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Research Article

Speed prediction system for reducing the time and fuel consumption using Adaptive Traffic Light Timer Control(ATLTC)

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Abstract: Traffic on roads had been a big problem since the automotive vehicles were launched to the market. Their main objective was for long distance travelling but now a days it became an essential part in our lives. Which in turn raised to many problems. This work presents a detailed overview of how we were able to reduce the effects of traffic that are time delay, fuel consumption air, pollution and sound pollution. Even though there are many ways to control traffic we are still unable to resolve problems due to heavy traffic. We are introducing new system which will be able to reduce the effects of traffic. We will be accomplishing this idea with the usage of Adaptive Traffic Light Timer Control (ATLTC), navigation system.

Keywords: ATLTC, Speed prediction, Traffic light control**.**

1. Introduction

Traffic has become a most common and serious problem in Todays day to day life. Due to increase in population and need for travel traffic has increased. So, weuse traffic signalsto control the traffic but so far, the effectiveness of the traffic signals is very less. Because of that many problems have raised, the waiting time in the traffic signals has been increasing drastically over years now. Since the vehicles must stay on for longer period it burns more fuel and which inturn increase the air pollution. Sometimes the traffic may not clear in time and people get frustrated and starts to blow horn which increases sound pollution. There are many reasons how people are getting affected by the traffic, by addressing all the problems we need to find a solution for the traffic on roads.

The solution which is proposed in this project is that by using Adaptive Traffic Light Timer Control (ATLTC) which works by taking pictures of vehicles at traffic signal and converting it into a binary image using MATLAB commands, comparing the input value with the threshold value and deciding that how much time is required for the traffic to clear and it is affected in the form of green and yellow signal timings. Once the signal timing is acquired the actual work starts here. These signal timings are generated based upon the no of vehicles that are present at the signal, so more the vehicles,more the green light timing "ON" with comparison to other green lights at the signal.

Now a person enters his current and destination locations, receives a route map in which a person will proceed in the given directions he/she counters many traffic signals and person has to cross all the signals in this travelling way without stopping the vehicle. We are going to design a software which tells at what speed the user should go so has to cross all the signals without stopping and this is achieved by Speed Prediction System.

2. Relatedworks

[1] In 2016 the "Development of an intelligent traffic control system using NI LabVIEW" was published *by Princess Dianne L. Delica, Maria Rowena U. Landicho, Jaybee Ann A. Tabigaa, Lahlee R. Virtus,* this paper proposesmeasurement of the traffic density by counting the no. of vehicles in each lane and calculate the time of traffic light.

[2] In 2017 the "Adaptive Traffic Lights through Traffic Density Calculation on Road Pattern" was published

by Billie Pratama, Josua Christanto, Muhammad Taris Hadyantama and Abdul Muis. This paper proposes an algorithm to calculate traffic density on road pattern to control traffic timings based on it.

[3] In 2018 "Urban Road Network Traffic Volume Prediction Based on Road Section Speed" was published by Yijun Miao and Liying Wei. This paper proposes an idea for predicting road network traffic flow, establishes a speed-flow relationship model.

[4] In 2018 "Research on Traffic Speed Prediction by Temporal Clustering Analysis and Convolutional Neural Network With Deformable Kernels" was published by GUOJIANG SHEN, CHAOHUAN CHEN , QIHONG PAN, SI SHEN, AND ZHI LIU. In this paper, a method called TCA-DCNN for traffic speed prediction is proposed. By combining differential evolution algorithm (DE) and hierarchical clustering (HC), TCA obtains several data clusters that contain consistent traffic speed variation pattern.

[5] In 2019 the "Neuro – Fuzzy Based Adaptive Traffic Light Management system" was published by Usha Mittal and Priyanka Chawla. In this paper, proposed neuro-fuzzy based adaptive systemcan take decisions depending upon the traffic situations on the current lane and its adjacent lane. Proposed system has been compared with fuzzy inference system and fixed timer-based system.

[6] In 2019 "Redundancy-Reducing and Holiday Speed Prediction Based on Highway Traffic Speed Data" was published by ZHIGANG, XIAOWEI YANG, JIANHUI ZHANG, HUIJUAN LU, RUICHAO XU, and WENJIE DIA. In this paper, present the Redundant Data Reducing(RDR) and Segment Prediction Algorithm (SPM) algorithms for the traffic speed prediction of holidays respectively.

[7] In 2019 "Traffic Speed Prediction Under Non-Recurrent Congestion: Based on LSTM Method and BeiDou Navigation Satellite System Data" was published byJiandong Zhao, Yuan Gao, Zhiming Bai and Shuhan Lu and Hao Wang.In this paper Location-based vehicle sensor data (LB-VSD) from BeiDou Navigation Satellite System Data is used to predict travel speed in congestion traffic conditions.

[8] In 2020 "Real-time video monitoring of vehicular traffic and adaptive signal change using Raspberry Pi" was published by Ayushi Gupta, Dr.Charu Gandhi, Vartika Katara, Stuti Brar. In this paper Raspberry Pi is used for hardware implementation and to perform image processing.

3. Design

Firstly, in this paper we determine the green signal time, and it is achieved by ATLTC. Firstly, a camera will capture the image of the current vehicles at the signal. There are many methods to convert the input image to binary by MATLAB that is by converting it into grayscale and then filtering out to remove the low-density areas, such as birds, banners, streetlights a filter is required for optimized results. Other way is by using Canny Edge Detector is one of the most popular method. The image is processed by Contrast Limited Adaptive Histogram Equalization equation. This method makes the contrast difference adjusted adaptively so that it can be used to reduce the noise that exists when poor performance camera is used or the effect of taking picture at night. Bilateral filtering is an image screening technique that performs smoothing process while maintaining the structure of the image (edge). In other words, bilateral filtering is used to perform edge-preserving smoothing on the image.Bilateral filtering is used to perform edgesmoothing on the image. In this paper, bilateral filtering is used to remove noise. Binary thresholding is the last process to detect the traffic congestion. The main purpose of this process is to separate the vehicles with the background. Binary threeshold changes the image to binary or black-and-white image so it can be known which region includes the object and background of the image clearly. The intensity of the traffic can be determined by the ratio of black and white pixels based on that we will be able to determine the green light timings.

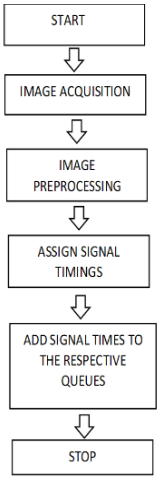


Fig.1. Flow Diagram of ATLTC

After the green light timings are determined, those values are added to the queues of the respective signals which are created in the start of the process these queues are generally small sized because of the randomness of the traffic, these queues will further help in the determination of speed which is required to travel.

The next step is the actual start of the paper, here in fig.2 we are going to design an application which will predict the speed to travel for the trip. The user enters the start address and the destination address. Once the start and destination addresses are determined next step is to get navigation details of the journey and it can be obtained from google API's (i.e., Direction API and Distance Matrix API) which on sending request of start and destination address returns JSON (JavaScript Object Notation) file figure which contains most accurate navigation information. After receiving the navigation details next step is to acquire the green light timings queue that is obtained by ATLTC as shown in the fig.1. Trip starts and the speed is calculated by the basic speed to distance time formula (3.1). Trip ends when the destination arrives.

4. Implementation

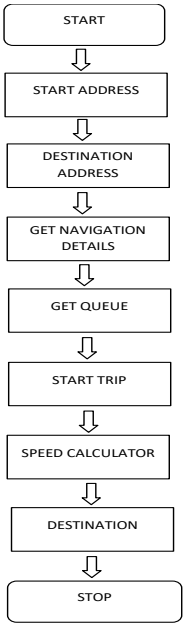


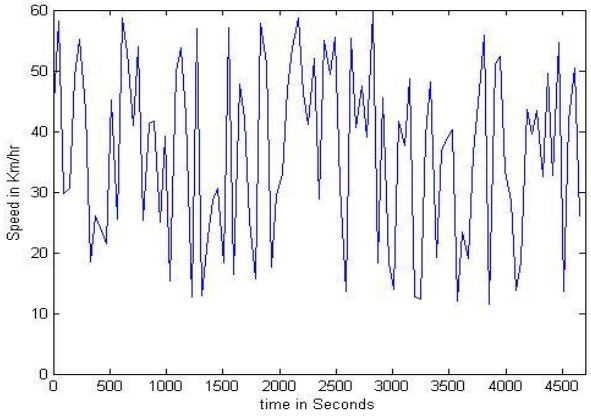
Fig.2. Flow Diagram for speed prediction

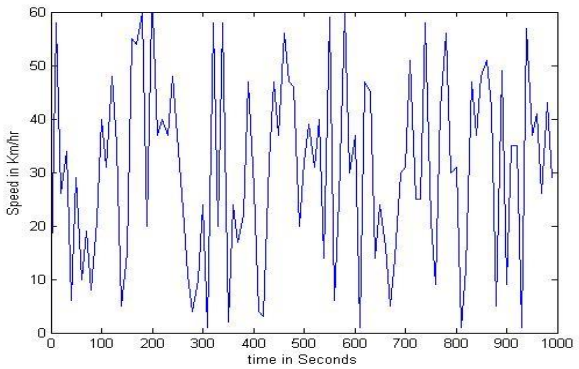
$$Speed = \frac{Distance}{Time}$$

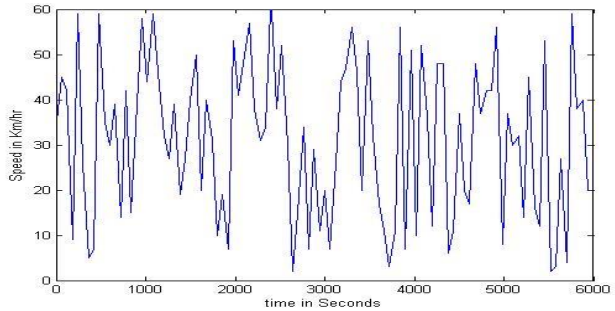
SUMO Configurations

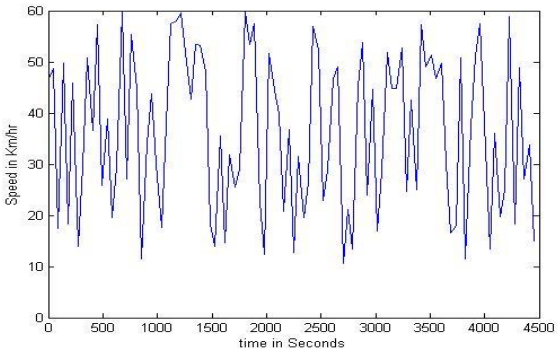
SUMO is the simulation itself; it is a microscopic and time-discrete traffic flow simulation.
Purpose**:** Simulates a defined scenario
System: portable (Linux/Windows is Programming Language**:** C++ teston command line
Input (mandatory):
A) a road network as generated via net convert or net generate, see Building Networks
B) a set of routes (as generated by dua router, jtr router, df router, or activity gen, see also definition of vehicles, vehicle types, routes).
Output: SUMO allows to generate a wide set of outputs including random route files ; visualization is done using sumo-gui.

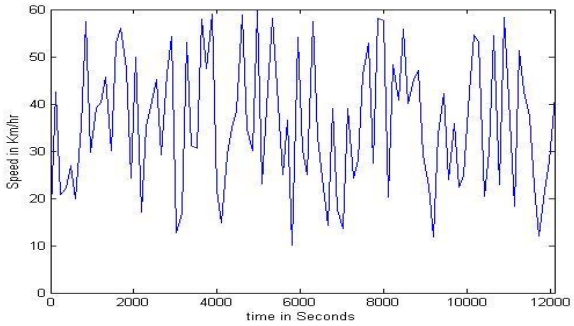
5. Results and discussion

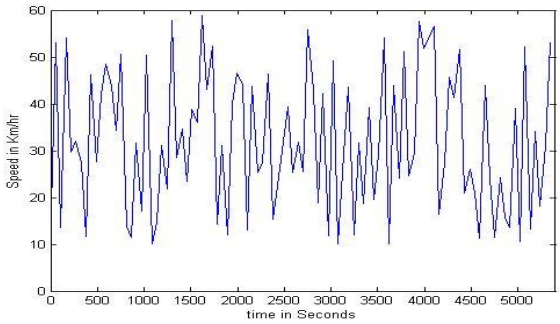







Speed in Km/hr
time in Seconds
0
10
20
30
40
50
60
0
500
1000
1500
2000
2500
3000
3500
4000
4500





All the above images are the graphicalrepresentation of the output speed values that have been generated at the time of sumo stimulation of a random trips.

6. Conclusion

In this article, we have proposed an algorithm that mainly focuses on reducing fuel and time. Security and privacy issues can be reduced. Thus, in this paper we have briefly discussed about how a user can reduce time and fuel without waiting in the signals and have a peaceful journey through out his trip.

7. Futureenhancements

The concept which is discussed in this paper can be used as an inbuilt software for auto polite cars. Wherein we give the speed and destination location by which there would be no accidents or difficulty in making sudden decision by the auto polite and it would be efficient.

The paper can be further updated using google API's instead of stimulator to get better location coordinates, directions, and accurate speed values based on traffic in real time situation.

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