SMART TRAFFIC ANALYSIS USING MACHINE LEARNING

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ABSTRACT

Traffic congestion is a major problem in many cities of India along with other countries. Failure of signals, poor law enforcement and bad traffic management has lead to traffic congestion. One of the major problems with Indian cities is that the existing infrastructure cannot be expanded more, and thus the only option available is better management of the traffic. Traffic congestion has a negative impact on economy, the environment and the overall quality of life. Hence it is high time to effectively manage the traffic congestion problem. So here in this paper solution for traffic analysis using machine learning is being proposed where the vehicles will be detected using MRCNN and the traffic signal will be updated according to it also it will notify the time estimation to reach destination. Thus accurate traffic flow information will help users for fast and safe transport.

Keywords: Machine Learning, Traffic Analysis, Android Application, Detection, MRCNN.

I.   INTRODUCTION

A smart city is an urban area that uses different types of electronic data collection sensors to supply information which is used to manage assets and resources efficiently. This includes data collected from citizens, devices, and assets that is processed and analyzed to monitor and manage traffic and transportation systems, power plants, water supply networks, waste management, law enforcement, information systems, schools, libraries, hospitals, and other community services.

The traffic analysis in the smart cities is very often fully automated. So the traffic information has to be provided accurately on the internet for the user purposes. So, smart traffic analysis will play a very major role in the major cities of India and also other countries. There is no definitive explanation of a smart city because of the breadth of the Technologies that can be incorporated into a city in order for it to be considered a smart city.

Smart traffic analysis will help the users in finding the shortest path to the destination without any loss of time. The system that is being developed will help in time of travel of a person and also would help in the safety of that person by avoiding the accident-prone regions health openly. They have fear that anyone will judge them and tease them.

Traffic congestion on road networks is nothing but slower speeds, increased trip time and increased queuing of the vehicles. When the number of vehicles exceeds the capacity of the road, traffic congestion occurs. In the metropolitan cities of India traffic congestion is a major problem. Traffic congestion is caused when the demand exceeds the available road capacity. This is known as saturation. Individual incidents such as accidents or sudden braking of a car in a smooth flow of heavy traffic have rippling effects and cause traffic jams.

There are even severe security problems in traffic system due to anti-social elements which also leads to stagnation of traffic at one place. In country like India, there is an annual loss of Rs 60,000 crores due to congestion (including fuel wastage). Congestion in India has also led to slow speeds of freight vehicles, and increased waiting time at checkpoints and toll plazas.

II.   LITERATURE SURVEY

In the below section we will discuss about the literature survey conducted on this topic based on the previous researches performed in this topic:

1) Paper Name: Machine Learning based traffic congestion prediction in a IoT based.

Advantages: gives a simple, accurate and early prediction of the traffic congestion for a given static road network

Disadvantages: It is used when there is less amount of traffic as traffic increases process becomes tedious and it is not completely machine learning based.

Overcome: Instead of using RFID will be using video analysis.

2)   Paper Name: Smart Traffic management system.

Advantages: Machine learning is used to update signals.

Disadvantages: It useful in case of traffic signal as traffic will be properly routed but traffic prevention is not there as well as it has High implementation cost and also Iot is used.

Overcome: Notification to end user.

3) Paper Name: Smart Traffic Analysis using Machine Learning.

Advantages: The behavioral and roadway accident patterns can be useful to develop traffic safety control policies. **Disadvantages:** It does not use real time information, accidents are random occurrences and the Random forest algorithm provides accuracy only up to 87%.

Overcome: By increasing accuracy and using Real time traffic information.

4) Paper Name: Road Accident Prediction using Machine Learning Algorithm.

Advantages: Accidents can be detected.

Disadvantages: Requires huge training dataset still accuracy not that good.

Overcome: Increasing accuracy incase of climate change.

III.   MOTIVATION

India is a country of huge population. The Road traffic in all cities of India is of greater concern. There is always a long wait for the people on the roads of the cities. India is among the top countries with large traffic index in the world and, it is also 5th among the traffic index rankings of 2021. With high time index and also the C02 (Carbon dioxide) percent among all the cities. So our main motivation was to provide an user with better experience of travelling through vehicles. Also to reduce some of the traffic congestion issues and detecting the accidents caused by it.

IV.   METHODOLOGY

For this project, we have created various modules for optimizing traffic problems. The data which we have used is in the image form. Further, using MRCNN has been used for vehicle detection on roads. In our traffic analysis using machine learning, we will have three modules that are updating traffic signals, for which firstly we will do the vehicle detection first, after that we will use a switching algorithm which will set the green signal timer according to traffic density returned by the vehicle detection module, and updates the red signal timers of other signals accordingly. It also switches between the signals cyclically according to the timers. These timers are set based on the count of Vehicles of each class received information from the vehicle detection module and several other factors, such as the number of lanes, average speed of each class of vehicle, etc. After that, a simulation module comes into the picture where using the Pygame library will simulate the traffic signals and vehicles moving across a traffic intersection. Then the second module is notifying the nearby drivers in which an android application is created where a user needs to enter the source. And destination after clicking on submitting, the user will be notified about the estimated time to reach the destination through data traffic monitoring. The application is connected to a firebase database and the database is connected to a traffic signal module through which will calculate the estimated time to reach the destination. After that, there is a vehicle accident detection module in which an MRCNN model has been used to detect an accident of a vehicle depression test, eating disorder test, etc. Then according to your test it shows the result. It also suggest therapist near your area.
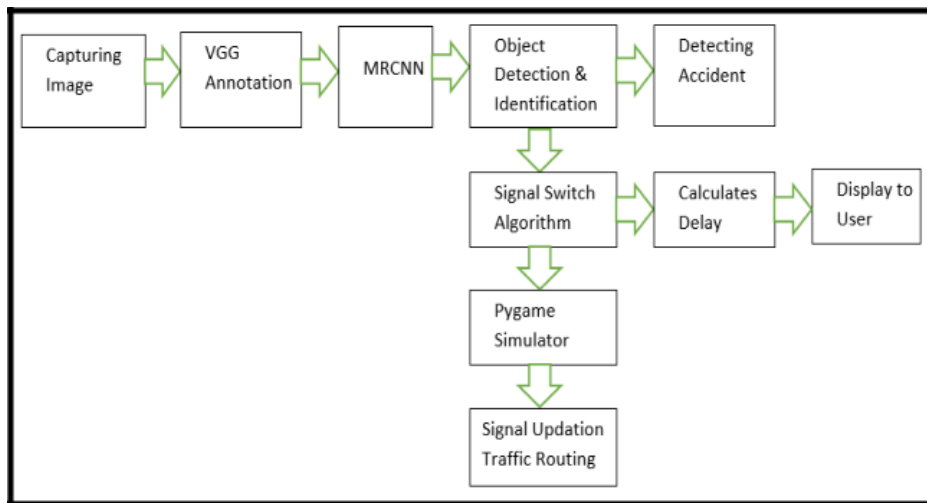
V. SYSTEM DESIGN

Fig 1: System design of Smart Traffic Analysis

1) Capturing Image:

Various Image dataset has been gathered from different sources and from coco dataset. It is gathered altogether for further process extraction of it.

2) VGG Annotation:

VGG Image Annotator is a simple and standalone manual annotation software for image, audio and video through which we had converted various images into different shapes present so that it can be used to identify for next process.

3) MRCNN:

MRCNN is a deep convolutional neural network which can perform image classfication as well as object detection. MRCNN is divided into two parts one is Region proposal network to proposes candidate object bounding boxes and another is Binary mask classifier to generate mask for every class it.

4) Object Detection and Identification:

Through MRCNN we had detected the object i.e the car for traffic analysis as well as for accidents and had identified it for futher process. With this kind we can identify and count objects accurately.

5) Detecting Accidents:

In this module it detects and identifies the accidents of vehicles with its class type and accuracy of the model.

6) Signal Switching Algorithm:

This algorithm updates the red, green, and yellow times of all signals. These timers are set bases on the count of vehicles of each class received from the vehicle detection module and several other factors such as the number of lanes, average speed of each class of vehicle, etc.

7) Calculate Delay:

The Delay is calculated with the help signal siwtching algorithm traffic analysis so that it can show the user estimated time to reach the destination.

8) Display to User:

After user had given the input for destination it will calculate the dealy which is been calculated using Signal switch algorithm and after clicking on submit an estimated time required will be popped up to the user to reach the destination from the user's current location.

9) Pygame Simulator:

It is the library which is used to simulate the traffic signal and vehicles moving across different paths and intersection through which the realtime traffic signal updation it uses the signal switching algorithm for smooth processing of the signal update.

10) Signal Updation Traffic Routing:

The signal is updated using the signal switching algorithm and the traffic routing is done accordingly. This is simulated on Pygame simulator through it simulates the vehicles, traffic signals and real time moving of vehicles with ream time updating signal according to the tarffic congestion.

VI.   RESULTS & ANALYSIS

The main aim of this project is to optimize the traffic analysis and better user experience. The results of the project are as follows:

- Traffic signal updating module comes with a good accuracy in which it will detect the vehicles and then using signal switching algorithm it updates the signal and timers and results the output in the form of simulation where there are four lanes and four traffic signals with timers on it and updates the signal accordingly.

- The notifying nearby driver's module results in the form of application where an user's current location is detected automatically and then the user needs to enter the destination after clicking on submit button it shows the result of estimated time required to reach the destination according to the current traffic situation.

- In detecting accidents module it identifies the accidents of vehicles with good accuracy.

Fig 2: Results of Accident Detection using mask rcnn
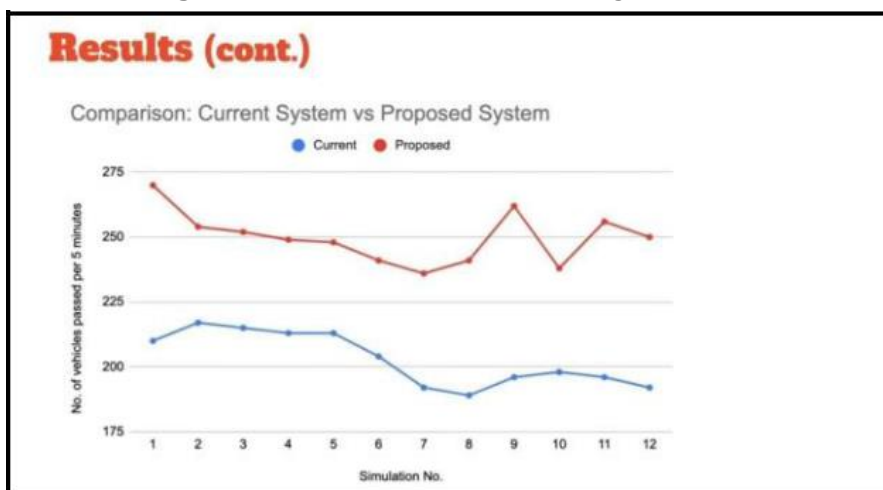
Fig 3: Line graph of traffic signal updation

VII.   CONCLUSION

The main idea behind this project was not only to analyze the traffic but also to update the traffic signals as well as notify to the user by calculating duration and time of source and destination. And the training model in this regard will help in analyzing the traffic by implementing updation of traffic signal. The main reason behind choosing the signal switching algorithm was because of analyzing the traffic and updating the signal according to it.. I would like to conclude by saying the need for using the Machine Learning for this project. It is because the analysis is being performed on random data the Machine learning Algorithms will help in training the model for new data which basically means for learning.

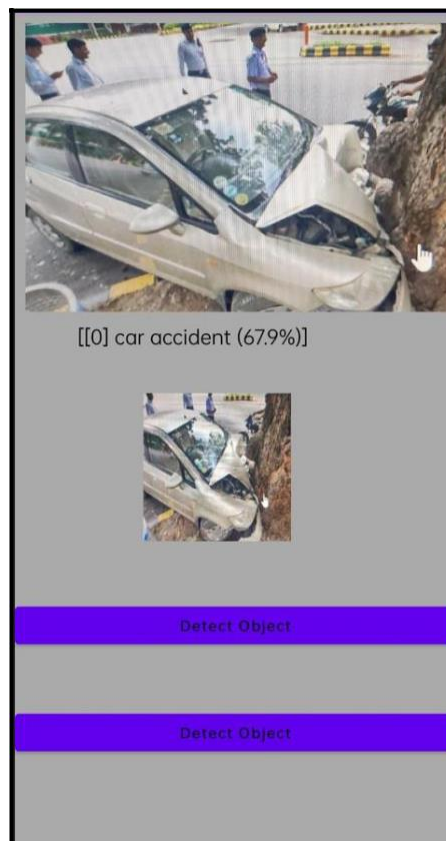**Fig 4:** Simulation of traffic signal updation

Fig 5: Accident Detection Android Application

VIII.   REFERENCES

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