Traffic Management System

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IT Department, Online Project Competition in Collaboration with ACM SAKEC Date: 27/04/2020

Abstract: (Problem Statement & Project Objectives)

The current system the traffic is not managed properly which causes breaking of traffic signal rules and accidents. Generate a traffic management system using Image Processing and IOT which will manage traffic signals on the basis of the traffic present. The traffic signals should be dynamic such that traffic can be managed efficiently. The Signal should work efficiently on types of roads such as a 4-lane road or a pedestrian crossing on the highway.

The objectives of our project are:

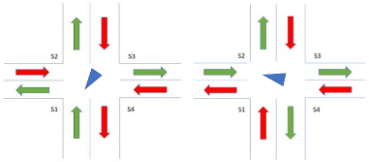
1. The systems need to be real time.
2. It should understand if cars present on the lane and count the number of cars.
3. The system should be able to monitor pedestrians on both the sides of the road simultaneously.

Literature Review:

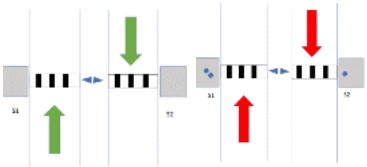
1. Sk Riyazhussain et al [1] have proposed a document regarding the co-relation between the resolution of RPI camera and frame rate. They have used viola-jones algorithm which uses cascaded xml file for face detection. They found that by increasing the resolution, Frame per second (FPS) reduced.
2. Marot et al [2] have proposed a document summarizing the advantages of raspberry pi in Image Processing and to give students a better understanding of the link between hardware and software using technology acceptance model (TAM).
3. This website gave a better understanding of TensorFlow lite. It explained how to install TensorFlow then convert it into compressed TensorFlow lite module then deploy it on an embedded system and how to optimize a 32-bit floats to more efficient 8-bit integers.

Implementation & Methodology:

First, the models were trained to recognize cars and pedestrians using TensorFlow then convert to TensorFlow lite for better performance. Using OpenCV small frames would be created which would only capture vehicles present on the lane and avoid all the extra vehicles. Considering the blue arrow as camera, initially our system would point towards the S1 lane and by using the raspberry pi camera, it will check the number of vehicles present on the S1 lane, and depending on that a green timer would be set for T1 seconds for lane S1. (Refer fig 1)



Upon turning red our device would rotate 90°, that is towards the west direction (S2 lane). Again, the number of vehicles on S2 lane would be calculated and a timer T2 would be assigned and for that long the lane S2 would remain green. Upon turning red it would again rotate 90° and the process would continue for the next lane. (Refer fig 2)



Initially, the signal is green for vehicles as there are no pedestrians present. Once the pedestrians are detected by our camera, the signals will turn red for vehicles for time T which will be calculated by the raspberry pi depending on the number of pedestrians present and once the timer ends, the signal will turn green. This would avoid the unnecessary waiting time for vehicles. (Refer Fig 3 and 4)

Result & Analysis:

It is observed that the system performed well and gave accuracy of 93.33% with extremely fast response time. Capturing images and identification of vehicles was successfully performed using Raspberry pi and libraries such as OpenCV, keras, TensorFlow, which was performed on Raspbian OS. The algorithm for dynamic allocation of time and displaying it were also performed. The complete demo video and test results can be viewed here:

https://drive.google.com/file/d/1w69njvqu8OPXbWWqcwGTAxQqY03D9dLF/view?usp=sharing

Conclusion:

In this project, a dynamic traffic management system to control the traffic is developed. This system has been developed with a highly accurate model for capturing and identifying vehicles. The system can work smoothly after providing a power supply of only 5 Volts (Except Motor which needs 12 Volts). The system is extremely compact and easy to use. The system is very cost effective and therefore, it is ready to be utilized in real-life application.

References:

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