

AUTOMATED NUMBER PLATE **RECOGNITION**

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Bachelor of Science
In
Mechanical Engineering

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DECLARATION

I hereby declare that the work in this thesis entitled “AUTOMATED NUMBER PLATE RECOGNITION” is my own except for quotations and summaries which have been duly acknowledged. It is carried out as requirement for the award of degree B.Sc. (Mechanical Engineering) at Islamic University of Technology, Gazipur, Dhaka, under the supervision of PROF. DR. NURUL ABSAR CHOWDHURY, Dean, FET, IUT during January 2018 to October 2018.

The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

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CERTIFICATE OF RESEARCH

The thesis titled “AUTOMATED NUMBER PLATE RECOGNITION” submitted by Md Abdur Rahman Ridoy (141435) has been accepted as satisfactory for the fulfillment of the requirement for the Degree of Bachelor of Science in Mechanical Engineering on November, 2018.

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MOTIVATION

An Automated Number Plate Recognition System (ANPR) is a particular surveillance method which takes the image of the number plate of a vehicle and recognizes their license number. At present computer vision technology has become a buzzword and due to the diminution of cost of the particular devices allied to the computer vision has expanded the usage of CCTV by rehashing it possible to automatically recognize vehicles visually.[1]

ANPR mainly depends on steps. These are Vehicle image capture, number plate education, character segmentation, character recognition respectively. This system is predominantly applicable for Bangladeshi number plates by recognizing bengali characters and numbers. This system is mainly performed on the entrance for security control of a highly entry confined zone or confidential area like martial zones, prime minister's house, Parliament, Court, International offices and so on.[2] Optical character recognition method is applied for the character recognition. If the turn out data matches with the records on the database the system will automatically run. Though there exists this system regarding English license number but in the Bangladesh perspective there has not done any system regarding Bengali number system as Bangladeshi vehicles use digital number plates which are consists of Bengali characters.[3] It's mainly a field of computer science named computer vision. Computer vision is an interdisciplinary field that deals with how computers can be made for gaining high-level understanding from digital images or videos.[4]

From the perspective of engineering, it seeks to automate tasks that the human visual system can do. "Computer vision is concerned with the automatic extraction, analysis and understanding of useful information from a single image or a sequence of images. It involves the development of a theoretical and algorithmic basis to achieve automatic visual understanding." As a scientific discipline, computer vision is concerned with the theory behind artificial systems that extract information from images. The image data can take many forms, such as video sequences, views from multiple cameras, or multi-dimensional data from a medical scanner. As a technological discipline, computer vision seeks to apply its theories and models for the construction of computer vision systems. It mainly based on pattern recognition which is a part of computer vision.

TABLE OF CONTENTS

ACKNOWLEDGEMENT	1
MOTIVATION	2
CHAPTER 1: INTRODUCTION AND BACKGROUND INFORMATION	
1.1.PROJECT BACKGROUND.....	3
1.2. PROBLEM STATEMENT	3
1.3. PROJECT OBJECTIVES.....	4
CHAPTER 2: LITERATURE REVIEW	
2.1. INTRODUCTION	5
2.2. WHAT IS OCR?	5
2.3.STEPS OF OCR	6
CHAPTER 3 : METHODOLOGY	
3.1.PROPOSED METHODOLOGY	14
3.2.SYSTEM PREREQUISITES	15
CHAPTER 4: ANPR APPLICATION	
4.1 CONVENTIONAL ANPR SYSTEM.....	16
4.2 VEHICLE IMAGE CAPTURE.....	17
4.2.1 INFRARED CAMERA (IR)	18
4.3. NUMBER PLATE DETECTION.....	19
4.4 CHARACTER SEGMENTATION.....	21
4.5.CHARACTER RECOGNITION.....	22
4.5.1 NUMBER RECOGNITION MATLAB.....	23
4.5.2 CHARACTER RECOGNITION IN MATLAB.....	23
4.5.3 CHARACTER RECOGNITION IN MATLAB CODE.....	24
4.6 STORING THE NUMBERS.....	25
CHAPTER 5: Complication & Conclusion	
5.1 DIFFICULTIES OF ANPR.....	28
5.2 CONCLUSION & FUTURE SCOPE.....	28
REFERENCES	29

LIST OF FIGURES

FIGURE 1: Converting the image into black and white representation.....	6
FIGURE 2: Converting the image into dilation and erosion.....	8
FIGURE 3: character segmentation.....	12
FIGURE 4:Architecture of ocr	13
FIGURE 5: Use case diagram of ocr system.....	16
FIGURE 6:Conventional ANPR system.....	17
FIGURE 7: Infrared Camera (IR)	18
FIGURE 8: Styles of number plates under consideration.....	19
FIGURE 9: Recognizing Plate using Matlab.....	23

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Most of the number plate localization algorithms merge several procedures, resulting in long computational time. The results are mostly dependent on the image quality, since the reliability of the procedures severely degrades in the case of complex, noisy pictures that contain a lot of details[5]. Unfortunately the various procedures barely offer remedy for this problem, precise camera adjustment is the only solution regarding this issue. The image processing part should be done with the help of OCR(Optical Character Recognition). A technology that enables converting non-digital file into editable text files. recognition of printed or written text characters by a computer.[6] Automatic Number Plate Recognition is an important research field due to its number of applications such as parking lot management, enterprise entrance management, automatic toll collection enforcement, traffic law enforcement, border surveillance, stolen vehicle search .

1.2 PROBLEM STATEMENT

Many intensive research studies have been conducted in other countries in the area of automatic number plate recognition, to our knowledge; there is virtually no research studies conducted in Bangladesh in this area. However, ANPR for vehicle identification is an essential area in the development of intelligent traffic systems and surveillance. The use of vehicles in Bangladesh has increased rapidly due to urbanization and modernization, especially in recent years, and thus, traffic congestion in cities specially Dhaka, Chittagong has become a major issue due to inadequate road infrastructure[7].

1.3 PROJECT OBJECTIVES

Therefore, control of vehicles and identification of traffic violators to maintain discipline, is becoming a big problem in those cities. For this reason, development of Automatic Bangla number plate recognition system is seen as a highly essential requirement. This section is about computer vision which is a sector of Computer Science.[8]

- Reduce vehicle related crime.
- For security control of a highly entry confined zone or confidential area like martial zone's, prime minister's house, Parliament, Court, International offices and so on.
- Electronic toll collection on pay-per-use roads.
- Traffic Control
- Enterprise security and services

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

As a vehicle passes an ANPR camera, its license number is detected and instantly inspected against database records of vehicles of interest. Police officers can obstruct and stop a vehicle, inspect it for evidence and where necessary they can arrest. A record for all vehicles passing by a camera is stored. The usage of ANPR in this way has proved to be significant in the detection of many iniquity, including locating stolen vehicles, detecting uninsured vehicles and it's main use in solving crime cases as well as terror attacks, major and organized crime. In past few years, ANPR has been one of the most helpful technology regarding vehicle surveillance.[9]

Majority of the number plate detecting algorithms consists of small number of procedures, Which results in long computational time. These results are strongly rely on the picture quality, since the reliability of the procedures severely demote in the complexity, pictures with more noise, that include a large quantity of details.[10] But now the new technology has come. Recent cameras and license both are come with Optical Character Recognition (OCR) technology.

2.2 WHAT IS OCR?

Optical character recognition 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.

2.3 Steps of OCR

- Grayscale
- Binarization
- Noise removing
- Image sharpening
- Line-word-character segmentation
- Feature extraction
- Classification

Normal image is converted to Grayscale image. This image has equal intensity of Red, Green and Blue colors. Algorithm used : Luminosity Method.

THIS IS JUST A TEST TEXT → THIS IS JUST A TEST TEXT

Normal Image

Gray scale Image

Converting the image into black and white representation. i.e., intensity information will be reduced to two values respectively 0 and 1. Algorithm used : Otsu's Algorithm

THIS IS JUST A TEST TEXT → THIS IS JUST A TEST TEXT

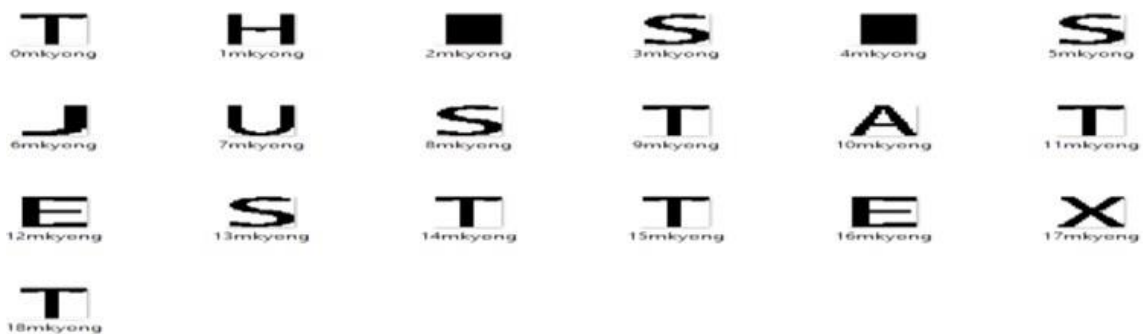
Gray scale Image

Binarized Image

Noise: Random fluctuations in brightness, color and intensity that usually make it more difficult to process image properly. Salt-Pepper Noise (Common Noise in Images)[19] This will have dark pixels in bright regions and bright pixels in dark regions.[18] For Image Sharpening Algorithm used : Erosion and Dilation Algorithm. Erosion reduces image by getting rid of small extrusions. Dilation expands the region as it tends to fill out small intrusions.

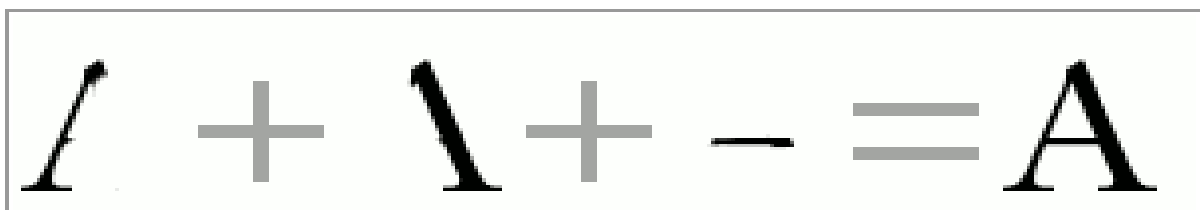


While doing character segmentation we separate different parts of the image i.e. isolate one word from another and then separate letters of the word. Algorithm used : Histogram and Mathematical Computation.



Segmentation

In order to do feature extraction we find a set of features that define the shape of the underlying character as precisely and Uniquely as possible. Algorithm used : Zoning Method.



For classification we use extracted features to identify character according to preset rules. We determine region of feature space in which the unknown pattern falls. Algorithm used : K- Nearest Neighbor Classification Method.

Grayscale Image

- Normal RGB image is converted to Grayscale image. This image has equal intensity of Red, Green and Blue colors.

-

```
I = imread('keypad.jpg');
I = rgb2gray(I);

figure;
imshow(I)
```

- **grayscale** image is one in which the value of each pixel is a single sample representing only an *amount* of light, that is, it carries only intensity information.

Binarization

- A **binary image** is a digital image that has only two possible values for each pixel.
- the two colors used for a binary image are black and white.

```
BW = imbinarize(I);

figure;
imshowpair(I, BW, 'montage');
```

-

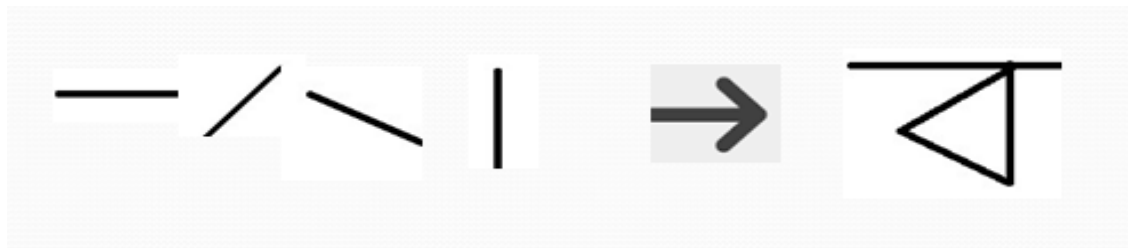
- A very important characteristic of a binary image is the distance transform. This gives the distance of every set pixel from the nearest unset pixel.

Noise Removing

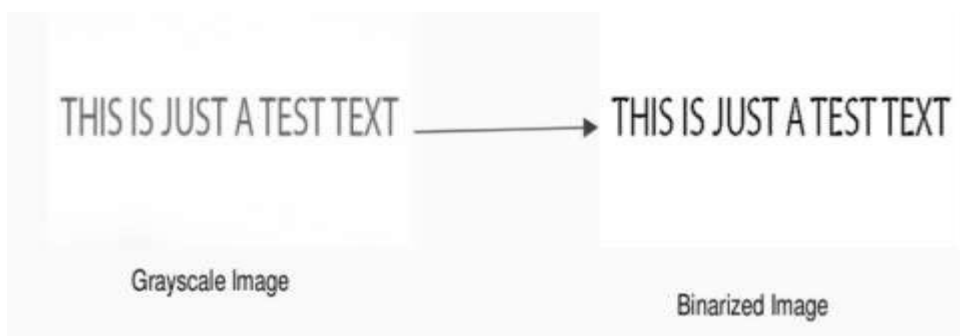
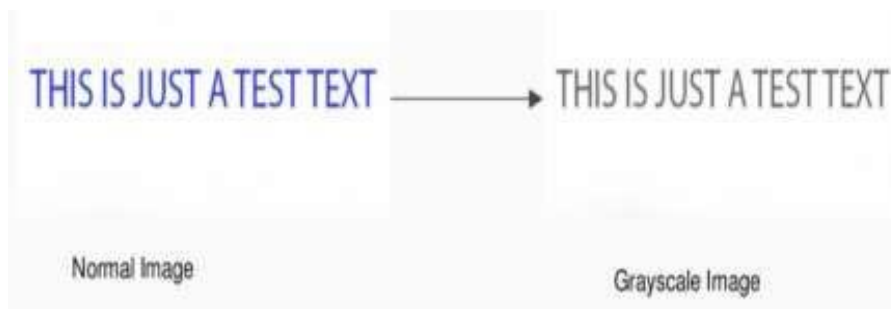
- Random fluctuations in brightness, color and intensity that usually make it more difficult to process image properly.
- Salt-Pepper Noise (Common Noise in Images). This will have dark pixels in bright regions and bright pixels in dark regions.
- For Image Sharpening Algorithm used : Erosion and Dilation
- Algorithm Erosion reduces image by getting rid of small extrusions. Dilation expands the region as it tends to fill out small intrusions.

Segmentation

- It is known as “adaptive recognition” which 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).

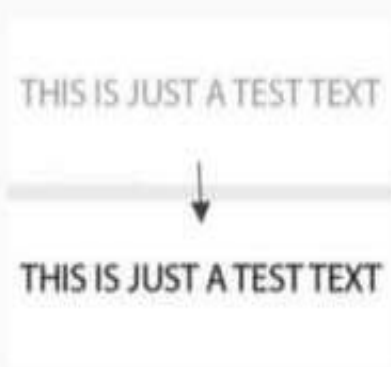


Example of Methods :

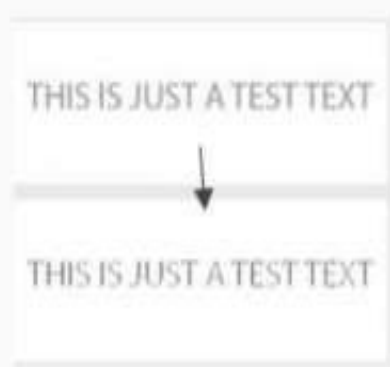




Example of Salt-Pepper Noise

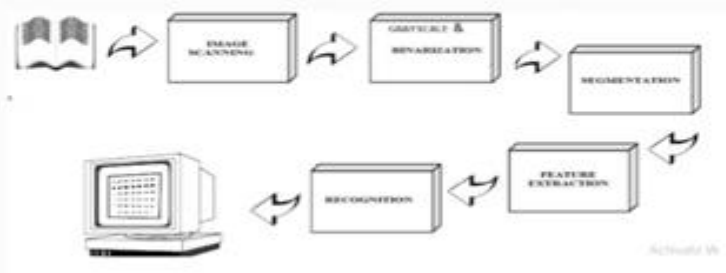


Dilation



Erosion

Architecture of OCR



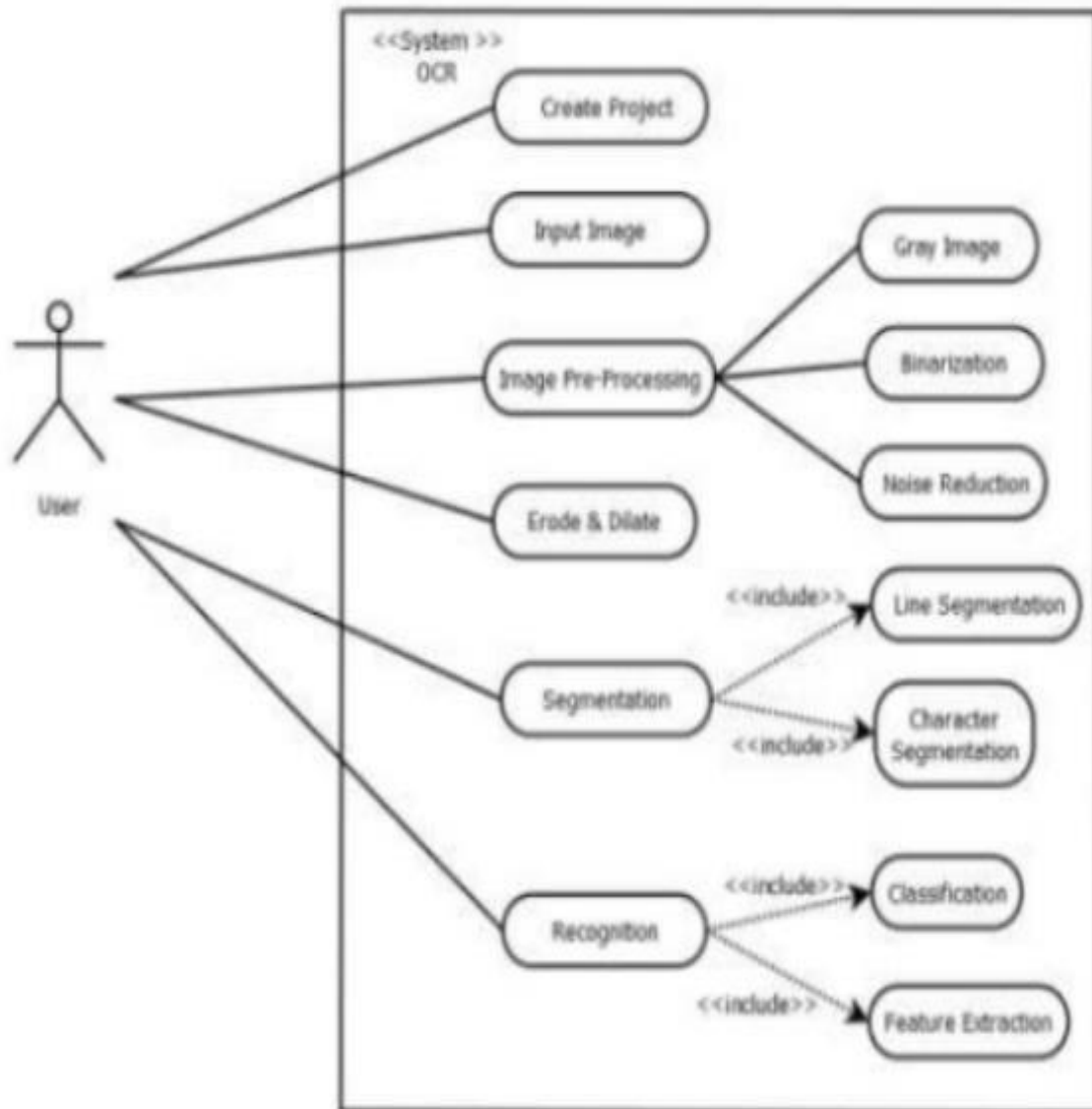


Fig: Use case diagram of OCR system

CHAPTER 3

METHODOLOGY

3.1 PROPOSED METHODOLOGY

According to application type, my research can be categorized under combinedly on Observational and applied research method . Because these refers to scientific study and research that seeks to solve specific and practical problem [20]. And at this research firstly I try to detect car plate number from surveillance real time pictures.

In my research I will mainly focus on the numbers of the plate.I want to focus mainly on one problem regarding number plate recognition[21].

Observational research (or field research) is a type of correlational (i.e., non-experimental) research in which a researcher observes ongoing behavior. There are a variety of types of observational research, each of which has both strengths and weaknesses. These types are organized below by the extent to which an experimenter intrudes upon or controls the environment.

Observational research is particularly prevalent in the social sciences and in marketing. It is a social research technique that involves the direct observation of phenomena in their natural setting. This differentiates it from experimental research in which a quasi-artificial environment is created to control for spurious factors, and where at least one of the variables is manipulated as part of the experiment. It is typically divided into naturalistic (or “nonparticipant”) observation, and participant observation. Cases studies and archival research are special types of observational research. Naturalistic (or nonparticipant) observation has no intervention by a researcher. It is simply studying behaviors that occur naturally in natural contexts, unlike the artificial environment of a controlled laboratory setting. Importantly, in naturalistic observation, there is no attempt to manipulate variables. It permits measuring what behavior is really like. However, its typical limitations consist in its incapability exploring the actual causes of behaviors, and the impossibility to determine if a given observation is truly representative of what normally occurs.[24]

Applied research refers to scientific study and research that seeks to solve practical problems. This type of research plays an important role in solving everyday problems that often have an impact on life, work, health, and overall well-being. Applied research is used to find solutions to everyday problems, cure illness, and develop innovative technologies.

There are many different types of psychologists who perform applied research. Psychologists working in human factors or industriorganizational fields, for example, often do this type of research. Applied research is a methodology used to solve a specific, practical problem of an individual or group. The study and research is used in business, medicine and education in order to find solutions that may cure diseases, solve scientific problems or develop technology.[25]

3.2 SYSTEM PREREQUISITES

Regarding the research we need to collect some sort of data also. We need to ensure that we have all the required numbers and alphabet which are used in number plate. In Bangladesh all the numeric numbers and 2 sort of bangla alphabets all are use both in private and commercial vehicles. So we need to have both of these in our DB as well as the characters like hyphens. And after that segmentation all the numbers of the cars should be stored in database. So Its really important to have a huge database regarding the research.[22] 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. This system will also assist in tracking any fraudulent behaviour that takes location on the toll checkpoints. The proposed system will capture a picture positioned at the toll checkpoint and will perform sure approaches to hit upon the quantity plate of a vehicle. Following are the stairs that desires to observe to locate various plates.[23].

1. Vehicle Image Captured By Camera
2. Extraction of number plate Location
3. Segmentation and Recognition of plate
4. Display Vehicle Number
5. Vehicle Image captured by Camera

Software

1. OCR
2. Matlab
3. Data Storage(online)

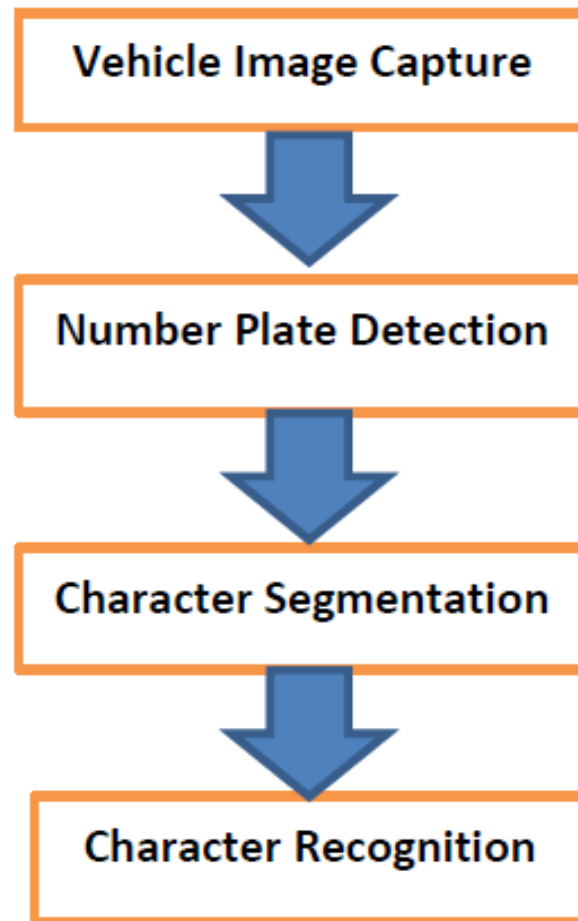
Hardware

1. PC
2. Camera(for speedy cars)
3. IR

CHAPTER 4

ANPR Application

4.1 Conventional ANPR System



4.2 Vehicle Image Capture

From the ANPR viewpoint image quality is always a prime concern. While capturing a fast passing vehicle the camera needs to be more agile to avoid motion blur by which the accuracy can be easily decrease. So in order to fix this problem the optical image stabilization (OIS) system have already in the market by which the accuracy will improve and also the short shutter time needs to be apply with the help of powerful illumination. For instance [11], The best illumination would be the IR, because of the retro-reflective number plates reflects this sort of light quite well and this thing is not detectable with the human eye. And most importantly this thing works smoothly during day and night. So while using IR low light is not a concern. The ANPR cameras are consists of these requirements like ANPR cameras which provides good shutter control and OIS technology and it also has built in IR flash which is capable of catching the vehicles upto 250km/h speed. [12]

A law enforcement officer on patrol could have a dash cam hooked to a computer that checks license plates automatically. If it matches a license plate number to a vehicle owner with an outstanding warrant or a vehicle involved in a hit-and-run accident, it would alert the officer to the situation, allowing them to drastically increase the number of plates checked when compared to the traditional method used of calling in a plate number to dispatch and waiting for the information to be sent back to them.

What about a service shop? When a repeat customer pulls into line, the license plate is read and that customer's file is pulled up, providing information to the clerk checking the vehicle in, such as the owner's name and contact information. It could also include any particular quirks for that vehicle, such as a car that typically uses 5w30 oil, but the owner's heavy towing requires 10w40 oil. The clerk can then use the service information to upsell services or suggest scheduling the next maintenance visit based on the owner's past habits and the condition of the vehicle.

But, to make this happen, optical character recognition (OCR) technology needs to be part of object detection software. The system needs to not only recognize that there is a vehicle in the picture, but also which part of the vehicle has the license plate and what the shapes on that plate translate to in terms of characters. Though OCR has been in use for many years, it's typically been applied to flat documents that fill a specific area. Filestack's OCR technology allows the system to adapt to changes in the environment, depending on where the camera is mounted, its resolution, and whether the license plate has been cleaned recently.

4.2.1 Infrared Camera (IR)

The best illumination would be the IR, because of the retro-reflective number plates reflects this sort of light quite well and this thing is not detectable with the human eye. Most importantly this thing works smoothly during day and night. So while using IR low light is not a concern.

IR flash cameras are capable of catching the vehicles upto 250km/h speed.

An infrared camera is a non-contact device that detects infrared energy (heat) and converts it into an electronic signal, which is then processed to produce a thermal image on a video monitor and perform temperature calculations. Heat sensed by an infrared camera can be very precisely quantified, or measured, allowing you to not only monitor thermal performance, but also identify and evaluate the relative severity of heat-related problems.[26]

In infrared photography, infrared filters are used to capture the near-infrared spectrum. Digital cameras often use infrared blockers. Cheaper digital cameras and camera phones have less effective filters and can "see" intense near-infrared, appearing as a bright purple-white color. This is especially pronounced when taking pictures of subjects near IR-bright areas (such as near a lamp), where the resulting infrared interference can wash out the image. There is also a technique called 'T-ray' imaging, which is imaging using far-infrared or terahertz radiation. Lack of bright sources can make terahertz photography more challenging than most other infrared imaging techniques. Recently T-ray imaging has been of considerable interest due to a number of new developments such as terahertz time-domain spectroscopy.



4.3 Number Plate detection

In this section, the styles of number plate that are considered in this study are discussed, followed by a brief description of the proposed ANPR process. Table 1 shows various styles of number plates found on vehicles in Bangladesh. Each style is associated with a particular class of vehicle[13]. The classes include private vehicle and commercial vehicles. Other categories of vehicles, such as embassy cars and military cars are not addressed since they are rarely seen.

Styles of number plates can easily be distinguished based on two attributes:


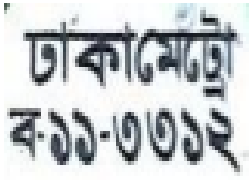
- 1) The combination of colors used in number plates
- 2) The compositional semantics of characters[14].

As shown in Table 1, each style has a different foreground and/or background color. However, two distinct colors (white and black) are utilized in these number plates. We shall pay attention to these two colors when searching for number plates in an input image. The compositional semantics of characters provides additional information for differentiating vehicles. As can be seen in Table 1, every number is composed of four parts separated by a hyphen and white space (e.g., ঢাকা – ক ০১-৩৮৩৩ or ঢাকা মট্টেরা – খ ১২-৩৮২৪). The first part consists of one or two words. In case of one word, it means the district name, on the other hand it means metropolitan (e.g., মনৌ or ঢাকা মট্টেরা). The second part contains a character that is used to recognize vehicle category (e.g., ক, ভ, হ). The third part contains two numerals which mean two sides of an area like north, south where the odd number used for north (e.g., ১১) and even number is used for south (e.g., ১০). Lastly the fourth part consists of four numerals (e.g., ৩৮৩৩) which means the identifier number of a vehicle.[15]

For a system of the automatic number plate recognition with OCR, it needs to have six algorithm processes to detect the plate data properly. The first algorithm would be the plate localization, which is the process of responsibly finding the plate on the image captured on the screen. The second would be the plate orientation and sizing. This is the process that will compensate for the skew and adjust the dimensions to get the desired image size. Furthermore, found in the automatic number plate recognition with OCR, is the normalization, character segmentation and geometrical analysis algorithms. The last algorithm and system would be the optical character recognition.

The automatic number plate recognition with OCR works by using the technology to capture the images and retrieving the license numbers on the plate. It works by simply highlighting the numbers on the image and separating them from the other objects on the screen. The automatic number plate recognition with OCR will then work to convert the data into editable, searchable and easily stored information into the database network. Business entities can make great use of the automatic number plate recognition with OCR in tracking and tracing the destinations of the company owned vehicles.

TABLE I
STYLES OF NUMBER PLATES UNDER CONSIDERATION UNITS FOR MAGNETIC PROPERTIES

Vehicle category	Plate color	Character color	Example
Private	Black	White	
Commercial	White	Black	

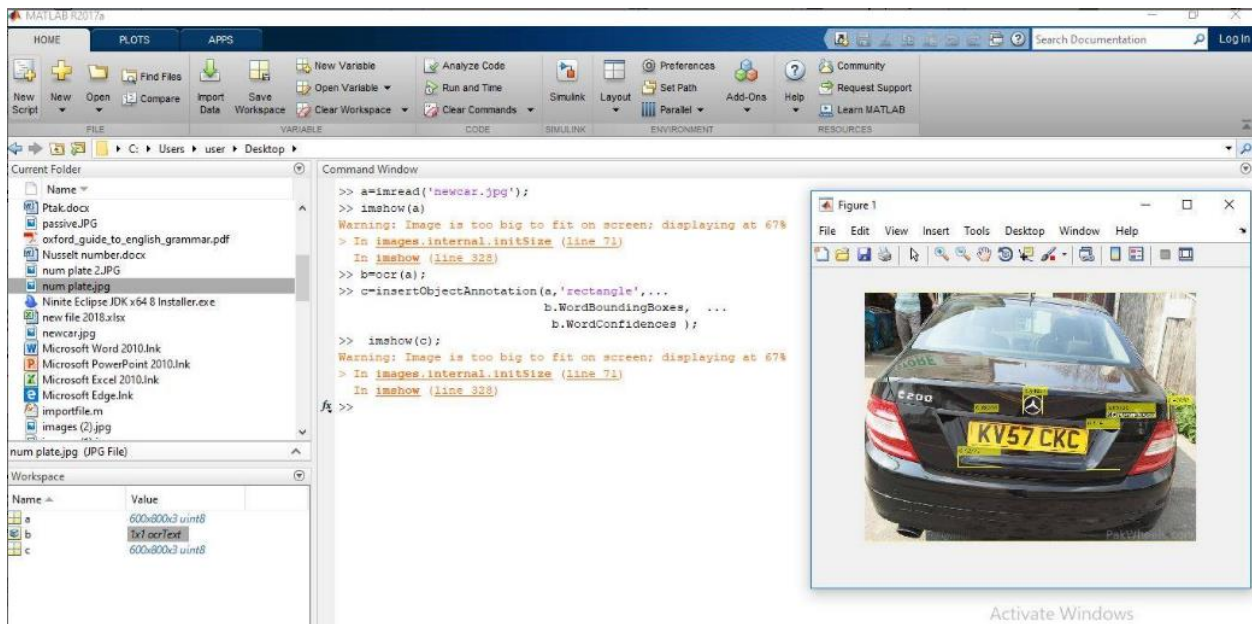


Fig : Recognizing Plate using Matlab

4.4 Character Segmentation

The connected-component based method is used for character segmentation. The characters of the connected components are confirmed by two properties of the number plate such as - the digits on the number plate are fixed and the characters lie in horizontal orientation.

When the fixed numbers of character components in the plate image are not obtained, the number plate image is rejected. One of the tasks in character segmentation is found in where the solution concerns about the reformation of the characters of upper and middle zone. The most commonly used algorithm for character segmentation is applying projections [16].

There are two types of projection – horizontal and vertical. Horizontal projection is used when the number plate contains two rows.

Character segmentation is more difficult due to many reasons such as stuck characters, screws, and mud covered in plates. For this reason vertical projection is used.

Character Recognition In the character recognition, some well-known schemes were used such as artificial neural networks, fuzzy logic, Support Vector Machine (SVM)- based character recognizer and template matching.

The character sequence of number plate uniquely identifies the vehicle.

From the picture all the characters will be matched with the data stored in the storage.

4.5 Character Recognition

In the proposed to use artificial neural networks for recognizing of number plate characters, taking into account characters properties to be as an associative memory. Using neural network has advantage from existing correlation and statistics template techniques [17] that allow being stable to noises and some position modifications of characters on license plate. Their approach is considered to identify vehicle through recognizing its number plate using, Hopfield networks with 42x24 neurons as the dimension of each character. The network must memorize all the Training Data (36 characters) and recognize correctly characters on number.

- Character Recognition part is fully depends on OCR.
- In my system the whole recognition part is done by using Matlab.
- The whole Process of OCR will be done in matlab.
- We have made a system for character recognition only for english alphabet using matlab with the help of neural network.

4.5.1 Number Recognition in Matlab

```
% Remove keypad background
Icorrected = imtophat(I, strel('disk', 15));

BW1 = imbinarize(Icorrected);

figure;
imshowpair(Icorrected, BW1, 'montage');
```



Activate Window

```
% Remove keypad background
Icorrected = imtophat(I, strel('disk', 15));

BW1 = imbinarize(Icorrected);

figure;
imshowpair(Icorrected, BW1, 'montage');
```



Activate Window

4.5.2 Character Recognition in Matlab



I L O V E A B C D

4.5.3 Character Recognition in Matlab code

```
% --- Executes on button press in pushbutton10.
function pushbutton13_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton10 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
contents = get(handles.popupmenu5, 'String');
popupmenu5value = contents{get(handles.popupmenu5, 'Value')};
switch popupmenu5value
    case 'Train using Gradient Technique'
        train
        helpdlg('Network has been trained using Gradient technique. Click on "Extract Text" to process the image',
            'Training Successfull');
    case 'Train using Geometric Feature Extraction'
        geo_train
        helpdlg('Network has been trained using Geometric Feature Extraction. Click on "Extract Text" to process t
            'Training Successfull');
end
set(handles.pushbutton11, 'Enable', 'on')
```

4.6 Storing the numbers

After successfully recognizing the number plate the system will store it in the database. Each and every iteration of the vehicle the storage will update by the history. Most of the first world company make it online database in order to make it open for the law enforcement. Various databases are used in order to store the data. Such as OracleDB, MongoDB, MySQLDB, Microsoft SQL server etc. But in this case we should avoid the open source database in order to ensure the top most privacy.

MySQL database:

MySQL is an open-source relational database management system. The MySQL server software itself and the client libraries use dual-licensing distribution. They are offered under GPL version 2, beginning from 28 June 2000 (which in 2009 has been extended with a FLOSS License Exception) or to use a proprietary license.

Support can be obtained from the official manual. Free support additionally is available in different IRC channels and forums. Oracle offers paid support via its MySQL Enterprise products. They differ in the scope of services and in price. Additionally, a number of third party organisations exist to provide support and services, including MariaDB and Percona.

MySQL has received positive reviews, and reviewers noticed it "performs extremely well in the average case" and that the "developer interfaces are there, and the documentation (not to mention feedback in the real world via Web sites and the like) is very, very good". It has also been tested to be a "fast, stable and true multi-user, multi-threaded sql database server".

Oracle database:

Oracle Database (commonly referred to as **Oracle RDBMS** or simply as **Oracle**) is a multi-model database management system produced and marketed by Oracle Corporation.

It is a database commonly used for running online transaction processing (OLTP), data warehousing (DW) and mixed (OLTP & DW) database workloads. The latest generation, Oracle Database 18c, is available on-prem, on-Cloud, or in a hybrid-Cloud environment. 18c may also be deployed on Oracle Engineered Systems (e.g. Exadata) on-prem, on Oracle (public) Cloud or (private) Cloud at Customer. At Openworld 2017 in San Francisco, Executive Chairman of the Board and CTO, Larry Ellison announced the next database generation, Oracle Autonomous Database.

Oracle Active Data Guard extends Oracle Data Guard functionality with advanced features, allowing read-only access to data in a physical standby database to offload

primary of such tasks as reporting, ad-hoc queries, data extraction and backup, offloading redo transport and minimizing standby impact on commit response times (using Far Sync feature), providing option for rolling upgrades for non-RAC customers, managing clients workload across replicated database and improving automated service failover (using Global Data Services), etc.

Microsoft SQL Server:

Microsoft SQL Server is a relational database management system developed by Microsoft. As a database server, it is a software product with the primary function of storing and retrieving data as requested by other software applications—which may run either on the same computer or on another computer across a network (including the Internet).

Microsoft markets at least a dozen different editions of Microsoft SQL Server, aimed at different audiences and for workloads ranging from small single-machine applications to large Internet-facing applications with many concurrent users.

Data storage is a database, which is a collection of tables with typed columns. SQL Server supports different data types, including primitive types such as *Integer*, *Float*, *Decimal*, *Char* (including character strings), *Varchar* (variable length character strings), binary (for unstructured blobs of data), *Text* (for textual data) among others. The rounding of floats to integers uses either Symmetric Arithmetic Rounding or Symmetric Round Down (*fix*) depending on arguments: `SELECT Round(2.5, 0)` gives 3.

Microsoft SQL Server also allows user-defined composite types (UDTs) to be defined and used. It also makes server statistics available as virtual tables and views (called Dynamic Management Views or DMVs). In addition to tables, a database can also contain other objects including views, stored procedures, indexes and constraints, along with a transaction log. A SQL Server database can contain a maximum of 2 objects, and can span multiple OS-level files with a maximum file size of 2 bytes (1 exabyte). The data in the database are stored in primary data files with an extension `.mdf`. Secondary data files, identified with a `.ndf` extension, are used to allow the data of a single database to be spread across more than one file, and optionally across more than one file system. Log files are identified with the `.ldf` extension.

Storage space allocated to a database is divided into sequentially numbered *pages*, each 8 KB in size. A *page* is the basic unit of I/O for SQL Server operations. A page is marked with a 96-byte header which stores metadata about the page including the page number, page type, free space on the page and the ID of the object that owns it. Page type defines the data contained in the page: data stored in the database, index, allocation map which holds information about how pages are allocated to tables and indexes, change map which holds information about the changes made to other pages since last backup or

logging, or contain large data types such as image or text. While page is the basic unit of an I/O operation, space is actually managed in terms of an *extent* which consists of 8 pages. A database object can either span all 8 pages in an extent ("uniform extent") or share an extent with up to 7 more objects ("mixed extent"). A row in a database table cannot span more than one page, so is limited to 8 KB in size. However, if the data exceeds 8 KB and the row contains *varchar* or *varbinary* data, the data in those columns are moved to a new page (or possibly a sequence of pages, called an *allocation unit*) and replaced with a pointer to the data.

MongoDb:

MongoDB is a free and open-source cross-platform document-oriented database program. Classified as a NoSQL database program, MongoDB uses JSON-like documents with schemata. MongoDB is developed by MongoDB Inc., and is published under a combination of the Server Side Public License and the Apache License.

MongoDB can be used as a file system, called GridFS, with load balancing and data replication features over multiple machines for storing files.

This function, called grid file system, is included with MongoDB drivers. MongoDB exposes functions for file manipulation and content to developers. GridFS can be accessed using mongofiles utility or plugins for Nginx and lighttpd. GridFS divides a file into parts, or chunks, and stores each of those chunks as a separate document.

CHAPTER 5

Complication & Conclusion

5.1 Difficulties of ANPR

- Poor file resolution, usually because the plate is too far away but sometimes resulting from the use of a low-quality camera.
- Blurry images, particularly motion blur.
- Poor lighting and low contrast due to overexposure, reflection or shadows.
- An object obscuring (part of) the plate, quite often a tow bar, or dirt on the plate.
- Read license plates that are different at the front and the back because of towed trailers, campers, etc.
- Vehicle lane change in the camera's angle of view during license plate reading.
- Circumvention techniques.

5.2 Conclusion & Future scope

- The automatic vehicle identification plays an important role in detecting security threat.
- It is not being used in our country but will be prove to be effective .
- There is an immediate need of such kind o ANPR system in Bangladesh as there are problems of traffic,stealing cars etc .
- This system is very economical and eco-friendly, if applied effectively.
- The system use series of image processing techniques for identifying thr vehicle from the database stored in the pc .
- The system is implemented in Matlab and it performance is tested on real images.
- The system robustness and speed can be increase if high resolution camera is used.

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