IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
PP 71-74

Density Based Traffic Light Control System Using Tensor Flow And Keras

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Abstract: *Since the count of road users are increasing on the daily basis, the vehicle population on the roads increased to an extreme level. Thus, leading to traffic problems which cause major time delay and more issues. Hence, there is a necessity to find an optimal solution for traffic control. There are several types of traffic problems; so, to overcome these problems, the project focuses on optimization of traffic light controller in the cities using image processing, Machine Learning and Artificial Neural Network (ANN), in which a Pi camera and a Raspberry PI 3 model B+ microcontroller is used in order to process the images and measure the traffic density at any traffic junction. The traffic controller changes the signal timing dynamically depending upon the density at the traffic signal. Artificial Neural Network is used to distinguish the vehicles such as cars, trucks, ambulances, etc. and the priority to the vehicle is set accordingly by Decision making Machine Learning Algorithm. The number of vehicles moving on the roads is counted by the microcontrollers and depending upon the various vehicle counts, the microcontrollers controls the timing of the signal at the traffic junction respectively.*

Keywords: *Raspberry PI 3 model B+, Artificial Neural Network, Machine Learning, Pi Camera, Microcontrollers*

I. Introduction

Basically, a traffic light control system is an approach towards solving traffic issues in a defined area. Traffic at every junction in our country is a major complication that India is facing today. [1]The standing traffic leads to surplus wreckage of time in everyone's life. In exigency circumstances, where medical help is required, possibility of an ambulance arriving at the right time becomes a great challenge. It becomes impossible to such an extent that, it costs a person's life. As noticed in the current time, the traffic light system is broadly classified into two types. They are: -

1.1. Time Based Traffic Light Control System (Static): This is an old and conventional form of signal controlling system using Electro-Mechanical signal controllers. On the contrary, to the computerized signal controllers these are build up using moving parts such as cams, dials and shafts. Additionally, the controls system is wired to them and it works accordingly. Apart from the electronic components, dial timers and electrical relays are used. The small gears which are located inside the dial timers which range from 35 seconds to 120 seconds are used for recognizing and evaluating cycle lengths of signalized intersections. If there is any failure in the cycle gear of dial timer, it can get substituted with another cycle that would be more feasible. Dial timer are designed in order to control phases at the signalized intersection in only one way. Many old signalized intersections till date use this type of signals. However, this fails if dynamic change in the flow of the traffic is noticed.

1.2 Density/Adaptive Traffic Light Control System (Dynamic): As compared to the system mentioned above, this works on the images captured by the camera at traffic signals, in order to evaluate the density of the traffic. Based on the processing done at the junction by the microcontroller, signal times are adjusted accordingly. This is an advance version, wherein real time data is accepted and accordingly preferences are given to make it dynamic. [2]Advance communication is used by the system, which uses sensors and RFID tags to acquire data and provide information to the system based on the current situation on the roads. [3]The smart system then processes this information and makes decisions; that is, it automatically recognizes the duration of each traffic light signal based on previous traffic situation on the road. Such type of system includes fuzzy experts' systems (FES), artificial neural networks (ANN) and wireless sensor networks (WSN).

II. Problem Definition

Traffic is the highlighted issue which almost every country faces because of the increasing number of vehicles, specifically in large metropolitan areas. As the problem of urban traffic congestion spreads & occurrence of road accidents increases. There is an immediate need for the introduction of advanced technology

and techniques to improve the traffic control algorithms to better satisfy this increasing demand. The basic way for controlling traffic is using timer for each phase. Another way is to use electronic sensors in order to detect vehicles and produce signal that cycles accordingly. Through this project a system is proposed for controlling the traffic light by Artificial Neural Network (ANN) and Decision-making Machine Learning algorithm. Detection of the vehicles will be done by image processing, taking images as inputs. A camera will be placed beside the traffic light. It will capture image in required order. The image sequence will then be analyzed and evaluated using digital image processing and according to traffic conditions on the road, traffic light can be controlled.

III. Proposed Work

As the number of road users is increasing on the daily basis, the vehicle population on the road is increased to an extreme level. Thus, leading to traffic problems which cause major time delay and more issues. Therefore, there is a need to find an optimal solution for traffic control. There are several types of traffic problems; so, to overcome these problems, the project focuses on optimization of traffic light controller in the cities using image processing, Machine Learning and Artificial Neural Network (ANN), in which a Pi camera and a Raspberry PI 3 model B+ microcontroller is used in order to process the images and measure the traffic density at any traffic junction. The traffic controller changes the signal timing dynamically depending upon the density at the traffic signal. Artificial Neural Network is used to distinguish the vehicles such as cars, trucks, ambulances, etc. and the priority to the vehicle is set accordingly by Decision making Machine Learning Algorithm. The number of vehicles moving on the roads is counted by the microcontrollers and depending upon the various vehicle counts, the microcontrollers control the timing of the signal at the traffic junction respectively.

IV. Methodology

4.1 Machine Learning

[4]The machine learning based content classifiers are a sort of managed machine learning worldview, where the classifier should be prepared on some named preparing information before it tends to be connected to real arrangement undertaking. The preparation information is normally an extricated bit of the first information hand named physically. After appropriate preparing they can be utilized on the genuine test information.

4.2 Artificial Neural Network (ANN)

[5]Artificial Neural Network (ANN) is a system that is inspired by biological neurons that resides in an animal brain. The neural network in itself is not an algorithm, but a structure for many such machine learning algorithms to do the job together and process many complex data inputs. Learning is the main key point in ANN. An ANN is basically a collection of connected units or also called as nodes known as artificial neurons, where each connection can transmit a signal from one artificial neuron to another. Then the received signal can be processed by the artificial neuron and then signal additional neurons adjoining the previous one. The original goal of ANN was to solve the problems that a human brain cannot.

V. Technology

5.1 Python

[6]Python is a broadly utilized abnormal state, universally useful, powerful programming vernacular. Its outline reasoning underlines code clarity, and its grammar enables developers to express ideas in less lines of code than conceivable in dialects, for example, C or Java. The dialect gives builds expected to empower composing clear projects on both a little and huge scale.

5.2 Tensor Flow

Across a range of tasks, Tensor flow is an open-source library for dataflow programming. It is nothing but a symbolic math library, and is also used in machine learning applications such as neural networks. It is used at Google for both research and production, often replacing its closed source predecessor, DistBelief. It was developed by Google Brain team Google's internal use but was the released by Apache 2.0 open source license on Nov 9, 2.15.

VI. Figure

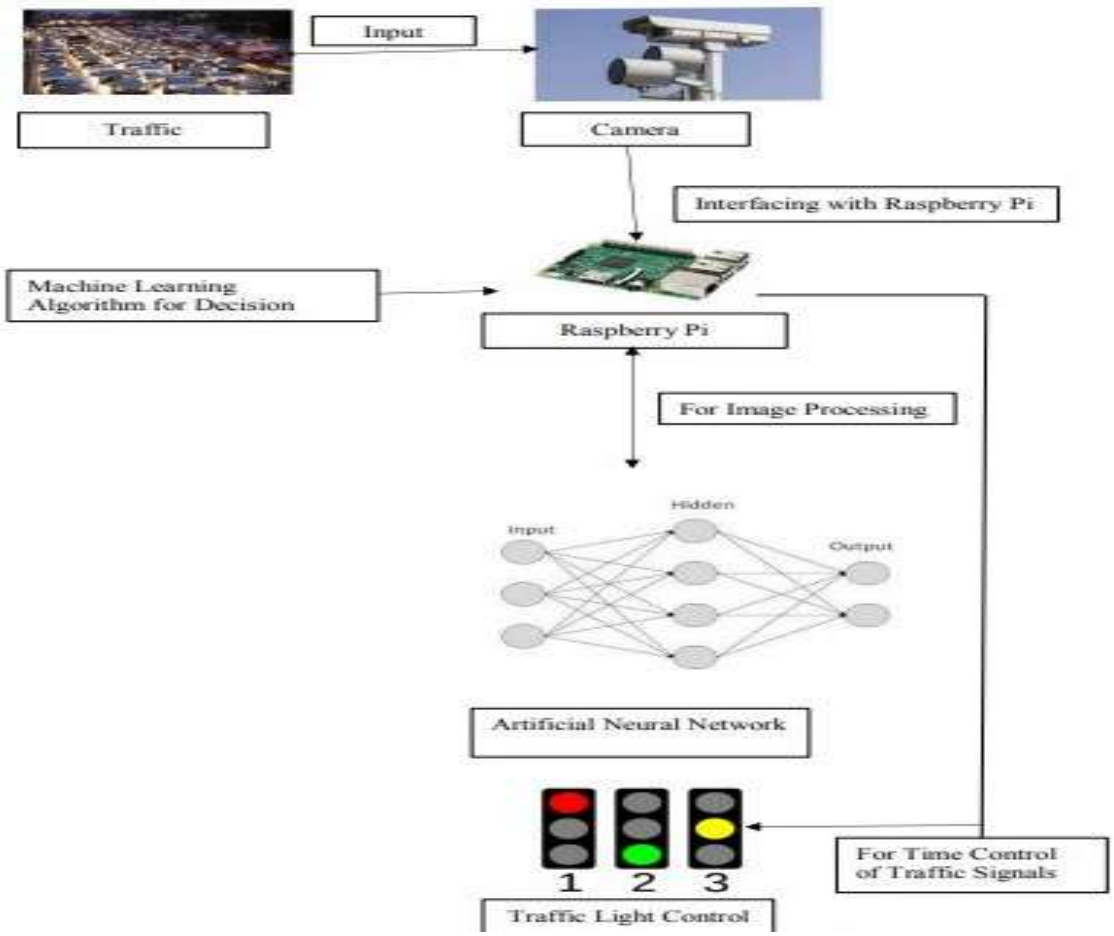

Fig.1: Density Based Traffic Light Control System.

VI. Conclusion

The project will help in reducing stagnant traffic at the junctions along with the reduced transportation cost and fuel consumption. Time for an individual person is saved and a path will be provided for the emergent vehicles in order to reach their destination on time, to help the needful. As Raspberry Pi is used in the project there's a scope of implementation of Internet of Things (IOT) in the future along with RFID. With the help of Artificial Neural Network and Machine Learning Algorithms interfaced with the Raspberry Pi, a real time analysis of the traffic will be achieved and accordingly the timing for the traffic signals will be controlled and priority for the emergency vehicle will be provided.

Acknowledgement

We sincerely thank our guide Ms. Megha Gupta for her guidance and constant support and also for the stick to our backs. We also thank the project coordinators for arranging the necessary facilities to carry out project work. We thank the HOD, Dr. Vinit Kumar Dongre, Dean Academic, Dr. R.R Sedamkar, Vice Principal, Dr. Deven Shah, The Principal, and Dr. B. K. Mishra and the college management for their support.

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