by developers under Windows and Ubuntu.

2.2 Existing System

Few Inconveniences of the Current Framework are

1. Constant human mediation.
2. High cost.
3. More Manpower is required.

2.3 Proposed System

The proposed system overcomes the above Disadvantages and apart from them has the

beneath specified benefits.

1. Automated framework requiring less labour.
2. Number is displayed and with some modification can be stored in a database or be searched or processed.
3. The featured number plate is automatically cropped and displayed separately.

In one of the papers by Anisha Goyal and Rekha Bhatia, from Department of CSE ,Punjabi University Regional Centre for Information Technology and Management, Mohali, Punjab, India, they proposed that till now, all the LPR systems have been created using neural networks. They proposed to execute the system using Gabor filter, OCR and Vision Assistant to make the system quicker and more proficient. Different recognition

strategies have been produced and number plate recognition systems are today used in different movement and security applications, for example, parking, access and border control, or tracking of stolen autos.

In another paper by Amr Badr, Mohamed M. Abdelwahab, Ahmed M. Thabet, and Ahmed M. Abdelsadek, proposed that Automatic recognition of car license plate number became a very important in our daily life because of the unlimited increase of cars and transportation systems which make it impossible to be fully managed and monitored by humans, examples are so many like traffic monitoring, tracking stolen cars, managing parking toll, red-light violation enforcement, border and customs checkpoints. This paper mainly introduces an Automatic Number Plate Recognition System (ANPR) using Morphological operations, Histogram manipulation and Edge detection Techniques for plate localization and characters segmentation. Artificial Neural Networks are used for character classification and recognition.

In the third paper by Hamed Sanghaei, an automatic and mechanized license and number plate recognition system is proposed that can extract license plate number of the vehicle passing through a given location using image processing algorithms. The resulting data is applied to compare with the records on a database. Experimental results reveal that the presented system successfully detects and recognizes the vehicle number plate on real images. This system can also be used for security and traffic control.

Chapter 3 : Proposed Methodology

3.1 Problem Formulation

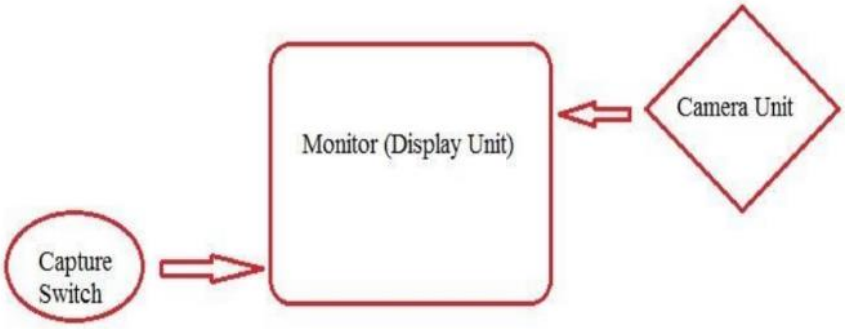
It is seen that the security forces and authorities face problems whenever security forces chase a vehicle or they can't catch a vehicle which broke traffic rules. Authorities find it very hectic on a busy day to log the vehicle numbers manually in a parking lot. So, in order to make the entire process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

3.2 Project Objective

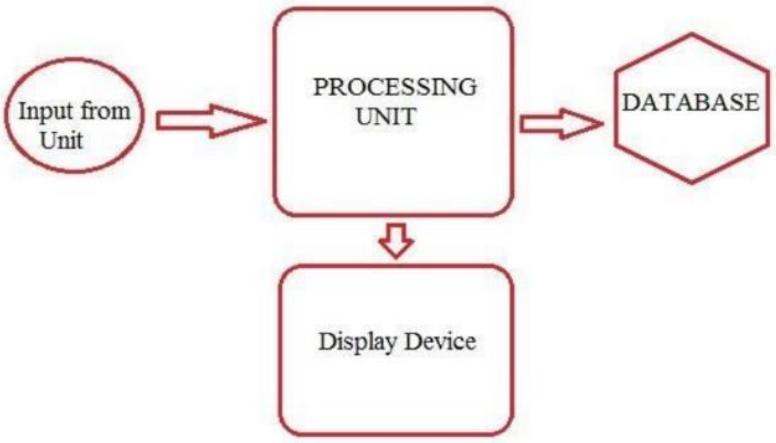
1. Image Acquisition using the computer's primary camera.
2. Image Enhancement and pre-processing to improve the quality of the image and
3. convert the image to binary scale so as to use it in contour extraction.
4. Extract the number plate region from the binary image and display it separately.
5. Apply optical character recognition to display the license plate number from the
6. picture as text.

3.2.1 Block Diagram of Input Unit

In the input unit, a preconfigured camera is arranged such that it is interfaced with a display device like a TFT monitor and a switch or a key is attached. Whenever the subject (the car) is in the frame of the picture, the key is pressed in order to capture the picture.



3.2.2 Block Diagram of the output unit



In the Output Unit, the input image is taken from the input unit and then processed in the processing unit. In the processing unit all sorts of enhancement and extraction is done and then the number on the license plate is extracted using Optical Character Recognition and then it can either be stored in a database or be displayed on a display device or both or can be used to excite an actuator.

3.2.3 Details of Processing

Basics of Digital Image Processing:

The image of a vehicle whose number plateis to be recognised is taken from a digital camera which is then loaded to a local computer for further processing. OpenCV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. In simple language it is a library used for Image Processing. It is mainly used to do all the operations related to Images. Python, being a versatile language, is used here as a programming language. Python and its modules like Numpy, imulits, Matplotlib and other special modules provide the optimal functionality to be able to cope with the flood of pictures. To enhance the number plate recognition further, we use a median filter to eliminate noises but it not only eliminates noise. It concentrates on high frequency also. So it is more important in edge detection in an image, generally the number plates are in rectangular shape, so we need to detect the edges of the rectangular plate. Image Processing mainly involves the following steps:

1. Image acquisition: This is the first step or process of the fundamental steps of digital image processing. Image Acquisition is the capturing of an image by any physical device (in this case the primary camera of the computer) so as to take the input as a digital image in the computer.

2. Image Enhancement: Image enhancement is among the simplest and most appealing areas of digital image processing. Basically, the idea

behind enhancement techniques is to bring out detail that is obscured, or simply to highlight certain features of interest in an image. Such as, changing brightness & contrast etc. In this step the quality or rather the clarity of the input image is enhanced and the image is made clear enough to be processed.

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

4. Segmentation: Segmentation procedures partition an image into its constituent parts or objects. In general, autonomous segmentation is one of the most difficult tasks in digital image processing. A rugged segmentation procedure brings the process a long way toward a successful solution of imaging problems that require objects to be identified individually.

5. Representation: Representation and description almost always follow the output of a segmentation stage, which usually is raw pixel data, constituting either the boundary of a region or all the points in the region itself. Choosing a representation is only part of the solution for transforming raw data into a form suitable for subsequent computer processing. Description deals with extracting attributes that result in some quantitative information of interest or are basic for differentiating one class of objects from another.

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

Optical Character Recognition:

Optical character recognition or optical character reader, often abbreviated as OCR, is the mechanical or electronic conversion of images of typed, handwritten or printed text into machine-encoded text, whether from a scanned document, a photo of a document, a scene-photo (for example the text on signs and billboards in a landscape photo) or from subtitle text superimposed on an image (for example from a television broadcast). The Techniques in OCR involve:

1. Pre-processing:

OCR software often "pre-processes" images to improve the chances of successful recognition. Techniques include:

- De-skew — If the document was not aligned properly when scanned, it may need to be tilted a few degrees clockwise or counter clockwise in order to make lines of text perfectly horizontal or vertical.

- Despeckle — remove positive and negative spots, smoothing edges

- Binarization— Convert an image from color or grey scale to black-and-white (called a “binary image” because there are two colours). The task of binarization is performed as a simple way of separating the text (or any other desired image component) from the background. The task of binarisation itself is necessary since most commercial recognition algorithms work only on binary images since it proves to be simpler to do so. In addition, the effectiveness of the binarisation step influences to a significant extent the quality

of the character recognition stage and the careful decisions are made inthe choice of the binarisation employed for a given input image type; since the quality of the binarisation method employed to obtain the binary result depends on the type of the input image (scanned document, scene text image, historical degraded document etc.).

- Line removal — Cleans up non-glyph boxes and lines

- Layout analysis or "zoning" — Identifies columns, paragraphs, captions, etc. as distinct blocks. Especially important in multi-column layouts and tables.

- Line and word detection — Establishes baseline for word and character shapes, separates words if necessary.

- Script recognition — In multilingual documents, the script may change at the level of the words and hence, identification of the script is necessary, before the right OCR can be invoked to handle the specific script.

- Character isolation or "segmentation"— For per-character OCR, multiple characters that are connected due to image artifacts must be separated; single characters that are broken into multiple pieces due to artifacts must be connected.

- Normalise aspect ratio and scale.

2. Character recognition:

There are two basic types of core OCR algorithm, which may produce a ranked list of candidate characters. Matrix matching involves

comparing an image to a stored glyph on a pixel-by-pixel basis; it is also known as "pattern matching", "pattern recognition", or "image correlation". This relieson the input glyph being correctly isolated from the rest of the image, and on the stored glyph being in a similar font and at the same scale. This technique works best with typewritten text and does not work well when new fonts are encountered. This is the technique the early physical photocell-based OCR implemented, rather directly. Feature extraction decomposes glyphs into "features" like lines, closed loops, line direction, and line intersections. The extraction features reduces the dimensionality of the representation and makes the recognition process computationally efficient. These features are compared with an abstract vector-like representation of a character, which might reduce to one or more glyph prototypes. General techniques of feature detection in computer vision are applicable to this type of OCR, which is commonly seen in "intelligent" handwriting recognition and indeed most modem OCR software.

Nearest neighbour classifiers such as the k-nearest neighbours algorithm are used to compare image features with stored glyph features and choose the nearest match.

Software such as Cuneiform and Tesseract use a two-pass approach to character recognition. The second pass is known as "adaptive recognition" and uses the letter shapes recognised with high confidence on the first pass to recognise better the remaining letters on the second pass. This is advantageous for unusual fonts or low-quality scans where the font is distorted (e.g. blurred or faded).”?!The OCR result can be stored in the standardised ALTO format, a dedicated XML schema maintained by the United States Library of Congress.For a list of optical character recognition software see Comparison of optical character recognition software.

3. Post-processing:

OCR accuracy can be increased if the output is constrained by a lexicon — a list of words that are allowed to occur in a document. This

might be, for example, all the words in the English language, or a more technical lexicon for a specific field. This technique can be problematic if the document contains words not in the lexicon, like proper nouns. Tesseract uses its dictionary to influence the character segmentation step, for improved accuracy. The output stream may be a plain text stream or file of characters, but more sophisticated OCR systems can preserve the original layout of the page and produce, for example, an annotated PDF that includes both the original image of the page and a searchable textual representation. "Near-neighbor analysis" can make use of co-occurrence frequencies to correct errors, by noting that certain words are often seen together. For example, "Washington, D.C." is generally far more common in English than "Washington DOC".

Knowledge of the grammar of the language being scanned can also help determine if a word is likely to be a verb or a noun, for example, allowing greater accuracy. The Levenshtein Distance algorithm has also been used in OCR post-processing to further optimize results from an OCR API.

3.2.4 Working of the Proposed Methodology

In this project, a prototype of Digital Image processing and OCR are executed using different python libraries such as OpenCV 4.2 for image processing and pytesseract as ocr respectively.

- The input image is fed in the system, for processing.

- The Morphed image is then displayed when any key is pressed. The Morphed image is obtained after morphological transformation.

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

- The final step involves performing optical character recognition on the segmented plate using Tesseract engine and a library known as pytesseract in python. The vehicle number is displayed on the terminal.

3.3 Prerequisites of the system

- Disk space: 1 GB
- Operating systems: Windows 7 or later, MacOS, and Linux
- Python versions: 3.7.5
- Compatible tools: Microsoft Visual Studio, PyCharm
- Included Python packages: NumPy, Matplotlib, imutils, PIP, pytesseract and others.
- Processors: Intel Core i3 processor or later

3.4 Project Implementation:

```
import cv2
from matplotlib import pyplot as plt
import numpy as np
import imutils
import pytesseract
from PIL import Image
from matplotlib import cm
```

```
pytesseract.pytesseract.tesseract_cmd = r'C:\\Program Files\\Tesseract-OCR\\tesseract.exe'


def trim_text(text):
  ans=""
  for i in range(len(text)):
    if(text[i]=='|'and i>0 and i<len(text)-2):
       ans+='I'
    elif(text[i].isalnum() is not True):
      continue
    else:
      ans+=text[i]
  return ans


img = cv2.imread('./test_images/94.jpg')
print("Reading Image.....")
gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
plt.imshow(cv2.cvtColor(gray, cv2.COLOR_BGR2RGB))


bfilter = cv2.bilateralFilter(gray, 11, 17, 17) #Noise reduction
edged = cv2.Canny(bfilter, 30, 100) #Edge detection
```

```
plt.imshow(cv2.cvtColor(edged, cv2.COLOR_BGR2RGB))


keypoints = cv2.findContours(edged.copy(), cv2.RETR_TREE,
cv2.CHAIN_APPROX_SIMPLE)
img1=img.copy()
cv2.drawContours(img1,keypoints[0],-1,(0,255,0),3)
cv2.imshow("img1",img1)
cv2.waitKey(0)
contours = imutils.grab_contours(keypoints)
contours = sorted(contours, key=cv2.contourArea, reverse=True)[:50]



location = None
for contour in contours:
   approx = cv2.approxPolyDP(contour, 20, True)
   if len(approx) == 4:
      location = approx
      break

#print(location)


mask = np.zeros(gray.shape, np.uint8)
new_image = cv2.drawContours(mask, [location], 0,255, -1)
new_image = cv2.bitwise_and(img, img, mask=mask)
```

```
plt.imshow(cv2.cvtColor(new_image, cv2.COLOR_BGR2RGB))


(x,y) = np.where(mask==255)
(x1, y1) = (np.min(x), np.min(y))
(x2, y2) = (np.max(x), np.max(y))
cropped_image = gray[x1:x2+1, y1:y2+1]
cv2.imshow("cm",cropped_image)
cv2.waitKey(0)


im = Image.fromarray(np.uint8(cm.gist_earth(cropped_image)*255))


text = pytesseract.image_to_string(im,config ='--psm 6')
text = str.upper(text)
text = trim_text(text)
print(f"License plate number is {text}")
```

- In this project Digital Image processing and OCR are executed using different python libraries such as OpenCV 3 and pytesseract respectively.

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

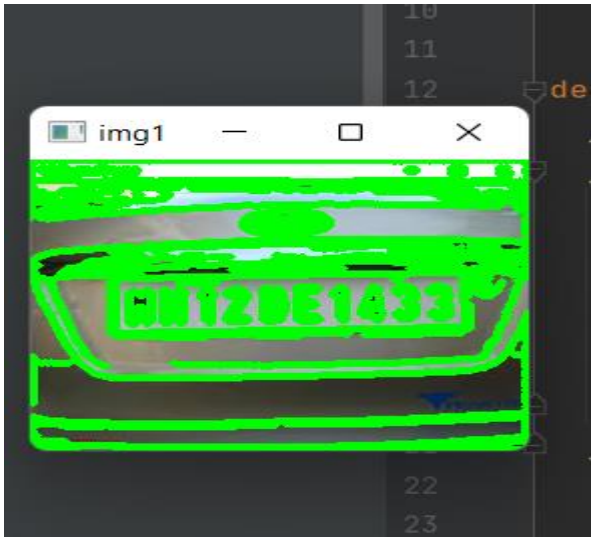
- The Morphed image is then displayed when any key is pressed. The Morphed image is obtained after morphological transformation.

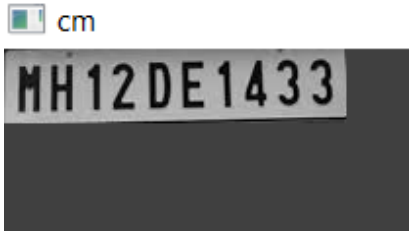
- After pressing one more key, the segmented plate is displayed from the morphed image in a new window which is performed using contour extraction on the morphed image.

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

- The project is tested on various sets of test data and the system is found to work fine with certain pictures with particular frame measurements.

Screenshots: The screenshots of the implementation of the project is attached below:






```
"C:\Users\Siva Sankar\AppData\Local\Programs\Python\Python39\python.exe" "C:/Users/Siva Sankar/Desktop/anpr/zoomanth.py"
Reading Image.....
License plate number is MH12DE1433

Process finished with exit code 0
```

Chapter 4 : Project Analysis

4.1 Testing

- The project script is tested on various pictures and was successful with certain pictures that were available under certain dimension frames.
- The image was successfully enhancing the image quality and was converting the image to binary and morphed image.
- The project extracts the number plate from the car image and displays it separately.
- The project successfully prints half of the License plate number after performing Optical Character Recognition using pytesseract. The accuracy issues are there in the Tesseract engine and can be enhanced after enhancing the configuration of the engine.

4.2 Inference

The final prototype is performing all the functions including the image acquisition, License plate extraction, pre-processing, character segmentation and character recognition along with printing it on the display or terminal. The project can be modified to store the number in a database.

4.3 Application

Automatic Number Plate Recognition has a wide range of applications since the license number is the primary, most widely accepted, human readable, mandatory identifier of motor vehicles.

ANPR provides automated access to the content of the number plate for computer systems managing databases and processing information of vehicle movements.

Below we indicated some of the major applications, without the demand of completeness:

- **Parking:** One of the main applications of ANPR is parking automation and parking security: ticketless parking fee management, parking access automation, vehicle location guidance, car theft prevention, "lost ticket" fraud, fraud by changing tickets, simplified, partially or fully automated payment process, amongst many others.

- **Access Control:** Access control in general is a mechanism for limiting access to areas and resources based on users' identities and their membership in various predefined groups. Access to limited zones, however, may also be managed based on the accessing vehicles alone, or together with personal identity. License plate recognition brings automation of vehicle access control management, providing increased security, car pool management for logistics, security guide assistance, event logging, event management, keeping access diary, possibilities for analysis and data mining.

- **Motorway Road Tolling:** Road Tolling means that motorists pay directly for the usage of a particular segment of road infrastructures. Tolls are a common way of funding the improvements of highways, motorways, roads and bridges: tolls are fees for services. Efficient road tolling increases the level of related road services by reducing travel time overhead, congestion and improve roadways quality. Also, efficient road tolling reduces fraud related to non-payment, makes charging effective, reduces required manpower to process events of exceptions. License plate recognition is mostly used as a very efficient enforcement tool, while there are road tolling systems based solely on license plate recognition too.

- **Border Control:** Border Control is an established state-coordinated effort to achieve operational control of the country's state border with the priority mission of supporting the homeland's security against terrorism, illegal cross border traffic, smuggling and criminal activities. Efficient border control significantly decreases the rate of

violent crime and increases the society's security. Automatic number plate recognition adds significant value by event logging, establishing investigate-able databases of border crossings, alarming on suspicious passing, at many more.

4.4 Advantages

- Automatic number plate recognition cameras are used to measure the average vehicle speed over longer distances.
- Used to identify a motorist when he/she drives away without paying for their fuel.
- Automatic number plate recognition cameras are used for Traffic management systems.
- Used to Analyse the behaviour (route choice, origin-destination etc.) of a motorist for transport planning purposes.
- ¢ ANPR camera solutions automatically recognize customers based on their license plate and provide them the complete information about the items that they ordered the last time they used the service.
- ¢ Automatic license plate recognition camera solutions are used to recognize the guest vehicles in order to assist visitor management systems.

4.5 Disadvantages

The disadvantage of the license plate recognition system could be privacy rights advocates as well as from citizens concerned with how the cameras are used to track people’s movements, and what is done with the data they produce. Others, however, believe the cameras reduce the need for agencies to hire more officers and are the future of law enforcement.

Computerized crime mapping combines geographic information from global positioning satellites with crime statistics collected by a department’s CAD system and demographic data provided by private companies or the U.S. Census Bureau. For example, maps of crimes can

be covered with maps or layers of relevant data: unemployment rates in the areas of high crime, locations of abandoned houses, population density, reports of drug activity, or geographic structures (such as alleys, canals, or open fields) that might be contributing factors. Geographic profiling, a moderately new development in the field of environmental criminology analyzes the geography of such locations and the sites of the victim encounter, the attack, the murder, and the body dump and maps the most probable location of the suspect's home.

Chapter 5 : Conclusion

This project performs mainly four tasks. The first task is to input an image of the car and this will happen with help of the webcam of the computer for the prototype. When the image is fed the image is enhanced in quality. The enhancement is done in the resolution and the thresholding. The image is constraint to a fixed image frame size.

After the enhancement the image is processed to segment the number plate from the full picture based on the mathematical model of the rectangle. The segmented plate is shown in a new window with all the characters in binary form.

The enhanced segmented plate is then processed for OCR or Optical Character Recognition to segment all the characters in the picture in the form of Text and then it can be stored in a database or can be displayed as in this prototype.

The project is designed so that we can understand the technology used in now-a-days Automatic license plate systems and OCR systems used in most of the developed countries like Germany, France, Singapore, Japan, etc.

It is seen that security forces all over the world face problem to locate or register vehicle number to track any culprit. It is also seen that technology can greatly help us in this situation by solving it.

Chapter 6 : Future Scope

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

REFERENCES

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2.