VARENDRA UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Varendra University, Rajshahi, Bangladesh

In partial fulfillment of the requirements of Varendra University for the degree of
Bachelor of Science in Computer Science and Engineering

"Vehicle Over Speed Estimation and Automatic Report using AI"

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LATTER OF TRANSMITTAL

January, 2020
To
Dr. Md Shahid Uz Zaman
Head of Department,
Department of Computer Science & Engineering,
Varendra University, Rajshahi.

Subject: Submission of Project on Vehicle Over Speed Estimation and Automatic Report using AI.

Dear Sir,
With due respect, I would like to submit my "Vehicle Over Speed Estimation and Automatic Report using AI" as a part of our BSC program. The report deals with an artificial intelligence base vehicle speed, count, number plate detection, if over speed then send a report with fine system for road accident safety which we will be monitored by engineer through a software. I tried my level best to make report meaningful and informative. I tried to the maximum competence to meet all the dimensions required from this report.

I will be highly obliged for your valuable judgment and acceptance of my project report. It will be my immense earning if you find this report informative and useful.

Sincerely Yours,
.....
Ahamed Imtiaz Rifat
Department of Computer Science & Engineering
Varendra University, Bangladesh.

APPROVAL

The capstone project entitled “Vehicle Over Speed Estimation and Automatic Report using AI” is approved in partial fulfillment of the requirement of the Degree of Bachelor of Science in Computer Science and Engineering on December, 2020 and has been accepted as satisfactory.

Supervisor Signature:

……..

Md. Golam Shahriar
Lecturer (Provisional)
Department of Computer Science and Engineering
Varendra University
Rajshahi, Bangladesh.

DECLARATION

This is my truthful declaration that the Project on Vehicle Over Speed Estimation and Automatic Report using AI project report I have prepared is not a copy of any Vehicle Over Speed Estimation and Automatic Report using AI project report previously made by any other. I also express our honest confirmation in support of the fact that the said Vehicle Over Speed Estimation and Automatic Report using AI project report has neither been used before to fulfill any other course related purpose nor it will be submitted to any other or authority in future.

.....

Ahamed Imtiaz Rifat

Department of Computer Science & Engineering

Varendra University, Bangladesh.

ACKNOWLEDGMENT

First, I am extremely grateful to Almighty God for giving me enough strength and for the health of our health. Secondly, I must express my deepest gratitude to our department for every necessary assistance to make my project possible. I would also like to express my gratitude to all the faculty members who still manage to teach me all the necessary things to get there so far in the engineering sector.

I want to thank my honorable supervisor **Md. Golam Shahriar,** who guided me throughout the project tenure, provided me each and every detail, references and technical helps, without his support, it was really impossible for me to complete my project more successfully.

I extend my gratitude to **Professor Dr. Md Shahid Uz Zaman**, Head of Department of Computer Science & Engineering and also special thanks to **Professor Dr. Khademul Islam Molla**, Coordinator, Department of Computer Science & Engineering, Varendra University for providing me a fruitful suggestion during this journey. I am deeply grateful to my parents for bringing me into this world and to my siblings for keeping a warm family where I grew up.

Finally, I wish to thank all of my friends and well-wishers for their support over the time it's taken to get this done.

Ahamed Imtiaz Rifat

ABSTRACT

This paper presents a system, developed for over-speed detection, number plate detection of the vehicle. For the past few years reducing road accidents and controlling traffic by limiting the speed of vehicles has gained more importance. Most of the methods so far used are RADAR, IR or Laser sensor based speed calculation. All of them are very expensive and also their accuracy is not quite satisfactory. In this paper, a Camera-based Speed Calculation System(CSCS) is employed, CSCS uses image processing techniques and can process video stream in offline mode, CSCS has the ability to determine the speed with good accuracy but at relatively low cost. In this study, the acquired video is pre-processed to remove the redundant information, then foreground information is extracted from the video. After this noise and shadow are removed from the video. Moving vehicles are localized and centroid for them are found out. Speed is calculated with the help of Distance Speed Time formula by counting the number of frames taken by the vehicle to pass through the ROI box. A database in the form of the log file is created which contains vehicle speed, location(vehicle has passed from which CSCS system), time at which this speed was recorded and whether it has crossed the speed limit or not.

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Chapter 1
Introduction

1.1 Overview

We all know that excessive speed is the main cause of road accidents. In this busy schedule of life, people prefer to drive very fast rather than low speed to reach their destination in time so, it is necessary to understand the need for a technology that will be used as a speed limit enforcement system. A system which helps to limit the speed of the vehicles and the owner would be punished under the law due to over speed and this is the best method for making people to drive at normal designated speeds. In some places, traffic policemen are there to monitor to proper functioning of traffic on roads and at some places, traffic places RADAR system is used and this is a technology which is based on the Doppler Effect and with just one trigger it can determines the speed of the vehicles. Every system whether it is a RADAR or any other it manually requires a human to take for watching the vehicles passing by and to report if any vehicle breaks the law or over speeds. Every system uses advancements in technology to prioritize the automation over human handled machines. So, the traffic monitoring system should also be made as automatic which is possible in many ways. This paper is an idea of one of such system. The project is developed by keeping in view all the disadvantages mentioned above and is named as Speed Check and over speed detector. This system mainly focuses on calculating the speed of approaching vehicle that over speeds.

1.2 Why Over Speed Estimation?

Monitoring traffic has become an important task in urban areas, so image processing and computer vision techniques are used to monitor manage and to determine speed of the moving vehicles. These techniques are more efficient compared to present and other techniques in terms of accuracy and processing speed. As the population has increased the vehicles on road is increasing tremendously and hence traffic surveillance systems based on capturing video and processing it to determine the speed has become an important issue to control the accidents and traffic jam problems. The traffic surveillance systems are very useful to monitor and manage various traffic conditions such as traffic management, prevention of accidents and secure transportation. Hence, determining the speed of vehicle has become a challenging task. Traditionally RADAR systems were used for monitoring the speed of vehicles .The major drawback associated with RADAR is its cost and accuracy, the device is quite expensive and is less accurate and the biggest drawback is that a line of sight connection needed between RADAR and the vehicles. So to overcome the limitations in existing methods, various image processing techniques are used. The Gaussian mixture model is one among those techniques which is efficiently used for vehicle detection and vehicle speed estimation.

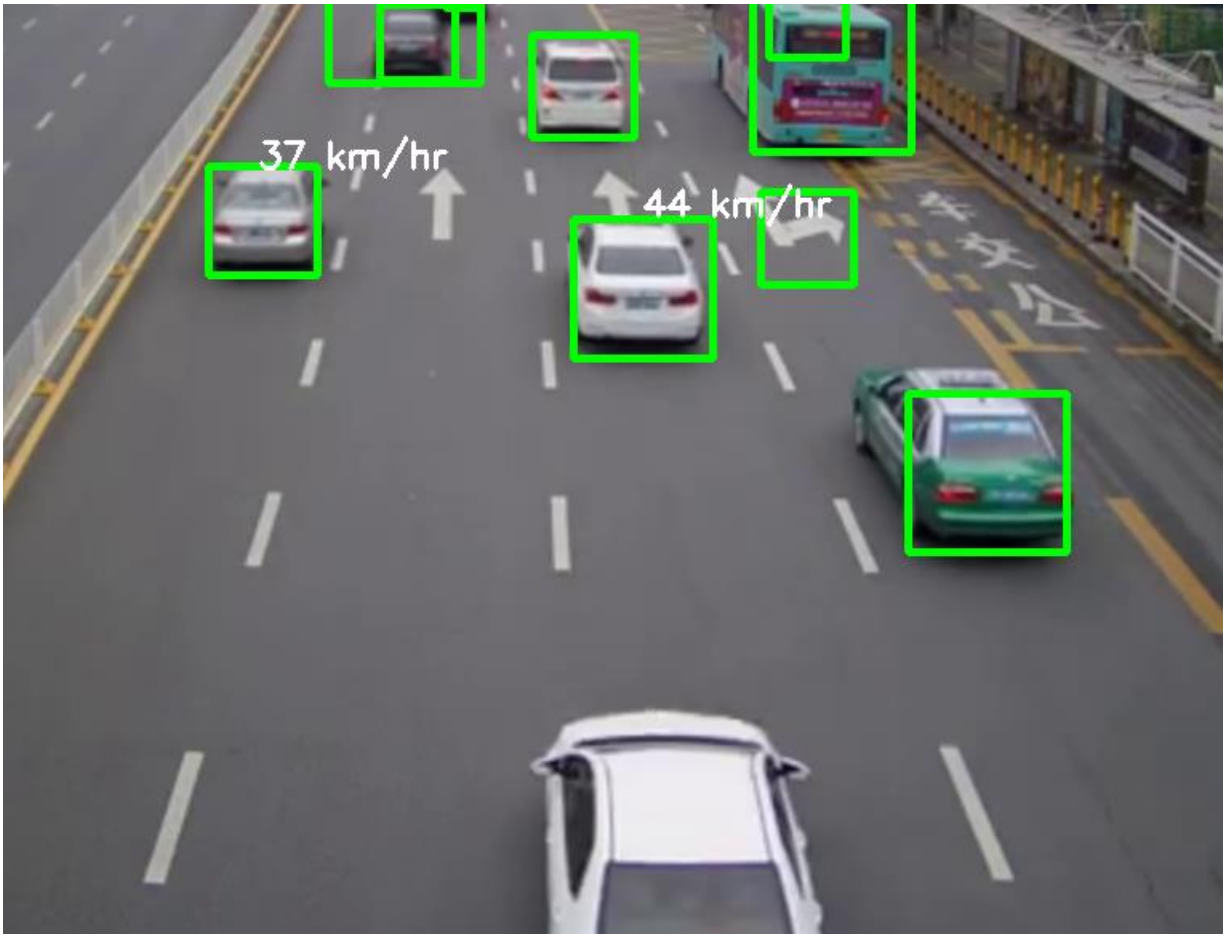

Figure 1.1 Speed Estimation

In urban areas the traffic monitoring cameras are stationary. They will be located above the ground level to get a clear view of vehicles moving on road. The vehicle detection from stationary camera will be much easier as compared to cameras which capture the dynamic change of the vehicles and its surrounding environment. In this paper we are analyzing the videos captured by stationary cameras, and to detect multiple vehicles optical-flow based technique is used. Using this technique multiple images are recognized at different times, optical-flow based technique indirectly detects obstacles by analyzing the velocity field. Object detection techniques can be classified depending on the background subtraction and frame differencing.

1.3 Over Speed Estimation Technology

The future of the environment that we built is now in our hands. Our surroundings are in the wake of a severe transformation through Automation technology. It is the technology by which a process is performed automatically without human assistance. Automation can save time by allowing people to complete their work a lot faster with less effort. The over speed estimation and number plate detection system is also an automation system, which allows faculties to save their time from checking vehicle speed and number plate manually. Speed estimation system is designed for the over speed detection.

Now-a-days, online system like speed estimation are getting popularity in various applications. It is a digital system that test different types of vehicle speed and number plate detection. Now this system works offline. When we put a video in this system the system give you result how many vehicle cross this road, you show the vehicle speed and over speed vehicle number plate for sand a report for over speed.

1.4 How does speed affect traffic collisions and injury?

- The higher the speed of a vehicle, the shorter the time a driver has to stop and avoid a crash. A car travelling at 50 km/h will typically require 13 meters in which to stop, while a car travelling at 40 km/h will stop in less than 8.5 meters.
- An increase in average speed of 1 km/h typically results in a 3% higher risk of a crash involving injury, with a 4–5% increase for crashes that result in fatalities.

- Speed also contributes to the severity of the impact when a collision does occur. For car occupants in a crash with an impact speed of 80 km/h, the likelihood of death is 20 times what it would have been at an impact speed of 30 km/h.

1.5 Motivation

Now-a-days, speed estimation and number plate detection are common and popular technology in the developed country. It's hard for the police to keep track of everything all the time so this system help our traffic police. Many people break the rules and drive fast and it is not possible to catch them but using this system is too easy catch them and punished them. Those who break the rules and flee will be caught and identify. A report with fines will be sent to their homes so for this fines everyone follow the rules. Many accidents can be avoided by using this system. When people follow the rules then they don't drive fast or over speed so number of accidents history decrease. In the busy road, school, college, university, hospital and many important place need to use this system for decreasing accident history. The main purpose of this system is to ensure that no one dies for over speeding in road accidents.

1.6 Objectives

This system helps human and decreasing accident history. This system has the following features:

- It will maintain the safety of human life on the road
- Speed estimation
- Number plate detection
- Count the numbers of vehicle cross the road
- Everyone's rules will be followed so that no fine has to be paid
- Will be caught while fleeing the crime
- It can also be used on the bridge, highway, express highway, school, college, university and hospital for the control of speed.

Chapter 2
Number Plate Detection

2.1 Overview

Number Plate Detection (NPD) is a fairly well explored problem with many successful solutions. However, these solutions are typically tuned towards a particular environment due to the variations in the features of number plates across the world. System for number plate recognition are based on these features and so a universal solution would be difficult to realize as the image analysis techniques that are used to build these systems cannot themselves boast hundred percent accuracy. The focus of this paper is a proposed system that is optimized to work with Ghanaian vehicle number plates. The system, written in Python with the OpenCV library, uses edge detection and Feature Detection techniques combined with mathematical morphology for locating the plate. The Tesseract OCR engine was then used to identify the detected characters on the plate.

2.2 Number Plate Technology

Intelligent Transportation Systems (ITSs) have become commonplace in an attempt to improve the safety, security and mobility on our roads**[1,2].** Number Plate Detection (NPD) is one of the technologies employed in ITSs to identify vehicles by capturing and extracting vehicle registration from their number plates

using image processing techniques. NPD was invented in 1976 by the UK police**[8].**

The NPD process typically involves three stages:

- plate detection
- plate segmentation
- character recognition

The plate detection stage is the most important as a failure at this stage immediately means complete failure of the system. This stage largely depends on certain features that the number plate should have. These features include shape, color, height and width symmetry and spatial frequency. The ability of the system to detect the plate also depends on the conditions (lighting, visibility, image skew and camera quality) in which the image was captured, and the nature of image itself. Most NPD algorithms add a preprocessing stage that involves grayscaling, thresholding and noise removal techniques to prepare the image. The most common method of grayscaling is simple averaging of RGB values in a color pixel.

Ghanaian vehicular number plates are standardised into two main classes:

- 'Long' plates which measure approximately 52cm by 13cm
- 'Square' plates which are 34cm by 17cm in dimension

Figure 2.1 Standard Number plate

Characters on the standard number plates typically begin with a two-word regional, one-letter serial and special code followed by a registration number between 1 and 9999 inclusive as shown in Figure 2.1.

2.3 Motivation

The proposed NPD detected most of the Ghanaian number plates tested with a successful recognition rate of 60% with an average processing time of about 0.2s to complete the entire image capturing to character recognition stage. This system will produce more accurate results upon further training. Now-a-days, speed estimation and number plate detection are common and popular technologies in developed countries. It is so difficult for the police to always deal with every issue that this system helps our traffic police. Many people break the rules and drive fast and it is not possible to catch them but using this system is easy for them to be caught and punished. Using this system detect the vehicle number plate. From number plate find the details of that vehicle so easy to find the owner and punish them. Many accidents can be avoided by using this system. When people follow the rules then they don't drive fast or over speed so number of accidents history decrease. In the busy road, school, college, university, hospital and many important place need to use this system for decreasing accident history. The main purpose of this system is to ensure that no one dies for over speeding in road accidents.

Chapter 3
Background Study

3.1 Overview

While we are discussing vehicle detection, vehicle speed estimation and number plate detection system, (Vehicle Over Speed Estimation and Automatic Report using AI) we will first discuss the similar existing systems of the filed and then gradually move on to our thesis, “Vehicle Speed Estimation Automatic Report using AI”. The concept of “Vehicle Speed Estimation Automatic Report using AI” is a little bit similar to the other traffic control system. An Number Plate Detection (NPD) was invented in 1976 by the UK police**[8]**. After that, there were several companies started providing this kind of traffic control and NDP system of their country.

3.2 Related Work

Related work in over speed detection mainly involves the usage of devices that are not installed inside the vehicles. Pacing [3] is quite a common technique where cops drive behind the vehicle and accelerate until the speed of officer’s vehicle matches the speed of the vehicle of the suspect and until the distance between both the cars is constant. Then by looking at the speedometer, the officer

can determine the target vehicle speed. But this technique is prone to human errors. Many time officers may read the wrong reading or may read the reading while he is accelerating his vehicle.

Another such speed detection system involves the use of a speed gun which is placed in the direction of moving a vehicle and is based on the radio frequency or laser. Radio wave signal [4] is sent and then waiting for it to be reflected by the car. Using the timing of the wave signal, the speed of the vehicle is detected. This involves manual efforts with a person holding the gun.

VASCAR (Visual Average Speed Computer and Recorder) is a small processor that is placed inside the officer's car. An officer passes the vehicle at a very high speed than the speed of the vehicle of the suspect. Officer would be waiting few miles away and by doing some calculations, it's possible to calculate the speed of the suspect's vehicle. This is the type of speed trap.

Many research studies have been conducted in the field of vehicle speed detection. One such technique [5] proposed involving the comparison of the vehicle position between the current frame and the previous frame from video captured with a stationery camera. Another similar technique uses video surveillance system [6]. Frame of the camera covers specific area, then calculates the speed of the car on basis of the time the car was in that area.

Figure 3.1 Speed detection using video surveillance

Moreover, most of the existing solutions need manual efforts or some kind of infrastructure setup. Such systems are either expensive or labor intensive and rely on outdated technology. All the solutions seen so far are based on physical methods and this is because of the limited computation capabilities in the ’90s and 2000s. Recent advances in high-performance computation and artificial intelligence can overcome these drawbacks. This will also ensure that all the over speeding violators are caught and are reported.

3.3 Deep Learning

Artificial intelligence can be defined as a science or engineering of making machines smart and intelligent. Deep Learning is a part of artificial intelligence which primarily deals with the neural networks. Neural networks try to learn from the training data without being programmed explicitly. They have a variety of applications in domains like natural language processing, image processing, object detection, classification, speech recognition, text processing, and summarization, etc.

The basic building block of a neural network is called a neuron. A neuron can be thought as of biological neurons present inside the human brain. The neural network may have millions of the neurons. Each neuron is connected to other neurons by means of edges. They receive inputs from other elements or neurons and then the inputs are multiplied by the weights and result is then transformed by some mathematical function into the output.

Neural networks have one layer of input, multiple hidden layers, and one output layer.

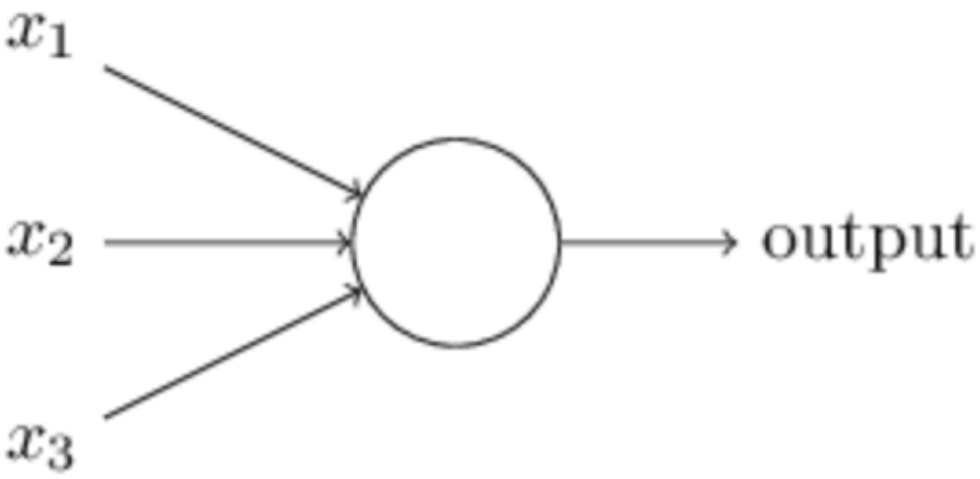

Figure 3.2 Neuron

In the above figure, neuron has 3 inputs but can have more or less inputs. Each input is associated with real numbers called weights.

3.4 Convolution Neural Networks

Convolutional neural networks are inspired by the brain [7]. They have a different architecture than the previously seen fully connected neural networks. All the layers in CNN used for image processing have three dimensions and input and output is 3-dimensional. Unlike fully connected neural network, only some neurons present in a layer are connected to the next layer. They are mainly used in applications related to image classification and recognition.

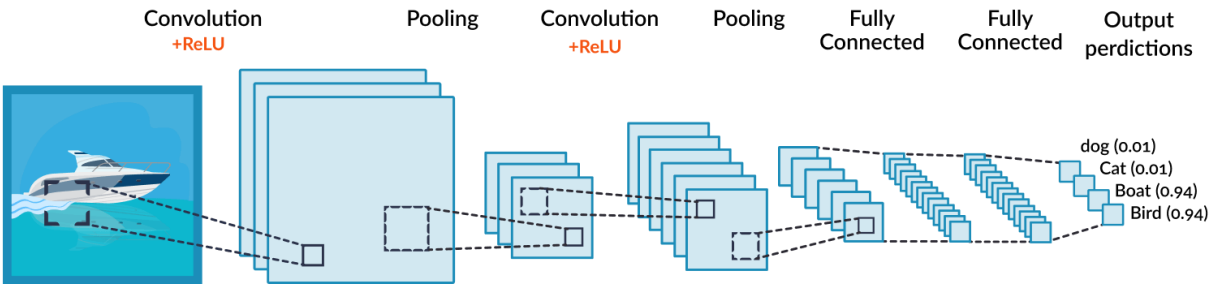

Figure 2.5 Convolutional Neural network

Convolutions are capable of extracting different features from an input image. It preserves the spatial relationship between pixels by learning features using small windows of input data. The motivation behind using CNN over a simple neural network is that they are capable to learn relevant features at different levels which was very similar to the human brain. A filter slides over the input to produce a feature map. Filters are associated with weights. We will get more feature maps if we use more number of filters. During the training phase, CNN learns or adjusts the values of weights.

One of the reasons for using CNN over a simple neural network is weight sharing in the CNN. CNN is more efficient in terms of memory, complexity and, computation. Consider we have 5 filters of size 3x3 in CNN. The number of parameters required would be 3*3*5 = 45 parameters. In case of traditional a neural network, we will require (45*h*w) parameters where h and w and are height and width of the image. Also, it is possible to do transfer learning by using CNN. Transfer learning is a machine learning technique where a model trained for some particular task can be re-used to perform a similar task. This helps in reducing the training costs.

Some of the layers used in CNN:

- **Convolution Layer**: This layer does dot product between the input tensor and weight matrix. The weight matrix is also called as a kernel. A kernel is generally square in shape and is spatially smaller than input tensor. A kernel can be imagined as a cube which has more depth in comparison to other dimensions. Kernel slides over the image and each kernel act as a feature detector.

- **Max pool Layer:** In max pool layer we move the window (size can be 2x2, 3x3, 4x4, etc.) over the image and take maximum value from the window as an output. Max pool reduces the number of parameters. It is down sampling layer which reduces the size of an output.

- **Average pool Layer:** Average pool is very similar to the max pool layer. Instead of taking maximum value from the window, it takes the average of all the values present in the window. It is also a down sampling layer, but it preserves the input information.

- **Up sample Layer:** Up sample is a deconvolution layer which increases the size of output. It uses interpolation techniques like bilinear interpolation to produce the output.

- **Dropout:** Drop out is used to prevent over-fitting. It simply ignores some units during the training. It makes the model more robust but takes more iterations for the model to converge.

- **Gradient Descent:** Gradient descent can be imagined as a ball moving down the hill. The aim is to find the deepest point among all the hills. It can be seen from the picture. Gradient descent measures the change in the weights with respect to change in the difference of actual output and predicted output or error.

Chapter 4
Methodology

4.1 Overview

A methodology of a project is a model of a system's design, technique, planning, procedures, rules, implementation, and achievement. A good design with an organized strategy and methods for a project helps in proper implementation. The system vehicle detection, vehicle speed estimation and number plate detection , (Vehicle Over Speed Estimation and Automatic Report using AI) implemented with a good design and organized methods, which vehicle detection, vehicle speed estimation and number plate detection process work done easily.

4.2 System Design and Architecture

The diagram below explains that firstly, a video is given as input to the system. The given input video is at first preprocessed according to the requirements. From the processed video sample, the vehicle is detected using the filters. After that count how many vehicle cross this road. Then using multiple filter detect the vehicle number plate. After than calculate the vehicle speed if speed cross speed limit than send a report with fine.

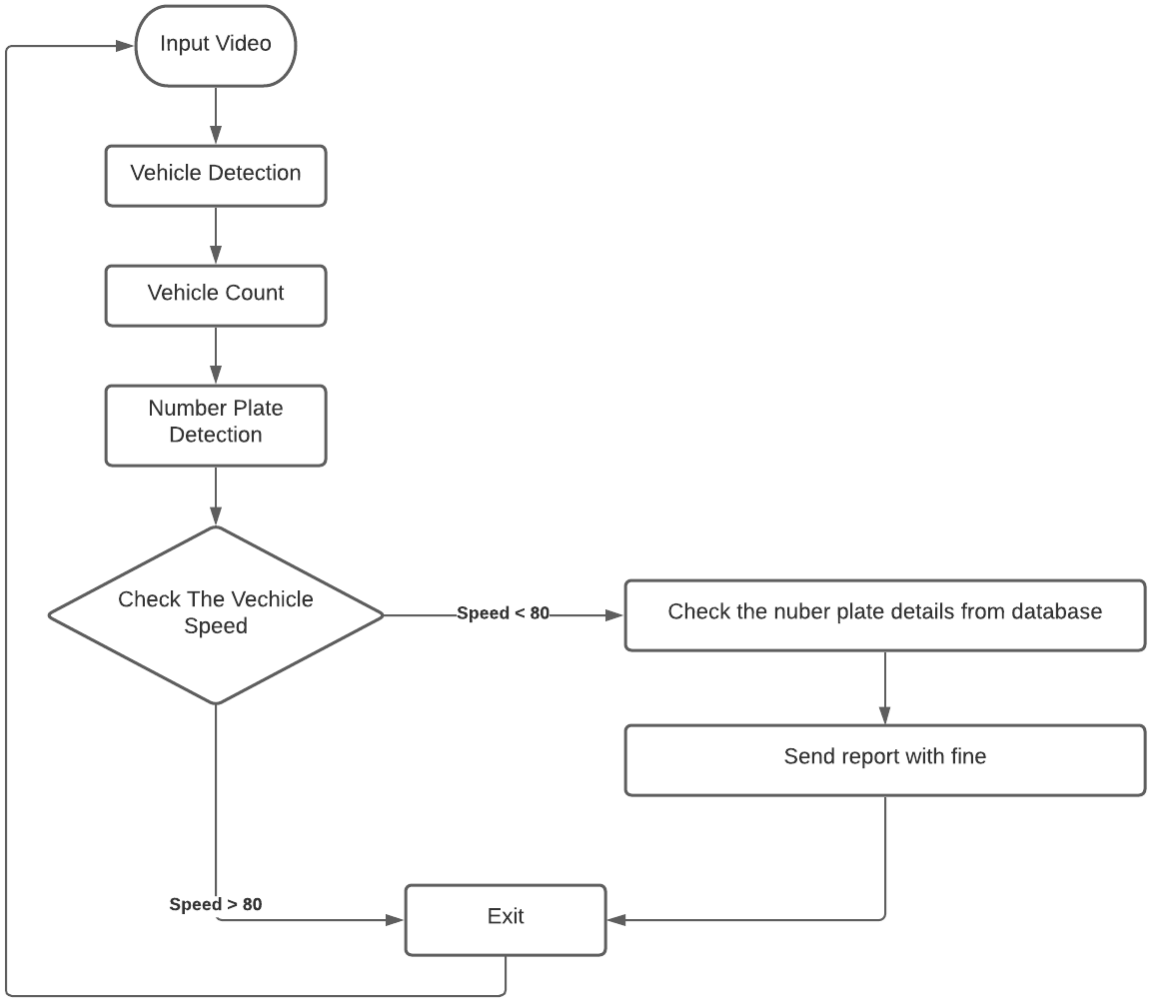

Figure 4.1 Overview of the Entire System

4.3 Vehicle Speed Estimation

This stage consists of introduction to the approach to create vehicle speed detection from a video scene system. In general, the idea of this project is to calculate the vehicle speed from known distance and time when the first vehicle passes the starting point and the time the vehicle finally reaches end point. Below is the flow chart of the vehicle speed detection. It is to provide a deeper

understanding of the details of operation of the vehicle speed detection. Based on flow chart below, the process consists of five major components which are image acquisition, image segmentation, image enhancement, image analysis, and speed calculation.

The following steps are followed to detect the speed of a moving vehicle in a video obtained from a still mounted camera on a road.

- Extract frames from the input video
- Find the foreground image by using Background Subtraction method
- Detect the moving objects by comparing consecutive foreground images and generate a blob object for each moving vehicle.
- Filter out the outside the selected lane or having size outside the selected area range
- Filter out the blobs outside the selected lane or having size outside the selected area range.
- Track the entry and exit frames for each moving vehicle/blob by storing the frame number when the centroid of the blob lies in the entry point detection range and exit point detection range respectively.
- Calculate the number of frames lapsed between the entry and exit points of the moving vehicle.

4.3.1 Object Detection

In this project, the object detection depends on adaptable foundation subtraction procedure called Gaussian blend model. After every pixel is gathered by this model framework, portions of the frontal area focuses are shown by DBSCAN (Density − based spatial social affair of organizations with tumult) gathering technique.

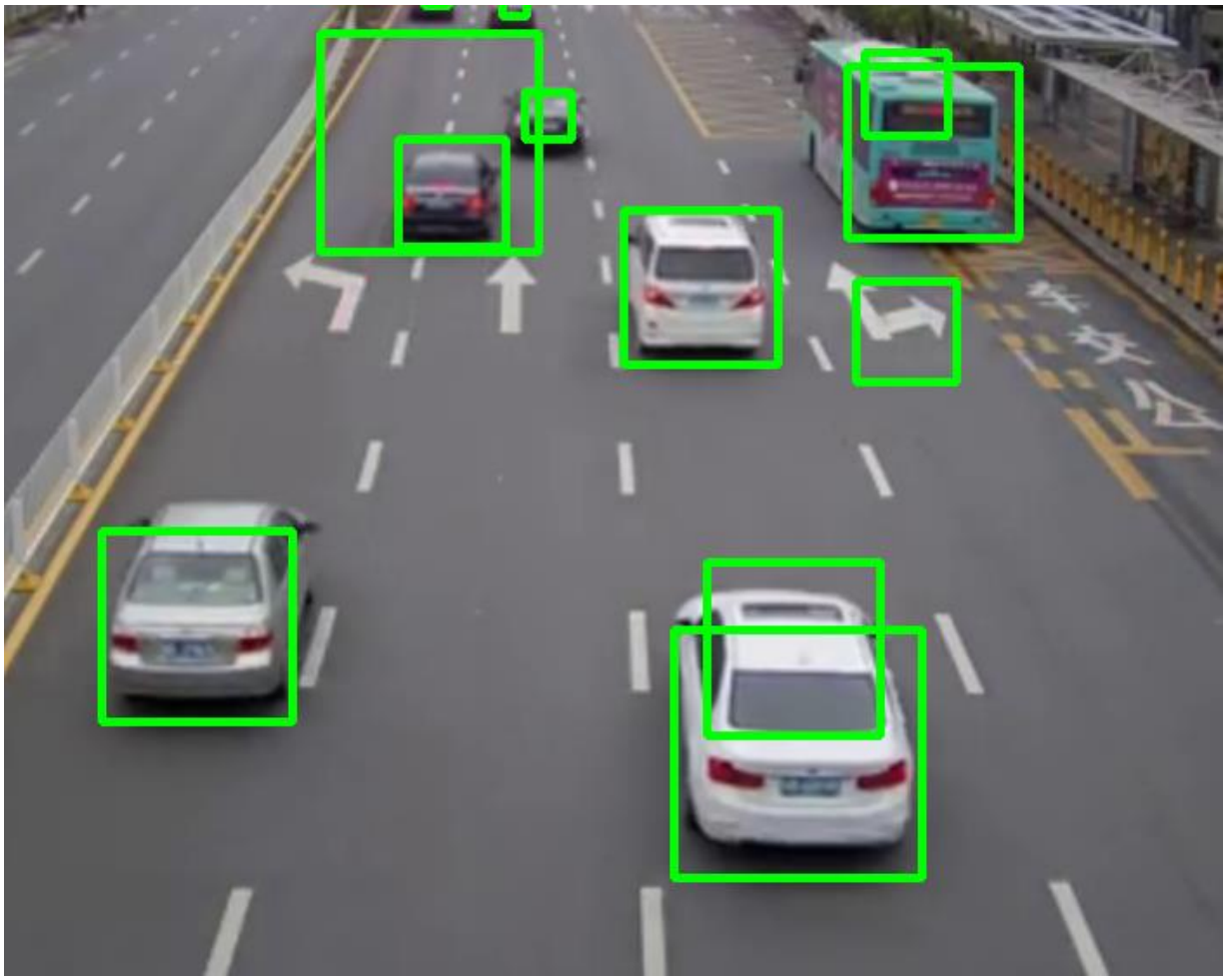

Figure 4.2 Vehicle as Object detection

4.3.2 Gaussian Blend Model

Gaussian blend model which is also called as Gaussian mixture model is a typical structure used in division of moving areas in a picture or a video. This model is a probabilistic model. It expects that the majority of the server farms are passed from a blend of foreordained number of Gaussian streams with cloud parameters. This model is used for representing normally distributed subpopulations with an overall population.

4.4 Number Plate Detection

The proposed NPD system is made up of four block as shown in Figure [4.3]. Our system is capable of using either Edge-detection or Template matching combined to mathematical morphology to extract the number plate from the input image. Character recognition is done by the open source Tesseract OCR engine.

4.4.1 Image Preprocessing

The preprocessing stage prepares the captured image for the whole plate recognition process. It involves reducing the cost of computing the image information. The colored image from the camera is grayscaled using the Luma method employed by OpenCV.

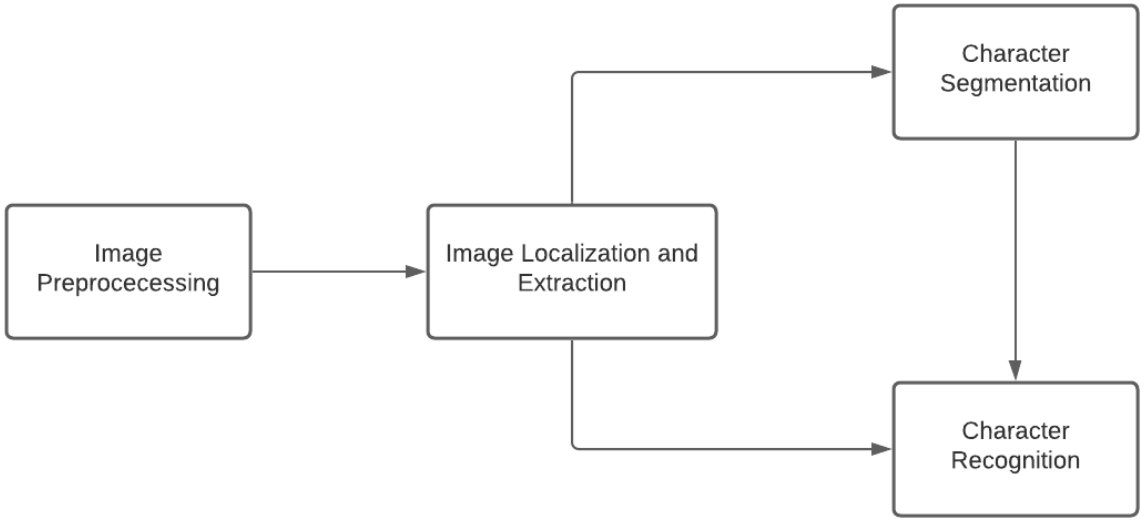

Figure 4.3 Architecture of proposed NPD model

Equation 1 relates each resultant gray image pixel value, Pgray to its corresponding colour image RGB values: Pred, Pgreen, and Pblue.

$$P_{gray} = 0299(P_{red}) + 0{:}587(P_{green}) + 0{:}114(P_{blue}) \ldots\ldots\ldots\ldots\ldots\ldots \text{Equation}(1)$$

A test image and its grayscaled version are shown in Figures [4.4] and [4.5] The gray image was then blurred to remove noise to improve plate localization and detection accuracy.

Figure 4.4 Original sample test image used to test the proposed system

Figure 4.5 Grayscaled image of the original test image.

4.4.2 Plate Localization and Extraction

After the captured image was preconditioned, the second block of our model was applied to identify the number plate and extract it for further processing. The flow chart in Figure [4.4] summarize the processes involve in finding and extracting the plate from the grayscaled image.

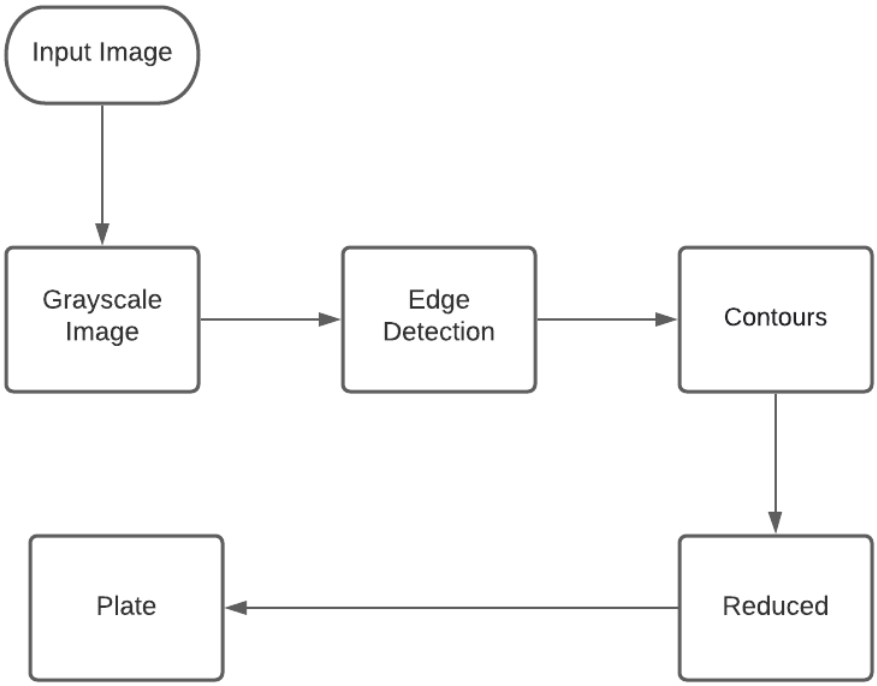

Figure 4.6 Process flow for the plate detection

- Grayscale is a range of monochromatic shades from black to white. Therefore, a grayscale image contains only shades of gray and no color. Many image editing programs allow you to convert a color image to black and white, or grayscale. This process removes all color information, leaving only the luminance of each pixel.

Gray

Figure 4.7 Grayscale Image

- Edge detection includes a variety of mathematical methods that aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed edges. The same problem of finding discontinuities in one-dimensional signals is known as step detection and the problem of finding signal discontinuities over time is known as change detection. Edge detection is a fundamental tool in image processing, machine vision and computer vision, particularly in the areas of feature detection and feature extraction.

Figure 4.8 Edge detection Image

- Contours can be explained simply as a curve joining all the continuous points (along the boundary), having same color or intensity. The contours are a useful tool for shape analysis and object detection and recognition. For better accuracy, use binary images.

Figure 4.9 Contours Image

- In computer graphics and digital imaging, image scaling refers to the resizing of a digital image. When scaling a raster graphics image, a new image with a higher or lower number of pixels must be generated. In the case of decreasing the pixel number (scaling down) this usually results in a visible quality loss.

Figure 4.10 Reduced Image

After doing all the process we get the number plate as a image.

Figure 4.11 Final Output

4.5 Components Used in the System

There are many components will be needed to run the whole system. Some major components of the Vehicle Over Speed Estimation and Automatic Report using AI can be a PC, a database system, camera.

- **PC:** To run the full system. This system is working using Artificial Intelligence (AI) which is neural network so main work done GPU.
- **Database:** To store all the information of the system, a well structured and optimized database system is needed.
- **Camera:** For video record.

4.6 Technology Used in the System

Front end:

- **HTML5:**
    - Html5 is better for semantics and for dynamic elements that are activated
    - using JavaScript. It is much cleaner with the revised DOCTYPE tag.
    - o It is mobile friendly thus it's easier to develop a web site in HTML5 that can be
    - deployed on both desktop and mobile devices.

- **CSS:**
    - Reduces delivery times and costs of future edits.
    - Makes browsing the website faster and enhances the overall user experience.
    - Conserves user bandwidth
    - Speeds up page rendering

Back end:

- **Python 3.6**
    - The performance optimizations in Python 3.6 come through bytecode parsing improvements, faster function calling, and more efficient dictionaries
    - Python scripts are compiled to cached bytecode to speed execution.
- **OpenCV**
    - OpenCV was designed for computational efficiency and with a strong focus on real-time applications.
- **Numpy**
    - NumPy arrays should be smaller memory consumption and better runtime behavior.
    - The more numbers you need to store the better you do.
- **Dlib**
    - Dlib is a modern toolkit containing machine learning algorithms and tools for creating complex software in to solve real world problems. I
    - t is used in both industry and academia in a wide range of domains including robotics, embedded devices, mobile phones, and large high performance computing environments.

- **Time**
    - The time() function returns the number of seconds passed since epoch for Unix system.
- **Threading**
    - Threading in python is used to run multiple threads (tasks, function calls) at the same time.
    - Python threads are used in cases where the execution of a task involves some waiting.

Database:

- **mysql MarriaDB:**
    - MarriaDB is a fork of Mysql and the indexes and database structure are the same as Mysql. Switching from Mysql to MarriaDB without altering main applications is allowed. [10]

[Front end and Database work is the future work]

Operating System:

- Windows 10 Pro

Editor:

- Jupyter Notebook
- Visual Studio 2019

Chapter 5

Demonstration

5.1 Overview

Systems for Vehicle Over Speed Estimation and Automatic Report using AI play an important role in enforcing speed limits. They also provide relevant data for traffic control. Those systems are divided in intrusive and non-intrusive. Intrusive sensors, usually based on inductive loop detectors, are widely used, but have complex installation and maintenance, accelerate asphalt deterioration, and can be damaged by wear and tear. Non-intrusive sensors, which include laser meters and Doppler radars, avoid these problems, but are usually more expensive and require frequent maintenance. As digital cameras become cheaper and able to produce images with higher quality, video-based systems can become a lower cost alternative for non-intrusive speed measurement. In fact, existing systems are often connected to video cameras that record the license plates of vehicles that exceed the speed limit thus, the infrastructure for such systems is already available in most cases.

5.2 Performance Analysis

Analyzing the performance of a system was one of the most important parts upon completion of this project. Only this step could tell us how much we worked and how good our work quality is. I conducted a performance analysis in three

Table-I

Stages	Accuracy	Number of Samples	
		Total	Passed
Detection	96%	1000	960
Extraction	90%	960	864
Segmentation	98%	864	846
Recognition	98%	846	892

Accuracy of this system in various stage

different phases. First on was to test the vehicle detection using OpenCv. The performance accuracy 90%. Second was vehicle number plate detection from image and the performance accuracy 96% and image use from unsplash **[11]**. For number plate recognition I was tested 1000 image from unsplash **[11]**. Finally vehicle speed estimation and the performance accuracy 85%. The performance accuracy is very good compared to other online vehicle detection from video 90% where one of the most popular research of Bangladesh vehicle detection accuracy around 70% to 95%**[9].** This is kind of achievement for me.

5.3 Future Plan

In this system I build vehicle speed estimation from video and find number plate from image. Future plan of Vehicle Over Speed Estimation and Automatic Report using AI this system is find out from video speed estimation, number of vehicle cross the road, vehicle name and model and over speed than find the

details of the number plate and send a report with fine. And all this work done by live video input. After done all the future work this system is the ready for use our country and any develop country. And this system will be one of the best system in our country.

5.4 Discussion

During the implementation of the Vehicle Over Speed Estimation and Automatic Report using AI system, some issues arise that can't be ignored. I have faced some major problems while completing the system implementation. Sometimes compiler stopped working, and sometimes the whole system crashed. But I have successfully completed building the major work of the system and the functionalities are working well so far as we hope at the beginning. We finished major the tasks that were being proposed earlier.

The Vehicle Over Speed Estimation and Automatic Report using AI system provides human road accident security. Using this system control the number of accident history. For over speed is the main reason of road accident. This system saves human life.

We all know testing is important to ensure that the system should not result in any failures and also for an effective performance. So, soon after completing all the tasks, I tested my system in several phases. All the phase I faced some issue but I solved it. For example when I was test speed than input video wasn't work properly. So, I fixed it now its work smoothly. The next testing phase was number

plate recognition in this phase I also found some bugs. The bugs wasn't detection number plate properly. After that, I fixed it now its work smoothly.

Everything was working very perfectly. The system is super-fast. Our system is also running smoothly. Front-end work is the future work but Back-end work smoothly. I got stuck several times, but in the end, I successfully completed it within the timeframe. I implemented all the major proposed functionality in our system and everything is running smoothly.

Chapter 5
Conclusion

This paper addressed the Vehicle Over Speed Estimation and Automatic Report using AI based on videos captured in an urban setting. We proposed a system based on the selection and tracking of distinctive features located within each vehicle's number plate. The system was tested on almost one hours of videos with full-HD quality and 1000 picture with more than 1,000 vehicles in three different road lanes, with associated ground truth speeds obtained by a high precision system based on inductive loop detectors, as well as manually labeled ground truth number plate.

As the number of accidents on the highways increases day by day, the speed of vehicles on the highways needs to be checked so that accidents can be eliminated by controlling the high speed of the vehicles and safe travel can be achieved. It also reduces traffic police department problems and makes it easier to control rash driving on highways. This will not only help maintain traffic rules but also reduce accidents. One person can operate the system efficiently as the circuit is compact and user friendly.

Recognition of license plate characters depends on segmentation, which in turn depends on the good quality clean images. To get clean and good quality images, the plate detection and extraction should be more accurate. We have achieved success for most of the easily readable and clean plate images but the highly slanted plates. The future research in this area should be focused on how to improve plate extraction for skewed or tilted plates in various illuminations and

weather conditions. As we have a limited time to do this project, so we have completed only the most important features. But we can extend our feature in near future. This system will be helpful for our country and other country.

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