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A Review on Autonomous Traffic Lights Control System

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ABSTRACT: In the proposed Autonomous Traffic Lights Control System, Image Processing techniques are used for detection of traffic and classification. For developing this system we have created a simulation system in Unity 3D Game Engine. In the simulation system we have created road junctions with traffic lights and cameras pointing in the direction of each approaching road. The data from video frames captured by each camera is used to identify and classify vehicles into different categories for extracting parameters for a learning algorithm which is used to control the duration of traffic lights. The proposed system, once implemented should be able to reduce traffic congestion by optimising the traffic light timings.

KEYWORDS: Computing Methodologies, Artificial Intelligence, Learning, Image Processing and Computer Vision, Simulation and Modelling.

I. INTRODUCTION

Mobile Traffic congestion is a problem in many modern cities around the world. To solve this high density traffic problem, we are developing an Autonomous Traffic lights Control System which will be based on learning algorithms which use image processing. This system can solve these problems by continuously sensing and adjusting the timing of traffic lights according to the actual traffic approaching at any junction. This system uses image processing techniques to detect vehicles, calculate the actual time required for each vehicle to clear the junction and compute signal timing for the next traffic lights cycle at that particular junction. Traffic Light timings can be optimised using vehicular data and statistics at the signal. The purpose of this research is to optimise the traffic lights timings such that, all the vehicles should have minimum waiting time to avoid traffic congestion based on vehicle classification data, number of vehicles currently at the junction and the time required per vehicle for clearing the junction in the past.

II. RELATED WORK

In [1] the author explains a system that estimates the size of traffic on highways by using image processing and as a result a message is shown to inform the number of cars on highway. It aims to prevent heavy traffic on highways. At first, film of highway is captured by a camera. Then, the film comes in the form of consecutive frames and each frame is compared with the first frame. After that, the number of cars on highways is specified. At the end, if the number of cars is more than a threshold, a message is shown to inform the traffic status. By this message it can predict the need to reduce the size of traffic carried.

In [2] authors have carried out a number of experiments and their results of vehicle flows are discussed in order to test the feasibility of the developed system. Several advantages and features are discussed in successfully implementing the developed system in order to reduce traffic jam in big cities and towns as well as other necessary places.

In [3] authors present a method for traffic signal control including simultaneously signal plan design and signal timing optimisation with real-time information. The problem is formulated so as to find the signal plan design, the green and inter-green time for each signal group in response to recurrent traffic flow demand at an intersection. The

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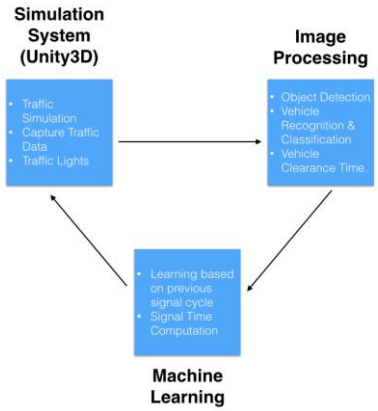
signal plan design selection was formulated to minimise the total delay. The resulting algorithm allows an automatic change of the signal settings at an isolated signal control intersection.

III. PROPOSED SYSTEM

In the proposed research, the traffic simulation system is implemented in Unity3D game engine. This simulation system consists of five junctions as shown in figure 2. Each junction has four approaching roads and traffic lights. In this system there are 12 source and destinations points marked by green and orange circles respectively. The vehicles instantiate at the source points randomly at regular intervals and start moving towards a randomly chosen destinations. There are four cameras at every junction, one facing towards each approaching road. These cameras capture images of the oncoming traffic and pass the frame data to the image processing algorithm for further computations. The image processing algorithm detects objects and vehicles from the frames and classifies the vehicles into predefined categories. After classification, it also gives the count of vehicles in every category. This data is then passed to a function for extraction of parameters for further computation. These parameters are then passed to the proposed signal timing



prediction algorithm which in turn predicts the signal timing for the next signal cycle and returns this data to the simulation system for traffic light control.

Fig. 1 : System Design

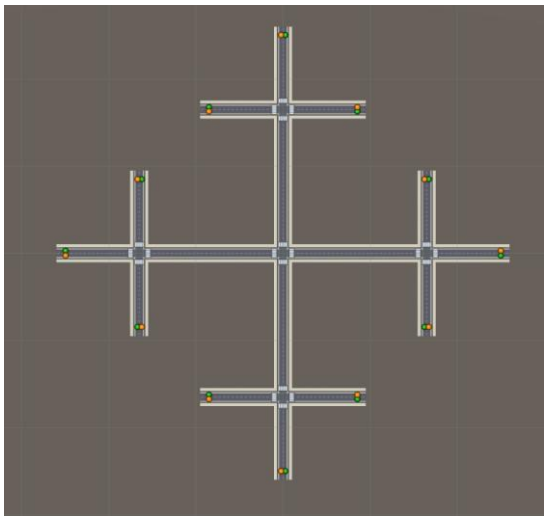


Fig. 2 : Simulation Plan

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IV. PROPOSED ALGORITHM

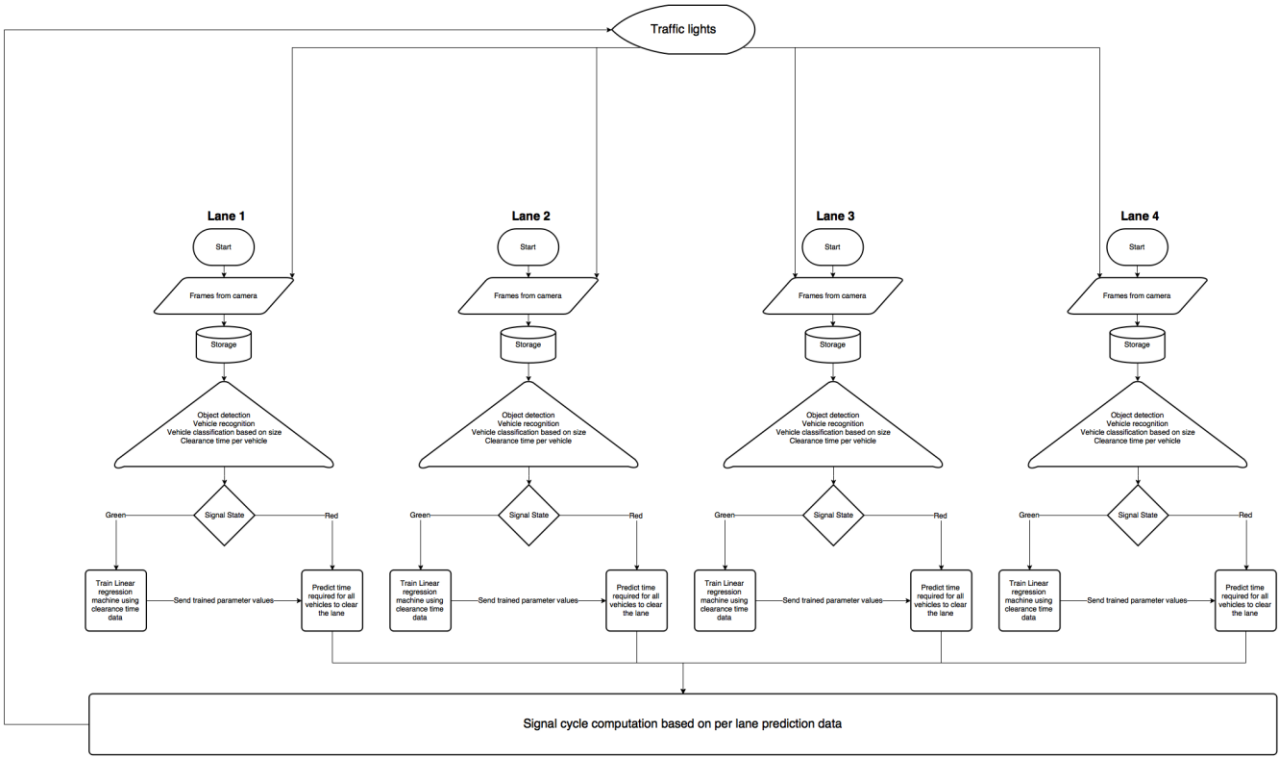

Fig. 3 : Proposed Algorithm

VI. CONCLUSION AND FUTURE WORK

The proposed system once implemented should be able to handle traffic efficiently. This should reduce traffic congestion at junctions and roads joining adjacent junctions. This system by optimising the signal timings should be able to reduce waiting times at signals thus facilitating better commuting through cities at peak traffic hours. This system should also reduce the time wasted by a green signal even when there is no traffic approaching the signal from that lane thus, reducing congestion at the other lanes approaching the same signal.

The junctions in this system can be further developed to communicate with each other which should help in better predictions as any junction can notify the next adjacent junctions about the incoming traffic. Once all junctions start communicating with each other, they can function as a single system which will make commuting through the city more efficient and faster since all the signals will be controlled by a single system. The camera feed of this system can be further processed to detect traffic violations and notify the traffic police about the violation with the details of the vehicle. This system can also be used to identify and track stolen vehicles.

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