

**AUTOMATIC LICENSE NUMBER PLATE RECOGNITION SYSTEM**

**BY**

**IFTEKHAR UDDIN**

**ID: 181-15-11313**

The Report Written in Partial Fulfillment of the Requirements for the Degree  
of Bachelor of Science in Computer Science and Engineering

Supervised By

**Nishat Sultana**

Lecturer

Department of CSE

Daffodil International University

Co-Supervised By

**Dewan Mamun Raza**

Lecturer

Department of CSE

Daffodil International University



**DAFFODIL INTERNATIONAL UNIVERSITY**

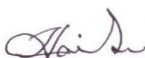
**DHAKA, BANGLADESH**

**DECEMBER 2021**

## **APPROVAL**

This Project/internship titled “**Automatic License Number plate Recognition System**”, submitted by **Iftekhar Uddin**, ID No: **181-15-11313** to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 5<sup>th</sup> January 2022.

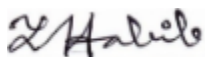
### **BOARD OF EXAMINERS**



**Chairman**

---

**Dr. Sheak Rashed Haider Noori (SRH)**  
**Associate Professor and Associate Head**  
Department of Computer Science and Engineering  
Faculty of Science & Information Technology  
Daffodil International University



**Internal Examiner**

---

**Md. Tarek Habib (MTH)**  
**Assistant Professor**  
Department of Computer Science and Engineering  
Faculty of Science & Information Technology  
Daffodil International University



**Internal Examiner**

---

**Md. Reduanul Haque (MRH)**  
**Assistant Professor**  
Department of Computer Science and Engineering  
Faculty of Science & Information Technology  
Daffodil International University



**External Examiner**

---

**Dr. Mohammad Shorif Uddin**

**Professor**

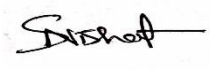
Department of Computer Science and Engineering

Jahangirnagar University

## DECLARATION

I hereby declare that, this project has been done by us under the supervision of **Nishat Sultana, Lecturer Department of CSE** Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

### Supervised by:



---

**Nishat Sultana**  
Lecturer  
Department of CSE  
Daffodil International University

### Co-Supervised by:



---

**Dewan Mamun Raza**  
Lecturer  
Department of CSE  
Daffodil International University

### Submitted by:



---

**Iftekhar Uddin**  
ID: 181-15-11313  
Department of CSE  
Daffodil International University

## ACKNOWLEDGEMENT

Firstly I express my heartiest thanks and gratefulness to almighty Allah for His divine blessing makes us possible to complete the final year project successfully.

I am really grateful and wish our profound our indebtedness to **Nishat Sultana, Lecturer**, Department, of CSE Daffodil International University Dhaka. Deep knowledge & keen interest of my supervisor in the field of “Machine Learning (ML), Artificial Intelligence (AI), Image Processing, Artificial Neural Network” to carry out this project. Her endless patience ,scholarly guidance ,continual encouragement , constant and energetic supervision, constructive criticism , valuable advice , reading many inferior draft and correcting them at all stage have made it possible to complete this project.

We would like to express our heartiest gratitude to Professor Dr. Touhid Bhuiyan, Head, Department of CSE, for his kind help to finish our project and also to other faculty member and the staff of CSE department of Daffodil International University.

We would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

Finally, we must acknowledge with due respect the constant support and patients, inspiration prayer and love of our parents.

## **ABSTRACT**

Traffic system will appreciate the usefulness of the Automatic License Number plate Recognition System. It's eliminates the manually checking number plate detection displeasure. As a result it will be more reliable and effective to detect number plate. It's provides vehicle update information. This system reduces time saving and energy loss. As a result this process will create more consistency of detecting vehicle plate at a short time slot. It provides more effective detection result which is use for reduce illegal vehicle on road by depend on stored information. This technology helps users to find out a vehicle production year information, license re-new information and tax-token information and also provides legal or illegal information for fitness.

# TABLE OF CONTENTS

<b>CONTENTS</b>	<b>PAGE</b>
Approval	ii
Declaration	iv
Acknowledgements	v
Abstract	vi
List Of Figure	x
List of Table	xi
Reference	30
Plagiarism Report	32
<b>CHAPTER</b>	
<b>CHAPTER 1: INTRODUCTION</b>	<b>1-4</b>
1.1 Introduction	1
1.2 History of ANPR	1
1.3 Application of ANPR	2
1.4 Expected Output	2
1.5 Context of Bangladesh	3
1.6 Waterfall Model of ANPR	3
1.7 Report Layout	3
	vii

<b>CHAPTER 2: LITERATURE REVIEW</b>	<b>4-9</b>
2.1 Background	4
2.1 ANPR Work-Flow	5
2.2 License Plate Detection	5
2.3. Uses of license plate recognition	7
2.4 Image Processing	7
2.5 Related Researches	9
<b>CHAPTER 3: METHODOLOGY</b>	<b>09-20</b>
3.1 System Requirement	9
3.1.1 Software And Hardware Requirement	10
3.1.2 User Requirement	10
3.2 Proposed Model	11
3.2.1 Tensorflow	11
3.2.2 Single Shot multi-box Detector (SSD)	11
3.3 Data Collection	13
3.3.1 Annotation	14
3.4. Create Model & Configuration	14
3.4.1 Train & Evaluate Model	15
3.4.2 Training	16
3.4.3 Evaluate Model	18
3.5 Segmentation & Recognition	18
3.5.1 Segmentation	19
	viii



3.5.2 Recognition	20
<b>CHAPTER 4: RESULT &amp; DISCUSSION</b>	<b>21-27</b>
4.1 Introduction	21
4.2 Static Result	21
4.3 Dynamic Result	23
4.4 Recognition Result	25
<b>CHAPTER 5: IMPACT ON SOCIETY &amp; SUSTAINABILITY</b>	<b>27-28</b>
5.1 Impact on Society	27
5.2 Ethical Aspects	28
5.3 Sustainability	28
<b>CHAPTER 6: SUMMERY &amp; CONCLUSION</b>	<b>29</b>
6.1 Summery of the study	29
6.2 Conclusion	29

## LIST OF FIGURES

<b>FIGURES</b>	<b>PAGE</b>
Fig1.1 : Recognition Process	3
Fig2.1: Image processing procedure	8
Fig3.1: Model flowchart	11
Fig3.2: SSD object detection Procedure	12
Fig3.3: Sample of dataset	13
Fig3.4: Sample of annotation	14
Fig3.5: Creating Model and Configuration	15
Fig3.6: Model Training Process	16
Fig3.7: Model Training script	17
Fig3.8: Evaluate script	18
Fig3.9: Character Segmentation & Recognition	19
Fig3.10: Character Segmentation	19
Fig3.11: License plate character recognition	20
Fig5.1 : Future using rate of ANPR system	28

## LIST OF TABLE

### TABLE:

Table 4.1: ANPR Manual Result	21
Table 4.2: ANPR Result frequency of vehicles	22
Table 4.3: ANPR Real Time Result	23
Table 4.4: ANPR Real Time Result frequency of Vehicles	25
Table 4.5: Character Recognition Result	26
Table 4.6: Number Recognition Result	27

# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

Modern civilization began with the use of vehicles to facilitate human travel and communication. At one stage it takes current modern civilization form where we use vehicles for a variety of purposes. With the increasing demand for vehicles among the people, the problem has increased due to these vehicles. Whereas problems are vehicle supervision, maintenance, safety, illegal movement, excessive speed, etc. Where these problems caused by vehicles are easily solved by Automatic Number plate Recognition System. At the present time people are becoming quite role models on using technology. Technology makes people's life-style more easy and enjoyable. This manuscript discusses about the topic of “Automatic License Plate Recognition System”. The entire process provides Number Plate image detection, image convert into text, stores detected plate image and text at excel file, find out detected vehicle plate information from previous stored database. Every working process need an operator like a police or army sergeant from operating place like any road side, police box etc.

### 1.2 History of ANPR

The automatic recognizable vehicles has been in significant demand especially with the increment within the vehicle-related offenses. Day by day ANPR has become an important part of security management, high-way toll collection, manage parking lot and also many others sectors. At first automatic number plate recognition system invented in United Kingdom at 1976. And first model frameworks was working by 1979 begin with at EMI Gadgets, and after that at Computer recognition systems. The primary capture was used to at 1981 to find out of a stolen car. In any case, ANPR did not ended up broadly utilized until modern improvements in cheaper and simpler to utilize computer program were spearheaded amid the 1990s. Police use ANPR to apply law in

high-way. Using for checking vehicle authorized or not. It is additionally utilized for electronic toll collection on pay-per-use streets and as a strategy of cataloguing the movement of vehicle activity by road agency [1].

### **1.3 Application of ANPR**

The ANPR methods are introduced in numerous places such as toll entryways, stopping and entrance of secured buildings and etc. These methods are valuable since it can mechanize car stop overseeing, increment the security of car stop administrator, stop the using of parking tickets. Also reduce traffic hours, and identify speeding cars on road. ANPR also control these kind of field: country borders, checking activity, traffic monitoring, stolen vehicle identification proof and vehicles tracking.

### **1.4 Expected Output**

License plates detects in this project at passive way. Recognition vehicle number plates goes through four function: capture a digital image from car, allocate license plate location from image, character division from the plate picture and then recognition characters from segmentation. Plate image is convert into the augmentation. Every character boundaries were found. Every character has more kind of variant. These type character are compare to their language region and character database. Highest database match result show as accuracy to user. Closeness rate of character of each one is shown to the user if detection happen more than one time. Finally, image of the license plate of the detected vehicle are merged into text and shown displayed as output.

## 1.5 Context of Bangladesh

In some private sectors as office, factory, parking lot etc. sometimes uses ANPR in Bangladesh, but its application in the public sector is not yet noticeable and it goes without saying. But recent years Road accident, snatching occurrence, exceeded traffic control and without-fitness vehicle has been raised. To accomplishment these issues and create public awareness, Bangladesh government planning to ensure ANPR use in upcoming days.

## 1.6 Waterfall Model of ANPR

Waterfall model indicates step by step a linear-sequential life cycle of ANPR process [2].

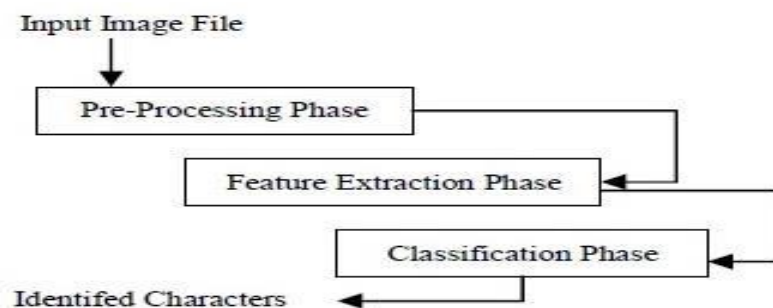


Fig1.1: Recognition Process

## 1.7 Report Layout

This report is split in six separate chapters to view of study. To easily understand the paper there makes some sections under every chapter. Chapter 1: The first chapter is introduction. It helps a reader to know pure view of this research. This chapter explains history of ANPR, application of ANPR. There has total 6 sub-sections. Chapter 2: Literature review discuss about background study, recent and future uses of ANPR also related research and image processing method. This chapter divided into 5 sub-section. Chapter 5: Here mainly discuss about work methodology. This chapter ensure proposed

model, data collection, data processing and also data recognition. This chapter divided into 5 sub-section. Chapter 4: Here discuss about project experimental result, performance, efficiency and also discussion of limitation. This chapter divided into 4 sub-section. Chapter 5: In this chapter discuss about project effect in society and also focused on ethical aspects for further research where indicates the future sustainability of ANPR. This chapter divided into 3 sub-section. Chapter 6: It is the final chapter of this research based project where Enlightened the summery of project implementation and it ended up with focusing on how to overcome its limitations in future.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Background**

Automatic License Plate Recognition (ALPR) system makes a difference to a vehicle license plate in an productive way without the requirement of human resource. There are several reasons why the process going to increase day by day. Last 20 years there are increased enormus number of vehicle on the highway which contains digital license plate. The digital advancement of image processing method makes more easy and faster to detect and identify vehicle license plate. To complete overall process, system need 2 to 5 seconds. Recognition of number plates is necessary to use different sectors in our daily life., National system uses it to find out vehicles that are included in wrongdoing, find out vehicles owner who annual tax evasion or find out owner of vehicles who breaks the road traffic rules. Saudi Arabia, UAE, Germany, U.S.A Italy and many countries se ANPR System more than 15 years to control their traffic system and detect crime which are occurred by vehicle. Many private sector taking advantage and benefit from ALPR

systems. An automatic productive system developed in this project which relates to a parking ticket payment system. If the checker needs to check the parking ticket acceptable or not he must physically enter license number and look in a database. Although it does not take much time but he has to test thousands or more cars so it is very time dependent to entry vehicle data during workday, it becomes much tough. Many kind of parking system has a limitation of vehicle entrance during whole day long. ANPR system can handle this easily. The primary goal of a ANPR system's is detect the license plate live video or capturing image, search in database and see the vehicle is valid or not. The main demand of ANPR system is best reading accuracy when read the license plate and faster processing [3].

### **2.1.0 ANPR Work-Flow**

ANPR system is divided into three major process:

1. Hold number plates from licensed photographs
2. Extract and segment characters from the license plate.
3. Recognition digit from segmented character [4].

### **2.2 License Plate Detection**

Vehicle number plate detection step incredibly impacts the exactness of the onward steps. Number plate image is a data where should not contain more than one number plate image and image should contain at least one license plate. Some different calculations and strategies have been proposed within the recent year time to unravel this hard issue. The exactness has continuously indicates a hard issue and moved forward within the later a long time but to begin with finding number plate from captured image from a certain perspective considering distinctive components as impediment alludes to diverse



light conditions influencing the method is still incomprehensible. To solution this, commonly utilized approach is to create use of eminent highlights within the number plate and prepare those pixels which have these highlights reducing the preparing time extremely. The process by which a car plate can be read without human touch is a combination of character recognition and integrated software. Automated system main goal is replace manual process and reduce timing. It is a vast conservative system which uses OCR on vehicles images to read from number plates. They used specifically designed camera which only performing this task properly. ANPR is also used to store the images text from vehicles number plate. This process normally use special cameras to capture an image at any day hour anytime and also used integrated flash light at night. It occurs plate shape variation from one place to place due to region.

The challenging research topic of License number recognition (LNR) has obtained vast eagerness in recent times. There are many reason behind of this (ex: dirt, light, shadows color, language, character cleanness etc.) and shape are varied one region to region. License plate recognition has ended up with vital portion of numerous applications, for example, road safety enforcement, parking lot management, automatic toll collection, and car tracking and identification. This automatic process implement as activity of traffic monitoring methods working along with traffic light in order to detect the car that break traffic act or identify criminal vehicles. Sometimes, License Plate Recognition system is useful for detect vehicle's over speed. There are vast number of vehicles and cars have been used in Bangladesh, where accidents rate is extremely high. In town area, now a day's private car have been widely used for sending children to their school. As a result many accident has been occur at road side school. Hence, street security requirement is presently getting great consideration as critical issue in arrange to decrease the plausibility of accidente from reckless driving. Some effective process have been implemented by previous research, but deep learning attempt has been increased to reduce and solve these kind of matter.

Optical Character Recognition (OCR) widely use as detect text, then segment along with many pre-processing and finally recognize character. Where last procedure connected

with extractions and classification. Different text detection methods are using: boundary of license plate detection, color features detection (plates color). For character recognition many kind of feature extraction is used which depend on also image representation forms like vector, grey level, binary etc. For character recognition there has many modern method which involve with machine learning. As an example, Tensorflow is also used for image processing and recognition task [5].

### **2.3 Uses of license plate recognition**

**KSA:** Saudi Arabia used ANPR system during last 15 years to control their traffic and detect crime in main cities and highway.

**Germany:** German federal constitutional court ruled an issue some area can use ANPR system at 2008. Specially used this rule for arrest terrorist.

**UK:** At first United Kingdom invent ANPR system at 1976 and Applies in practical work at 1979. United Kingdom uses ANPR system to detect and smash miscreant including prevent organized terrorists, crime groups, etc.

**USA:** Moreover 73% police sectors uses tiny form of ANPR according to 2011 report by the PERF. Police department uses ANPR to searching databases to find out migration culprit, smuggler group member, lost public, national Sex criminal, etc. [6].

### **2.4 Image Processing**

TensorFlow is an open source library. It compiles various algorithms and models simultaneously, it helps to construct an appropriate model for recognition or classification

an image. Image feeding into model and contains many label in output for that image, means image recognition. Most of the time pre-defined class correspond with the label. Image can be leveled as one or more classes. If label as single class, the term is "recognition".

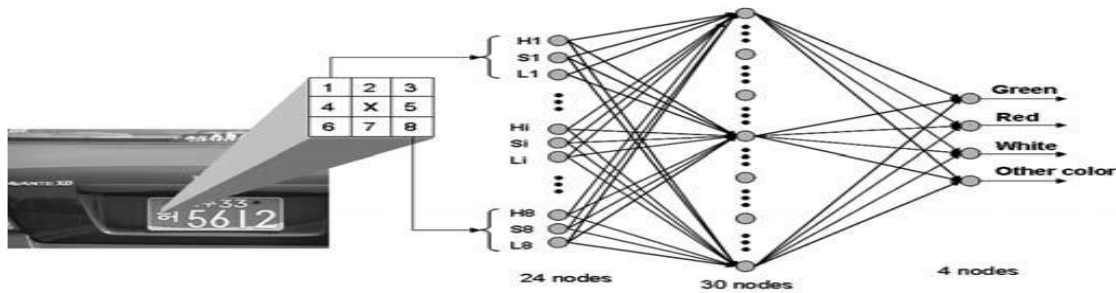


Fig2.1: Image processing procedure

Subset of an image classification is object detection, where particular occurrences of objects are recognized as having a certain class like man, truck, or mobile. To authenticate an image for classification or recognition, neural network provides feature extraction. Groups of pixels of an image, can be image points, edges, etc., are analyze for patterns for the specific case of image recognition. The method of pulling the significant features out from an input picture is says feature extractions, which use for feature analyze. Most of the time images annotation contains information of an image from where network layer find out its related features. An image contains pixel, the first network layer received all the pixel. [8] When all data fed into the layer, then image get various filters, structure represents different parts of an image. Extracting features of an image is adjacent with a “common weighting scheme”, and common weighting scheme represent a part of an image. This concept introduce the term Convolutional Neural Network (CNN) [7].

## **2.5 Related Researches**

Recent years more than 25 countries researchers are trying to invent new Effective method to identify license number of vehicles. The system and methods that researchers follows many procedures used for identify number plate:

1. Find out plate location from vehicle used Region-based mechanism.
2. Used Genetic Algorithm mechanism to find out vehicles number plate.
3. Gray level variation mechanism.
4. Edge detection mechanism combined with texture, moving windows to detect plate location.

Above all the number plate detection method reference above are the major procedure to identify proper location and clear image of a number plate before recognition action.

## **CHAPTER 3 METHODOLOGY**

### **3.1 System Requirement**

This project is compatible with windows 7/8/10. Where minimum operating systems 64-bit, as well as other platforms such as Linux OS X. A 486 / 66 MHz or higher processor. Higher processor with 8 GB RAM for Windows 7 and Windows 8 systems.

### **3.1.0 Software and Hardware Requirements**

#### **Software Requirements:**

- Programming Languages: Python 3.7.4
- Web Technologies: Jupyter Notebook
- Version Control: GitHub Desktop
- Development Tools: Visual Studio, VS Code

#### **Hardware Requirements:**

- RAM: 8GB or more
- Hard Drive: 500 GB
- GPU: 2GB

### **3.1.1 User Requirements**

#### Administrator Aspect:

- Authorized user permission
- A controller (means) computer
- A High Definition Camera
- Proper lighting condition

## 3.2 Proposed Model

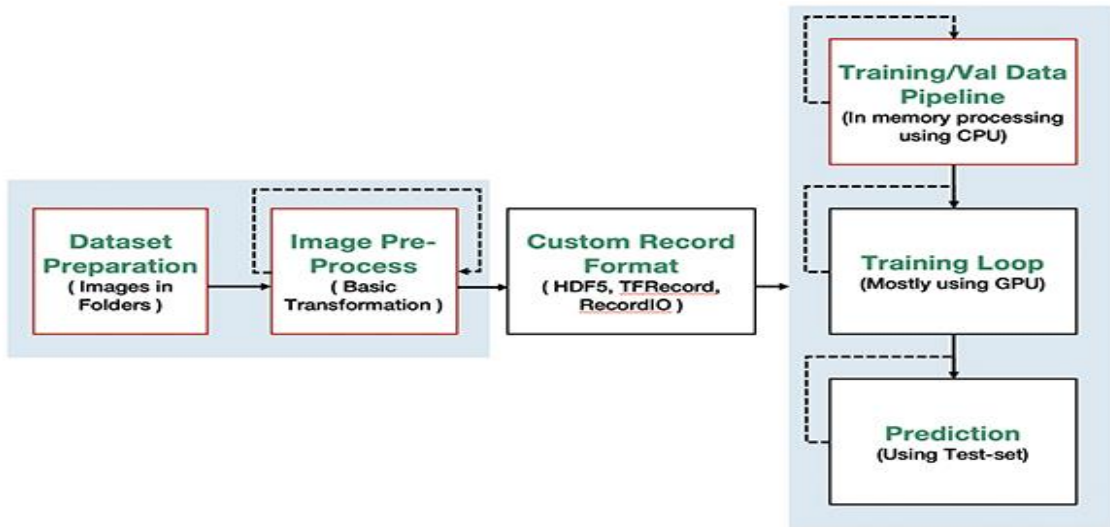


Fig3.1: Model flowchart

### 3.2.1 Tensorflow:

TensorFlow is a free and open-source software library for machine learning [9]. It can be used across a range of tasks but has a particular focus on training and inference of Single Shot multi-box Detector (SSD) algorithm. To implement and construct our 'Automatic Number Plate Recognition' project here also used (SSD).

### 3.2.2 Single Shot multi-box Detector (SSD)

SSD procedure are appropriate for object detection. SSD specially uses convolutional neural networks. For using real time data SSD approach are best to take a data. Convolutional neural network layers are select for construct SSD. To reduce complexity and improve performance this method uses some portion of R-CNN, YOLO V2. Main target of using these feature combination are increasing detecting accuracy, reduce detection time and improve performance. However it is not appropriate to detect tiny

object which situated out of the measuring box. Having multiple layer box has great advantage, it leads to significant results in detection [10].

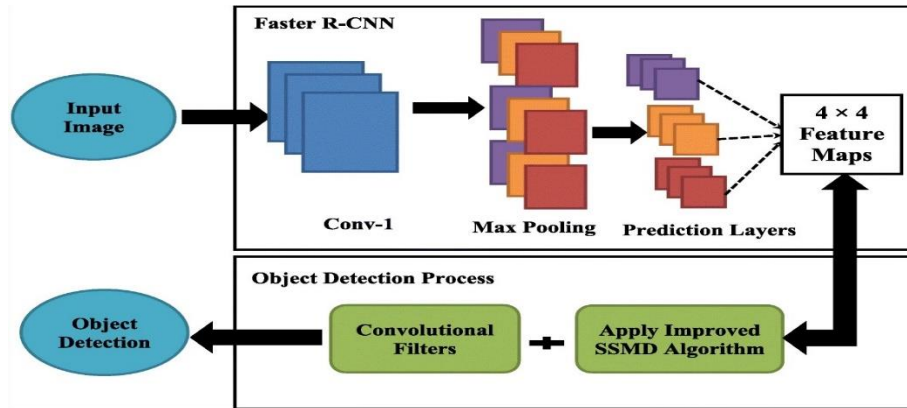


Fig3.2: SSD object detection Procedure

Measuring the accuracy of SSD process is:

$$A_{accuracy} = \frac{Object (O_{correct})}{TotalObject (T_{obj})}$$

Height and weight use to find out aspect ratio. It is represents an image shape. Definite ration is significant in SSD. Here used AR to represent the aspect ratio [11].

$$A_R = \frac{Width\ of\ image}{Height\ of\ image}$$

### 3.3 Data Collection

It's say that, current word trends depends on data. Without data we can't think modern world, because data uses everywhere. Normally data is uses for acquiring knowledge, training, researching, analyzing, finding information, and also used for new invent. In a word data usage is much more. In my project I also used data. Our data type is image, which contains various type of cars with license plate. Without using data it is quite impossible to implement this project. Here I using dataset for machine learning, training, detecting, predicting, identifying, finding accuracy and also getting final result.

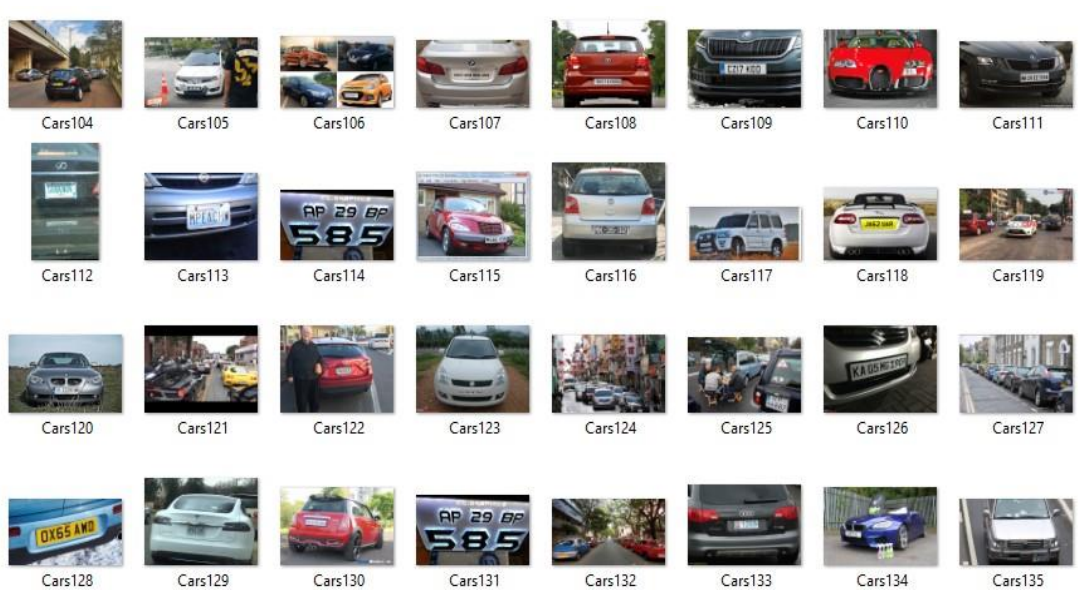


Fig3.3: Sample of dataset

Various kind of Latin American vehicle image uses as data set, where contains 433 image data with 433 annotation data used for Automatic Number Plate Recognition project. Using dataset collect from Kaggle website.



### 3.3.1 Annotation

A machine learning train model uses image datasets which is leveled with various kind of information belongs to image is called annotation. Annotation helps a ML model to increase learning rate with details information which provides best analyzing result and satisfied accuracy.

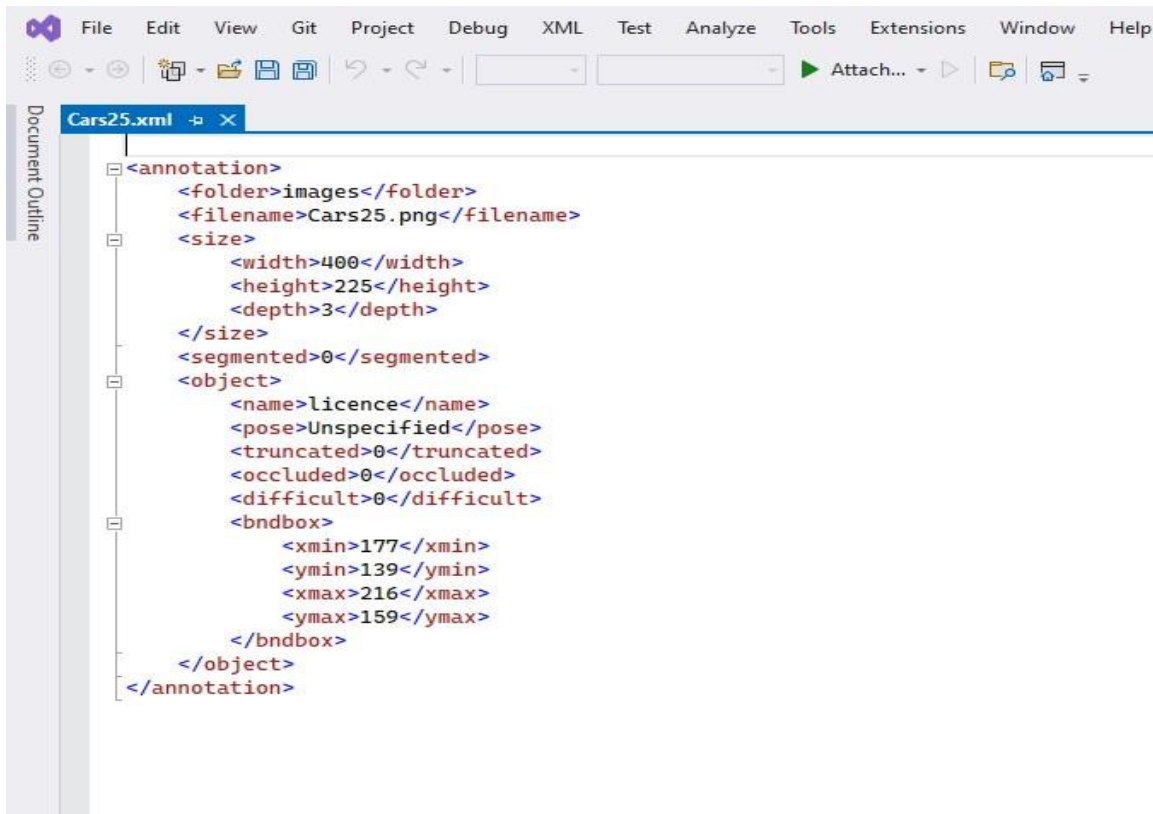


Fig3.4: Sample of annotation

### 3.4 Create Model & Configuration

Download tensorflow model from <https://github.com/nicknochnack/GenerateTFRecord>, to create training records form and configure train model for Machine Learning.

```
# https://www.tensorflow.org/install/source_windows

if os.name=='nt':
    !pip install wget
    import wget

if not os.path.exists(os.path.join(paths['APIMODEL_PATH'], 'research', 'object_detection')):
    !git clone https://github.com/tensorflow/models {paths['APIMODEL_PATH']}

# Install Tensorflow Object Detection
if os.name=='posix':
    !apt-get install protobuf-compiler
    !cd Tensorflow/models/research && protoc object_detection/protos/*.proto --python_out=. && cp object_detection/packages/tf2/s

if os.name=='nt':
    url="https://github.com/protocolbuffers/protobuf/releases/download/v3.15.6/protoc-3.15.6-win64.zip"
    wget.download(url)
    !move protoc-3.15.6-win64.zip {paths['PROTOC_PATH']}
    !cd {paths['PROTOC_PATH']} && tar -xf protoc-3.15.6-win64.zip
    os.environ['PATH'] += os.pathsep + os.path.abspath(os.path.join(paths['PROTOC_PATH'], 'bin'))
    !cd Tensorflow/models/research && protoc object_detection/protos/*.proto --python_out=. && copy object_detection\packages\tf2\
    !cd Tensorflow/models/research/slim && pip install -e .
```

Fig3.5: Creating Model and Configuration

Project over all procedure and workflow depends on a model. When select an exact model for project then it provides best implementation and result. TensorFlow provides multiple levels of abstraction, so we choose best one for this project that is Tensorflow object detection.

### 3.4.1 Train & Evaluate Model

Model training offer professional attempts to fit the most excellent combination of inclination and weights. It make machine learning calculation to decrease loss function over the expectation extend. Loss function capacities optimize the machine learning calculations, by reliance objective, sort of data and calculation. Model prepared to be

approved, experiment, and construct. Execution of the model decides the quality. Extend quality of preparing data and the training calculation are both critical components. It is important parameter in overall our machine learning development cycle [12].

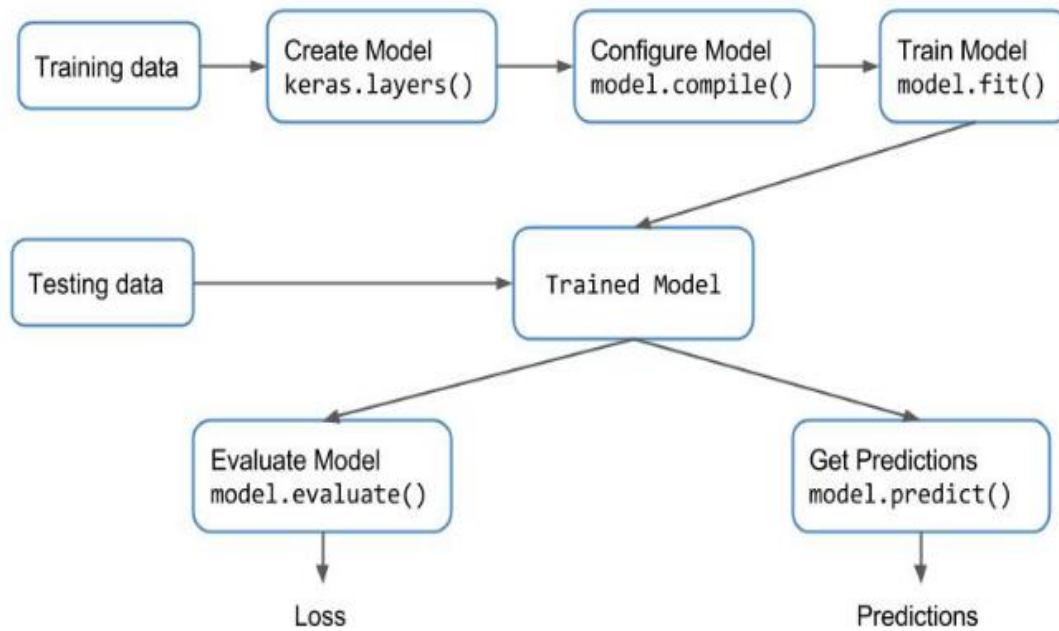


Fig3.6: Model Training Process

### 3.4.1.0 Training

Training model is utilized to prepare an ML calculation. It comprises of the test yield information and the comparing sets of input information that have an impact on the yield. Training model is utilized to run the input data through the calculation to relate the

prepared output against the sample output. When machine learn over about dataset then prediction increased for unseen data.

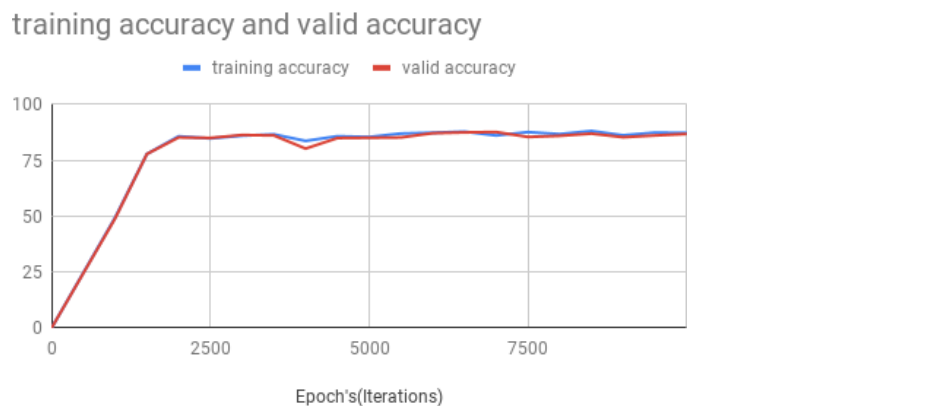
```
TRAINING_SCRIPT = os.path.join(paths['APIMODEL_PATH'], 'research', 'object_detection', 'model_main_tf2.py')

command = "python {} --model_dir={} --pipeline_config_path={} --num_train_steps=10000".format(TRAINING_SCRIPT, paths['CHECKPOINT_

print(command)

python Tensorflow\models\research\object_detection\model_main_tf2.py --model_dir=Tensorflow\workspace\models\my_ssd_mobnet --pi
peline_config_path=Tensorflow\workspace\models\my_ssd_mobnet\pipeline.config --num_train_steps=10000
```

Fig3.7: Model Training script



The grade in the configuration file of object detection are constructed into subsets 100, at steps 10000. The width and height are set to 800 x 600, resize all the input image for proper resolution. Almost training is finish. Stop training by depends on average loss function. Then the learning rate stands at 0.08. If the training is not stopped at minimum loss stage, then average loss function will be increase gradually because of iterations and sometime after will make decrease average loss function. After few iteration and it will continue. Steps are record for every 100 iterations. Iteration can be changed at will when

need. Stop training model when get the Average Precision which indicates model accuracy.

### 3.4.1.1 Evaluate Model

```
: command = "python {} --model_dir={} --pipeline_config_path={} --checkpoint_dir={}".format(TRAINING_SCRIPT, paths['CHECKPOINT_PATH']
<
: print(command)
python Tensorflow\models\research\object_detection\model_main_tf2.py --model_dir=Tensorflow\workspace\models\my_ssd_mobnet --pi
pipeline_config_path=Tensorflow\workspace\models\my_ssd_mobnet\pipeline.config --checkpoint_dir=Tensorflow\workspace\models\my_ss
d_mobnet
```

Fig3.8: Evaluate script

Evaluating the model is similar to training the model. The most intervening distance is the examples come from a separate test set rather than the training set. Completing evaluation and overall training process checkpoint provides future prediction which load from trained data.

## 3.5 Segmentation & Recognition

This project main purpose is identify dynamic condition vehicle's license plate for segmentation and recognition of its character [13].

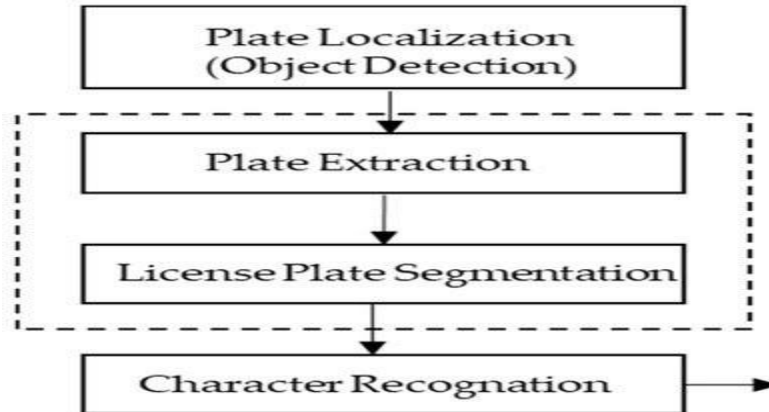


Fig3.9: Character Segmentation & Recognition

### 3.5.0 Segmentation

Segmentation is utilized to discover the separate characters on the number plate. This project, division of characters is performed utilizing the threshold mechanism. It is sectioned by finding the characters within the picture and bounded each character with the rectangle to partition them. [14].



Fig3.10: Character Segmentation

### 3.5.1 Recognition

The most reason of this step is to supply classification and total distinguishing proof to pictures that comprises of the characters gotten from the number plate localized districts. The division of Picture Handling, the method of recognizing characters from advanced pictures is commonly called ‘Optical Character Recognition’ (OCR) and numerous diverse strategies can be utilized for this reason. The OCR computer program is utilized in arrange to change over the portioned characters to the ASCII code. OCR program is brilliantly sufficient to recognize all the characters from latter and number. All the characteristic of characters is analyzed and put away into the database. One of the most elevated score is chosen for recognition result [15].



Fig3.11: License plate character recognition

## CHAPTER 4

### Result & Discussion

#### 4.1 Introduction

Every work and research has a definite result. The result is essential for every type of research and project. So a project also contains the outcome. All of the results in this chapter are presented in the table. This chapter explains the dataset for Automatic Number Plate Recognition System including data collecting and data usage. The results of this thesis based project are separated into two sectors. One is manual data and another is live data. Manual data and dynamic data values are always different. It gives two kinds of accuracy and loss. Here discussed about both kind of results.

#### 4.2 Static Result

In this thesis based project static data result is not main target for detect license plate but it helps to measure manual data result which ensure ANPR project capability to recognize a number plate. Static data is stored in advance, and will be used to retrieve any vehicle's previous records as needed without the presence of a vehicle. Static data result gives a manual pure view of project performance. Below using 20 sample data for manual testing and find out the result of detection, time, accuracy, also recognition and invalid recognition.

Table 4.1: ANPR Manual Result

Actual Data	Detected Data	Time (s)	Detection Accuracy
KL43B 2344	KL43B 2344	03	75%
DL8CX 4850	DLBCX 4850	03	79%
OX65 AWD	OX65 AMD	05	87%
DL7CN 5617	DL7CN 5617	02	86%



MH20CS 9817	MH20CS 9817	04	83%
HR26CK 8571	HR26CK B571	03	86%
MH20EE 7601	MH20EE 7601	03	79%
MH20EE 7598	MH20EE 7598	02	80%
TN37CR 4019	Not Detected	04	73%
MH02BM 5048	MH02BM 5048	04	92%
MH04DW 8351	MH04OW 8351	03	89%
KL25B 2001	KL258 2001	03	78%
MH15BD 8877	MH15BD 8877	02	82%
MH14GN 9839	MH1Z GN 9239	02	87%
KL07CB 8599	FLU7CB 8599	04	77%
TN52U 1580	Not Detected	03	82%
TS08ER 1643	TS08ER 1643	04	82%
HR26DKO830	HR26DKO830	03	85%
MH20BY 3665	HH200Y 3665	03	76%
HR 26 DA 0471	HR 26 DA 0471	04	82%

Table 4.2: ANPR Result frequency of vehicles

<b>Not Detected</b>	<b>Detected</b>	
	90%	
10%	<b>Miss Recognition</b>	<b>Recognition</b>
	20%	70%

In this table 20 data provides small view of Automatic Number Plate Recognition partial result where average 3.2 seconds time need to detect a vehicle for number plate detection and average accuracy is 82%. Data table also provides Not detected number plate and Detected number plate. Where theirs ratio is 10% and 90%. Detected Number plate character segmentation level is 100%, Recognition portion is 70% and Miss Recognition portion is 20%.

### 4.3 Dynamic Result

The ongoing results for this project are the real results, because from the ongoing results we can achieve the desired objective. From the running results we identify the number plate of a vehicle and the data obtained from it is used in our daily work. There are many factors are taken into account in the use of moving data, such as accuracy of detection, timing, accurate data, etc. Ongoing results reveal the actual state of the project and the efficiency of the work. Above all, the performance of the ongoing results shows the acceptability of the project. Here using 30 real time data to find out the result of detection, time, accuracy, localization, segmentation, recognition.

Table 4.3: ANPR Real Time Result

Actual Data	Detected Data	Time (s)	Detection Accuracy
MH 14DT8831	MH 14DT8831	02	81%
HR 26 CT 6702	HR 26 CT 6702	03	83%
HR26 BP3543	HR26 BP3543	04	80%
KA I9/TR -2011	KA I97R ,2011	02	78%
PBO8 CX 2959	PBO8 CX 2959	02	87%
KLO1AX8000	KLO1AX800	02	85%
TN 74AI 507	TN 724I 507	04	76%
MH 14EP 4660	MH 14EP 4660	03	79%

MH 14 ICF 300	MH 14 ICF 300	02	78%
MH12JC2813	MH12JC2813	02	84%
KIO43 GC	KIO43 GC	02	75%
ZG 902-ZG	ZG 902-ZG	02	77%
ZH 247640	ZH 247640	04	83%
H982 FKL	H98Z FKL	03	81%
COVID19	COVID19	02	84%
G526JHD	G526JHD	02	81%
LR33 TEE	LR33 TEE	03	83%
VIPER	VIPER	03	81%
HR26BR9044	HR26BR9044	03	83%
MH 20 EE 7598	MH 20 EE 7598	03	81%
CZI7 KOD	CZI7 KOD	02	75%
KA G5MG 1909	KA G5MG 1907	03	89%
DZI7 YXR	DZIZ YXR	02	84%
PUIB BES	PUI8 BES	03	84%
PGMNI12	PGMNII2	02	77%
MH20CS 1941	MH20CS 1941	03	80%
MH-20 EE 0 45	JIH - 20 EE 0 45	03	81%
HR26DG6167	HR26DG6167	03	75%
MH20DJ0419	HH20DJ0419	04	78%
OX65 AWD	OX65 AWD	02	83%

From testing 30 real time data, we can see vehicle number plate detection average time is 2.5 seconds. It means average project efficiency time is 2.5 seconds.

Table 4.4: ANPR Real Time Result frequency of vehicles

	Correct	Incorrect	Accuracy
Plate Localization	29	01	96.67%
Character Segmentation	30	00	100%
Character Recognition	25	05	83.33%

#### 4.4 Recognition Result

During manual and real time testing result, many character find very close and look like similar. 'A' and '4' is one of them. It may be stated that OCR ignores the left side knee of 'A' while processing the character from left side. So 'A' character shown as 4. Again same case problem happened on 'O' and 'D' character. Due to small differences between left and right side of these two character sometimes it could not recognized because of misidentification. This problem is seen also at 'G' and '6'. Character acknowledgment calculation disregards the bend within the center whereas preparing the character from the up side. Main Cause of this overlooking is this curve's being exceptionally little number plate. Occasionally very nearest results were envisage for 'S' and '5' characters, also for 'C' and 'O', '1' and 'I', '0' and 'O', 'Z' and '7', 'B' and 'D', '2' and 'Z'. OCR couldn't recognize these character nuance difference due to low light, small number plate, unclear character, stylish shape of character. Sometimes the low quality license plate image that is taken from the car due to being influenced by the surrounding environment makes it so difficult to distinguish each character from the other [16].

Table 4.5: Character Recognition Result

Latter	Trial Number	True Recognition	False Recognition	Accuracy
A	09	07	02	77.78%
B	11	09	02	81.81%
C	07	06	01	85.71%
D	08	07	01	87.50%
E	09	09	00	100%
F	09	09	00	100%
G	10	08	02	80.00%
H	12	11	01	91.67%
I	08	06	02	75.00%
J	10	10	00	100%
K	08	08	00	100%
L	09	09	00	100%
M	09	08	01	88.89%
N	11	11	00	100%
O	11	08	03	72.73%
P	09	09	00	100%
Q	12	12	00	100%
R	09	09	00	100%
S	10	08	02	80.00%
T	08	08	00	100%
U	07	07	00	100%
V	09	09	00	100%
W	09	08	01	88.89%
X	12	12	00	100%
Y	08	08	00	100%
Z	11	08	03	72.73%

Table 4.6: Number Recognition Result

Number	Trial Number	Correct Recognition	Incorrect Recognition	Accuracy
0	10	07	03	70.00%
1	12	09	03	75.00%
2	13	11	02	84.61%
3	09	08	01	88.89%
4	11	09	02	81.82%
5	14	12	02	85.71%
6	09	08	01	88.89%
7	08	07	01	87.50%
8	09	08	01	88.89%
9	10	10	00	100%

## **CHAPTER 5**

### **IMPACT ON SOCIETY & SUSTAINABILITY**

#### **5.1 Impact on Society**

If a project has been completed properly, then it can be good impact on society. The impact of the ANPR project has been described in three parts in this chapter. It helps to make our life easier. It influence on society and this project will significantly affect mankind. Then there are ethical considerations. The ethical component of the study was thoroughly examined to comprehend how this initiative can benefit vehicles and the traffic sector of a country. Finally, the project's long-term viability was considered. All in all, it opens the door to how to easily solve the problems caused by our current traffic

jams and illegal vehicles. Based on which we can build an extensive research in the future.

## 5.2 Ethical Aspects

In Bangladesh still traffic police uses manual process to detect a vehicle and its related information. Hope, further it will be remove by this kind of machine learning project. Nothing can be accurately predicted by a machine. It will require some time. When the database has millions of records, the model will be stronger, and it is hoped that it will be able to accurately predict over time. There will come a time when not a single car will be left out of the database and if future Artificial Intelligence and the Internet of Things can be interconnected to a database.

## 5.3 Sustainability

Sustainability of this project is so good. Because modern worlds every work shifting with new technology day by day every sphere of our life. Automatic Number Plate Recognition system has many sustainability quality. It provides traffic control facilities, illegal vehicle detecting facilities and also increase performance and time efficiency. If the technology can be implemented properly then we can provide service easily. Worlds everywhere vehicles increasing with growth of population. As a result its long term use has become inevitable.

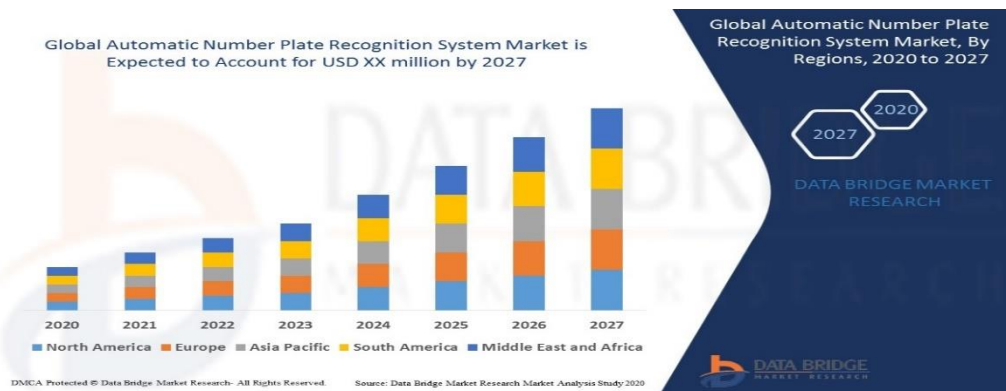


Fig5.1: Future using rate of ANPR system.

This graph indicates the future using rate of ANPR and the sustainability of this project. This report also ensure the market size of ANPR is increasing that will reach in 2027 up to target million USD. [17]

## **CHAPTER 6**

### **Summery & Conclusion**

#### **6.1 Summery of the Study**

First of all, this project main target was detect a vehicle number plate and recognition its character. It is real that ANPR detect vehicle for helping us different way. Primary, here used two types of data. One is dataset and another is real-time data to measure it performance and accuracy. This project implemented with TensorFlow object detection. To implement this project there also some library and dependencies, e.g. pytorch, imutils, easyocr, pillow, keras, OpenCv, numpy, protobuf, pyyaml, etc. Due to low PC configuration and limitation of graphics here used 433 images for training, where 411 data used for train and 22 data used for test. After all we got 82% accuracy from training model.

#### **6.2 Conclusion**

This project is a part of Artificial Intelligence. To implement this project used deep learning and using this technology to detect definite object. TensorFlow is a deep learning object detection API which is programming based implementation model. Further, this project performance can be increased by using more efficient algorithm for image detection and character recognition. Also using high configuration PC and more dataset for training, will provide better accuracy and performance.



## Reference:

[1] <http://www.anpr-international.com/history-of-anpr/>

[2] Sina Ghasempour, Master of Science in Electrical and Electronic Engineering, “Automatic License Plate Recognition (ALPR)” Eastern Mediterranean University, Gazimağusa, North Cyprus, February 2015.

[3] Nadimpalli Lakshmi Manasa, degree of Master of Engineering in Microelectronics and Embedded Systems, “Thai Digit Recognition on License Plates using YoloV3”, Asian Institute of Technology School of Engineering and Technology Thailand, May 2019.

[4] Nadimpalli Lakshmi Manasa, degree of Master of Engineering in Microelectronics and Embedded Systems, “Thai Digit Recognition on License Plates using YoloV3”, Asian Institute of Technology School of Engineering and Technology Thailand, May 2019

[5] Nadimpalli Lakshmi Manasa, degree of Master of Engineering in Microelectronics and Embedded Systems, “Thai Digit Recognition on License Plates using YoloV3”, Asian Institute of Technology School of Engineering and Technology Thailand, May 2019

[6] [https://en.wikipedia.org/wiki/Automatic\\_number-plate\\_recognition](https://en.wikipedia.org/wiki/Automatic_number-plate_recognition)

[7] k-NN classifier in machine learning - Google Search

[8] k-nearest neighbors algorithm - Wikipedia

[9] <https://i1.wp.com/www.adeveloperdiary.com/wp-content/uploads/2019/09/Imagenet-PreProcessing-using-TFRecord-and-Tensorflow-2.0-Data-API-adeveloperdiary.com-1.jpg?resize=600%2C403>

[10] Leticia Fernandez Sanchez, degree of Master of Computational and Software Techniques in Engineering, “Automatic Number Plate Recognition System using machine learning techniques”, Cranfield University, August 2018.

[11] Ashwani Kumar,Zuopeng Justin Zhang and Hongbo Lyu, “Object detection in real time based on improved single shot multi-box detector algorithm”, EURASIP journal on wireless communication and networking, 2020

[12]Google Image Result

[13]Google Image Result

[14]Google Image Result

[15] Amri Bin Mohd Yasin, “Development of Automatic Number Plate Recognition Software and journey time measurement”, Faculty of Engineering University of Malaya Kuala Lumpur, JULY 2012

[16] Kayhan Bora “Carplate Recognition”, Faculty of Computer Engineering of Atilim University, JUNE 2009

[17] [Tunable Laser Market – Global Industry Trends and Forecast to 2028 | Data Bridge Market Research](#)

## Automatic liscence plate

---

### ORIGINALITY REPORT

---

<b>5</b> %	<b>4</b> %	<b>1</b> %	<b>2</b> %
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

---

### PRIMARY SOURCES

---

<b>1</b>	<b>ise.ait.ac.th</b> Internet Source	<b>3</b> %
<b>2</b>	<b>Submitted to University of Hong Kong</b> Student Paper	<b>1</b> %
<b>3</b>	<b>eprints.uthm.edu.my</b> Internet Source	<b>&lt;1</b> %
<b>4</b>	<b>Submitted to Université Internationale de Rabat</b> Student Paper	<b>&lt;1</b> %
<b>5</b>	<b>Submitted to TechKnowledge</b> Student Paper	<b>&lt;1</b> %
<b>6</b>	<b>Submitted to Arab Open University</b> Student Paper	<b>&lt;1</b> %
<b>7</b>	<b>eprints.utem.edu.my</b> Internet Source	<b>&lt;1</b> %
<b>8</b>	<b>docplayer.net</b> Internet Source	<b>&lt;1</b> %

---