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Traffic Signal Management System

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Abstract: - *India is home to the world's second-largest road network. The Indian Road networks have a total length of 5.4 millionkilometres! As a result, it serves as a big deadline for the Indian government to supply immaculate roads at all times. Driving in Indian streets is a nuisance that no one wants to go through, whether they are an ordinary or millennial Indian. Poor road quality owing to high traffic is one of the most common traffic issues. - Because of the heavy usage of private vehicles, metropolitan roads are extremely congested, resulting in a decline in road quality. Most of the time, this results in constant traffic congestion. Noise pollution and air pollution, particularly in urban areas- Other health-harming difficulties, including as air and sound pollution, arise as a result of the sheer size of traffic problems. As a result, the suggested system is a solutionthat dynamically controls traffic depending on several critical criteria such as time of day, road condition, and so on. The technique allows for an equitable distribution of traffic congestion around the area.*

Keywords: - Traffic, Jam Factor, Dynamic Traffic Control, Machine Learning, etc.

I. INTRODUCTION

Due to a rise in the number of vehicles on the road and a growing population, traffic congestion is becoming more and more of a problem. Noise and air pollution are caused by poor road quality and excessive wait times for road signals, resulting in mayhem. The primary objective for doing this project was to contribute to the country's traffic congestion problem by eliminating unnecessary signal waiting times. Due to the randomness in the traffic density pattern throughout the day, the current traffic control system (TCS)in India's major cities is inefficient. The traffic signal timers move traffic between directions for a set amount of time. Asa result, even when traffic density is low, vehicles must wait for significant periods of time. The problem of traffic congestion can be decreased to a substantially lower degree if the traffic signal timing (TST) can be configured to manipulate with the continuously shifting traffic density. Thefollowing are some of the most common traffic issues:

1) Poor road quality as a result of heavy traffic
2) Noise and air pollution, particularly in cities

Existing systems use image processing to construct traffic control systems, in which images of traffic are recorded using cameras and sensors stationed at specific traffic destinations. The problem with current systems is that complex backgrounds should be removed from real photographs before they are entered into the CNN model. When adopting real images in the future, simple image- processing skills will be able to accommodate this process. We presented a system that uses an algorithm to dynamicallycontrol traffic depending on several critical criteria such as time of day, climate, road condition, and so on. The goal of our technology is to eliminate the need for an imageprocessing system and to enable traffic congestion to be distributed equally throughout the area by dynamically managing traffic. Previous research on traffic management systems has relied on image processing and sensors to handlethe problem, raising doubts about the system's viability. Wefeel that an algorithm could be employed to address this problem.

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II. LITERATURE SURVEY

Smart Traffic Control System using Image Processing [1]

The Smart traffic control system handled traffic using imageprocessing based adaptive signal controlling. The main aim in designing and developing of the Smart Traffic Signal Simulator is to reduce the waiting time of each lane of the cars and also to maximize the total number of cars that can cross an intersection given the mathematical function to calculate the waiting time. The system worked by detecting the entering objects to the scene, and tracking them throughout the video. The input to the algorithm is the raw video data of a site.

Adaptive Signal Control using Reinforcement Learning [2]

The Adaptive signal control system were implemented usingdeep learning and reinforcement learning algorithm (RL). Instead of a real traffic operation, the present study utilized Vissim, a commercial traffic simulator, as an environment.[1] A real intersection located in Seoul, Korea was chosen as a test-bed for the simulation. that showed botha real photo and an animation image of the test-bed. It statedthat complex backgrounds should be eliminated from real photos prior to being inputted for the CNN model. Simple image- processing skills can accommodate this process whenadopting real photos in the future. The algorithm was trainedfor 20,000 simulation seconds (= about 5 hours 30 minutes)for each episode. There were 50 episodes simulated fortraining the model. Thus, the total simulation time was tantamount to 1,000,000 seconds.

Locality Constraint Distance Metric Learning for Traffic Congestion Detection [3]

LCDM, a locality constraint distance metric learning is proposed for traffic congestion detection. First of all, an accurate and unified definition of congestion is proposed andthe congestion level analysis is treated as a regression problem in the paper. Based on that definition, a dataset consists of 20 different scenes is constructed for the first timesince the existing dataset is not diverse for real applications.[3] To characterize the congestion level in different scenes, the low-level texture feature and kernel regression is utilized todetect traffic congestion level. To reduce the influence among different scenes, a LocalityConstraint Distance Metric Learning (LCML) which ensured the local smoothness and preserved the correlations betweensamples is proposed. The extensive experiments con-firm the effectiveness of the proposed method.

Smart Traffic Control System Using Image Processing [4]

The system works by detecting the entering objects to the scene, and tracking them throughout the video. The input tothe algorithm is the raw video data of a site. The algorithm then performs the following steps: First, a statistical background model of the scene is populated using the first few frames of the video. This background model collects thestatistics of the background of the recorded scene such as road, trees, buildings, etc. This model is then used to distinguish the objects of interest (vehicles) from the surroundings. In the next step, the detected foreground partsof the scene are grouped together by a neighbourhood analysis, and a filtering process is applied to remove noise and misdetections. The objects of interest obtained at the endof this step are then tracked throughout the video until they leave the scene.

Real Time Traffic Management Using Machine Learning [5]

The congestion of vehicles on the road is increasing day by day and also the management of such large traffic by traditional approach isn't adequate enough. In today's scenario the traditional approach works efficiently only if thecount is sparse, as the density of vehicles on a particular sideof road increases or if the traffic is comparatively larger on one side than other side in such case the approach fails. Hence, we aim to redesign the traffic signal system that is static switching to signal switching, which can perform real-time signal monitoring and handling. So, in this project the

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switching time of signal will be decided based on real time image detection with good accuracy in dense traffic. This practice can prove its most effectiveness in releasing the congested traffic at an efficient and faster rate.

III. Proposed System

When a large volume of traffic or a modular split creates a demand for space greater than the available road limit, traffic blockage occurs; this point is sometimes referred to as immersion. There are a variety of explicit factors that createor aggravate clogging; the majority of them reduce or increase the number of vehicles required for a particular volume of people or goods at a specific point or over a specific length of time. In order to distribute traffic equitablyaround the junction, our traffic signal management system will use a machine learning algorithm. After logging into theportal, the user will enter the name of the road junction, andthe system will return the coordinates for that junction. Real-time data will be returned. The system will allocate traffic inthe most efficient manner possible, taking into account traffic congestion. As a result, our approach solves the problems that image processing and sensor-based systemshave.

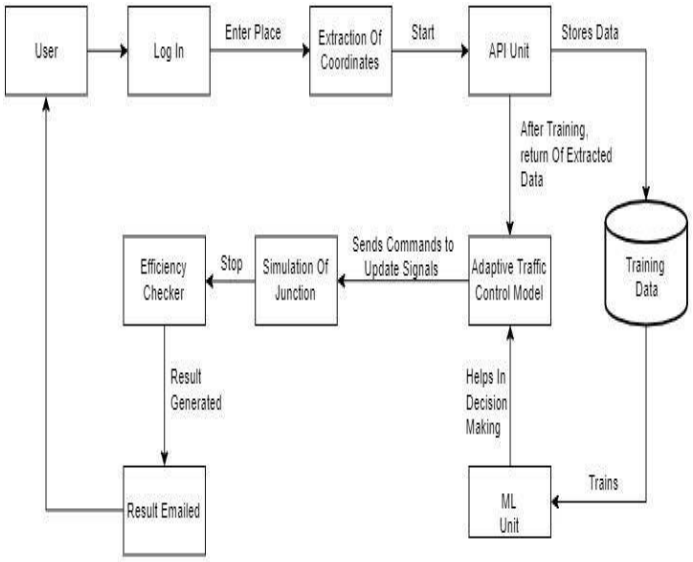

Figure: Proposed System

Algorithm:

Naive Bayes Algorithm

- For our system, we'll use the Naive Bayes algorithm. We first extract data from HERE Maps API[4], which gives us with traffic density data in JSON or XML format, in order toachieve our goals and objectives. We obtain information on the traffic on the road, including the average speed of any automobile on the road, the length of the road, the maximumspeed of any vehicle on the road, and the jam factor (traffic density) on that stretch of road.
- The first thing we did was set up our environment for collecting data from the API and saving it in the database. We pre-processed the data during collection, storing only theattributes that were required for the model's implementation.We went so far as to sanitize the data to remove any inconsistencies, such as zero values.
- We preprocessed the data according to our project's specifications in order to use it as input to our machine learning unit. The data was passed into the Machine Learning Unit, where we utilized the sci-kit learn libraries to train andsave our model, which we will use later during the traffic simulation.

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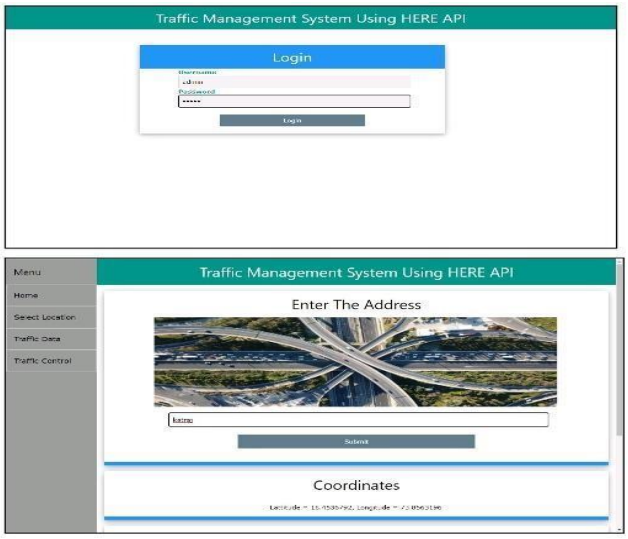
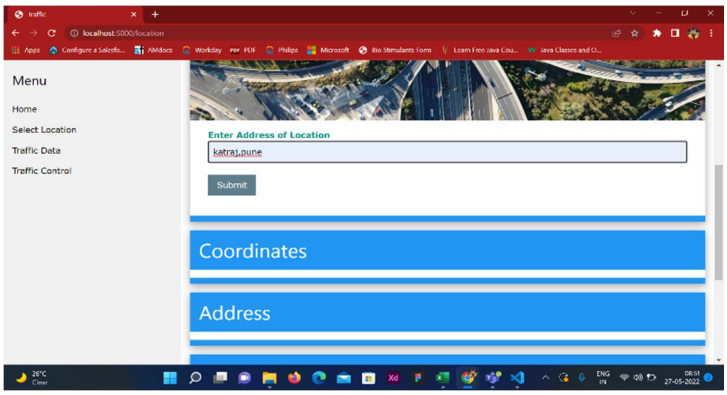
- When we receive the output from our ML unit, we take intoaccount a variety of scenarios. We are evaluating numerous alternatives in our simulation model since we are contemplating a junction of four highways and its subsequentconnected roads. The direction of traffic flow when there is a green light, i.e. left, right, or forward, is one of the many alternatives.
- Our main goal is to dynamically manage traffic lights basedon current traffic density and historical traffic density statistics. The road with the highest jam factor (traffic density) will be considered first among the roads we'vestudied.
- The time for a specific activity, such as a red light or a greenlight, will be determined by a number of factors, the most important of which is the jam factor. We will compare our simulated values with real-time values collected from the API to determine the efficiency of our system and whether or not we were able to alleviate traffic congestion on the roadways using our simulated model. We'll calculate the difference between these two numbers, which will be reported as a percentage

IV. RESULT





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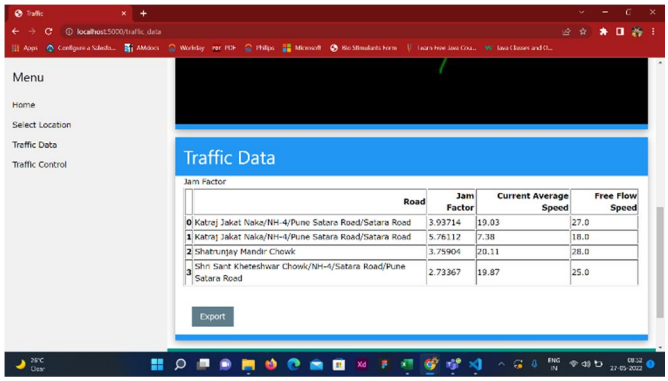

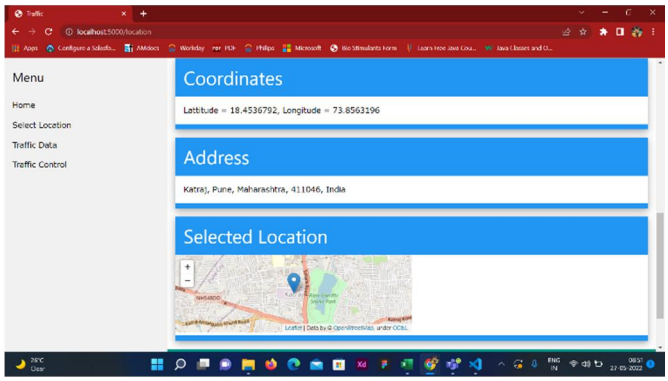

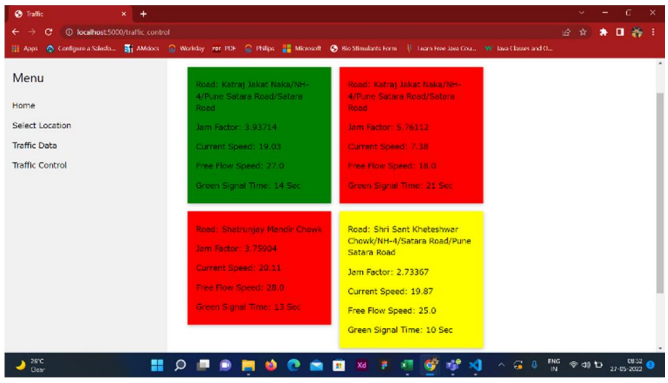

V. CONCLUSION

As a result, our primary goal is to effectively control traffic flags based on current traffic density and remembered traffic density esteems. The street with the highest noticeable jam factor (traffic density) will be shown first, and the jam factor will be reduced in our recreation run depending on theestimated usual speed of any vehicle on that specific street and the traffic on the following street. The amount of time allotted for a specific activity, such as a red or green light, will be determined by a variety of factors, mostly the jam factor. As a result, with the increase in traffic in our daily lives, the need to monitor it has become a must. Our conceptprovides an ideal solution for intersections at top events as well as varied events. We proposed a solution to avoid trafficcongestion in this project by eliminating the traditional picture processing technique used by previous frameworks and using strong traffic light control.

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