

# HIGH LEVEL DESIGN

*Vehicle Number Plate Detection*

Created by **Vikram Singh**

GitHub Profile : [VkasRajpurohit \(github.com\)](https://github.com/VkasRajpurohit)

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## ABSTRACT

The purpose of this HLD (High Level Design) document is to add necessary details to the current project to represent a suitable model for coding. This document will help to detect the contradictions prior to coding and it can also be used as a reference manual for how the modules interact at high level.

HLD uses non-technical to mildly-technical terms which should be understandable to the administrators of the system.

## 1. Problem Statement:

The goal of this project is to build a solution that should be able to get an input as vehicle image and provide the result as extracted number from vehicle number plate.

### 1.1 Overview:

Title : Vehicle Number Plate Detection

Domain : Traffic Surveillance and Security

## 2. Domain Knowledge:

Now a Day's security has become one of the biggest concerns for any organization, and automation of such security is essential. However, many of the current solutions are still not robust in real-world situations, commonly depending on many constraints.

In this project, we will understand how to detect & recognize License number plates using the Python programming language. We will utilize **OpenCV** for this project in order to identify the license number plates and the python **pytesseract** for the characters and digits extraction from the plate. We will build Web App using Flask-API that automatically recognizes the License Number Plate.

- License plate detection and recognition is the technology that uses **computer vision** to detect and recognize a license plate from an input image of a vehicles.

### 2.1 Business Problem:

Automatic vehicle license plate detection and recognition is a key technique in most traffic related applications and is an active research topic in the image processing domain. As a result, different methods, techniques and algorithms have been developed for license plate detection and recognition.

In most countries, they use Arabic and English letters, plus their national logo. Thus, it makes the localization of plate number, the differentiation between Arabic and English letters and logo's object and finally, the recognition of those characters become more challenging research task. The use of the artificial neural network has proved itself beneficial for plate recognition, but it has not been applied for plate detection.

## 3. Product Understanding:

- Trying to build a solution that should recognize many places with uttermost clarity in any circumstances. With a varying distance and colour combination, it should work for any Indian continent.

## 4. Data Requirements:

For the Problem statement, we have collected data from different-different sources i.e. collected by web scraping (didn't got data as expected), then collected data manually by recording & clicking pictures on traffic signal, also a part of dataset collected via open-source data.

## 5. Expected Solution:

- Build a solution that should be able to get an input as vehicle image and provide the result as extracted number from vehicle number plate.

## 6. Formulation of the business problem:

### First Cut Approach

- First of all, we need to **collect data** i.e. image data (vehicle images with number plate), also increase dataset size by **data augmentation** techniques to avoid overfitting problem.
- After data collection, preprocess the dataset, need to **resize** all the images in the same size.
- Now need to do **data annotation**, for labeling we will be using tool i.e. **Labellmg**. Need to labeling manually for each image data.
- After data annotation, we will save this **xml files** & then need to **convert xml to csv**.
- Now for **model training**, we will be using Tensorflow-Keras **Inception-Resnet-V2 Model**.
- Inception-ResNet-v2 is a convolutional neural network that is trained on more than a million images from the ImageNet database. The network is 164 layers deep and can classify images into 1000 object categories, such as keyboard, mouse, pencil, and many animals. As a result, the network has learned rich feature representations for a wide range of images. The Inception-ResNet-v2 was used for the classification task. The architecture of the network is shown in Figure 9 . Inception-Resnet-v2 is formulated based on a combination of the Inception structure and the Residual connection. In the Inception-Resnet block multiple sized convolutional filters are combined by residual connections. The usage of residual connections not only avoids the degradation problem caused by deep structures but also reduces the training time.
- After model training, **save the model** for later use.
- Now **build flask web application & create pipeline**.
- For **number extraction** from number plate, we will be using **TESSERACT OCR**. Tesseract OCR have a python API and it is open source. For this task, we will load our image and convert to array. Crop our bounding box with coordinates of it. We will identify region of interest (ROI).
- Finally, we will deploy the model in productionisation.

## 7. Business Constraints:

- 1) **Time:** Latency is really not a major issue, even a few seconds of the latency is considerable.
- 2) **Accuracy:** Accuracy is a vital constraint too get the accurate number plate.

**Interpretability:** Model should be easy to interpret and user friendly.

## 8. Tools & Technology Requirements:

Tools & Technology : Python | OpenCV | PyTesseract | Tensorflow | Keras | Image Data-Processing | Deep Learning | Flask-API | HTML | Bootstrap | GitHub |

AWS

IDE : PyCharm | Google Colab

## 9. Conclusion:

**Vehicle Number Plate Detection** is a Deep Learning Algorithms based model. For the Problem statement image data collected via the multiple sources i.e. web scrapping /open source data / manual data collection at traffic signal, and built an end-to-end deployment ML model.

User will give an input as vehicle image and provide the **extracted number from vehicle number plate** as result.

----- **End of HLD** -----