IoT based smart traffic signal monitoring system using vehicles counts

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Abstract

Traffic signal management is one of the major problematic issues in the current situation. Such scenarios, every signal are getting 60 seconds of timing on the road at a regular interval, even when traffic on that particular road is dense. As per this proposed model in this article, which will be optimized the timing interval of the traffic signal purely depends on the number of vehicles on that particular roadside. The major advantage of this system is that it can able to decrease the more waiting time for the drivers to cross road signal. In this model, we are using the clustering algorithms model which is based on KNN algorithm. Using this algorithm new model will be liable to determine expected required timing as per provided inputs to the signal which is vehicles count. The input of these systems is vehicles counts on each side of the road from crossing signal. And this input will be determined on much time is to be provided. "Case studies on this system are traffic network and real-time traffic sub-networks are organized to get the effectiveness of the proposed model."

Keywords: Internet of things, traffic automation, k nearest neighbours.

1. Introduction

"One of the important things in the Internet of things in smart cities is the Intelligent Transportation System (ITS). ITS improves Vehicle to vehicle and Vehicle to Infrastructure communication for improving road facilities rather than increasing road capacities or developing new roads. This is possible because of ITS, it utilizes advanced information and communication, and this communication will be helpful for decreasing traffic congestion and to reduce the accidents on the road, which is dangerous in the urban areas."
"Managing traffic signal timing is one if the key thing in the urban areas. Managing to time on the road will decrease the waiting time of the drivers on the road, and that will help to reduce the fuel consumption. This is done with the help of the ITS." In this system, we are going to use IR Sensors. IR sensor is also called as an Infra-Red spectrum. IR sensors have 2 parts in it, one is the transmitter and second is a receiver. The transmitter is used to transmit the light and receiver keeps on receiving the light. When this connection is interrupted, the counting process is started, i.e., when the receiver does not receive the light transmitted by the transmitter it is said that the object is there in

between transmitter and receiver. The line of sight concept is used in this approach."

2. Proposed System

Everyday traffic congestion bigger issues are a daily basis. So automation systems are currently not available in India. We need of IoT to utilize in the traffic signal monitoring systems and to control it in an advanced controlling system. Any system is designed to act smartly with higher control features for all four side way traffic systems. Every road towards heavy traffics of vehicles in higher counts. We need to define the priority level of traffic in our TMS on the basis on which least or highest priority.
Traffic management system-TMS key appliances to control over traffic as per population of vehicles ID that particular area. So every road lane needs IR sensor to monitor and capture data of vehicles count in that lane. In this proposed system depends on the count of vehicles from the road lane IR data we are allocating higher time rate for that signal. This systems model using more numbers of IR sensors, for automation control microcontroller, with Bluetooth controller, as well as Android mobile device and finally PC-server. Any of these sensors surround with IR transmitter & receiver for placing in both directions of road lane.
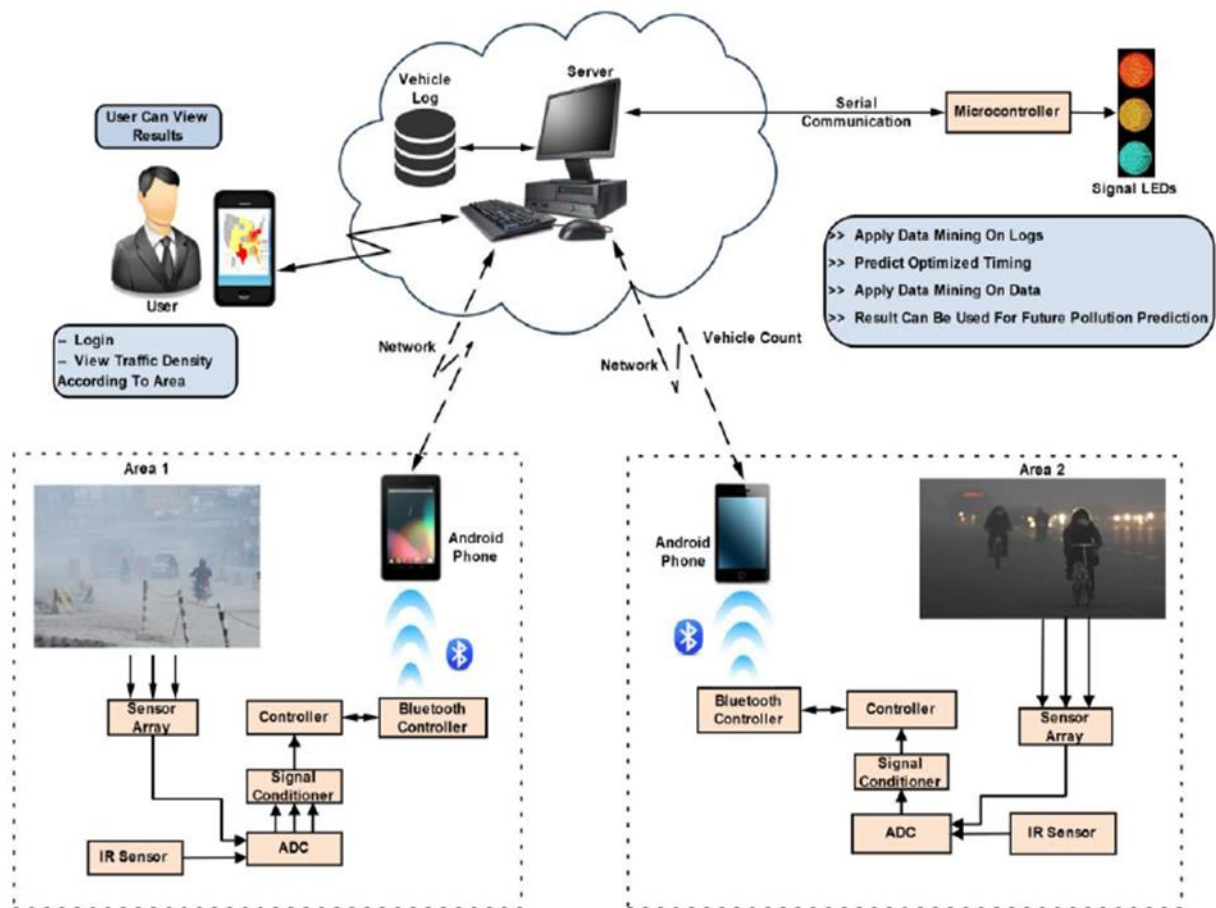
3. Implementation

Fig. 1: TMS architecture diagram

Traffic Monitoring System–TMS using multiple IRs in IOT model to learn vehicles count in real time then updates signal timing of every side traffic lights according's to the predicting factors using KNN algorithms. It uses IRs to collect signals from numerous inputs on basis IOT model setup to learn vehicles count available in a traffic signal. So it will get cleared depends on the dependability of vehicles count to either increase or decreases timing of particular signals using KNN algorithms by data analysis.
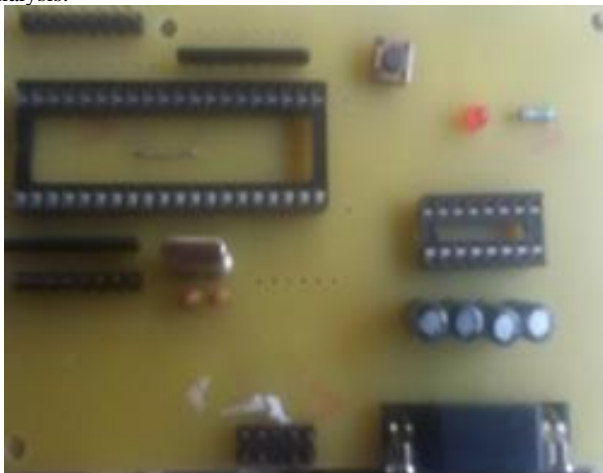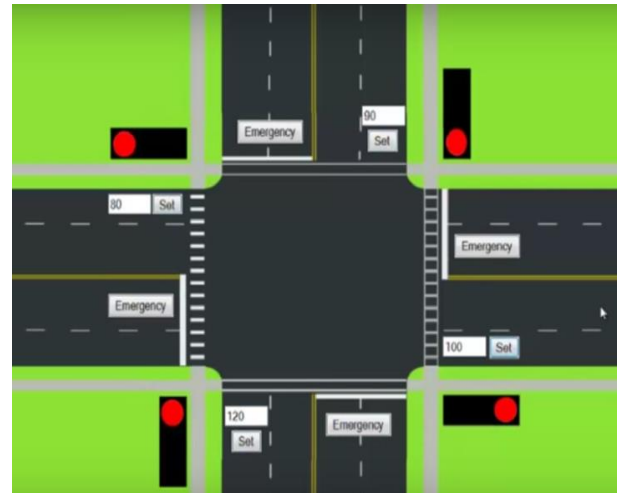

Fig. 2: Microcontroller Kit in TMS

Fig. 3: Signal model - IR sensors for vehicles count

4. Modules

In this implemented application considered three major works as modules processes of the project.
These modules describes in detail about work done in the project which is listed below:
1.   Android Application
2.   Server Side Communication
3.   User Communication

1.   Android Application: In this Android 1st module about android kit utilized to transfer data from onside the micro-

controller to the other side server communication. Then it's coded for the android application. The server performing communication operation towards data transaction.

2. Server Communication: This module is used to perform algorithms computation using clustering technique from data given inputs using an android device, which is used to store all the previously stored data i.e., like the history of all the previous vehicles already used the same signal crossing. KNN model algorithm is utilized for clustering model extraction from the given inputs, which is working on non-parametric methods for classification & regression model of data analyses. This input which contains k closest outputs of training examples for the feature space. K-NN working on the instance-based learning those function is approximated as local values.This project always collects data for four side road crossing as the vehicle counts. According to the count as inputs, this algorithm going to decide the signal timing intervals to get higher time limits for that particular signal to avoid the traffic queuing in a dense number of vehicles.

3. User Communication: From the user's communication, they can able to view required information about traffic condition in that particular area. If the user decided to travel in the particular area, then they can use current scenario of traffic conditions by this android application.

5. TMS results

Fig. 4: TMS mobile application

Fig. 5: TMS mobile application

Android Mobile application for Traffic Monitoring System –TMS which is using multiple IRs for IOT model. To check IRs sensors status particular pages used from the admin side, Client Users can able to see traffic flow and timing for that particular road lane.
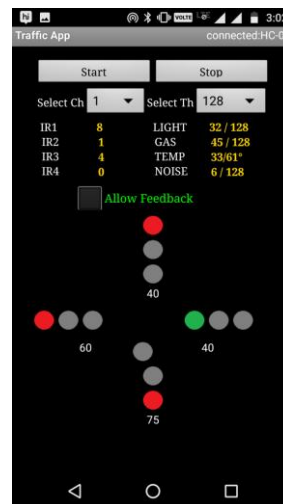

Fig. 6: TMS using IR in IOT

TMS results are displayed for user and admin to monitor traffic flow in particular route using multiple IRs in IOT model. Client Users checking their traffic flow as per their wishes to know about which lane and path-usage in that area nearby to them.
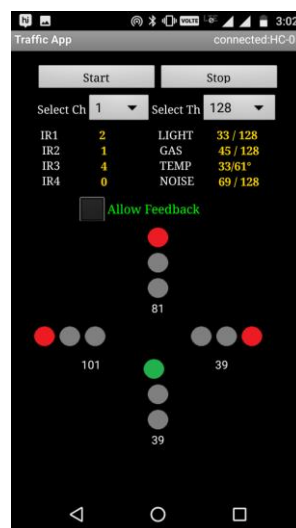

Fig. 7: TMS using IR in IOT

Four IR case study results from TMS apps system are displayed to understand monitoring of traffic flow in any particular route which based on IRs. Timing of any signal is varying as per KNN logical methodology algorithms purely depends on IR data captured in real time scenario to updates the timing of that traffic signals

6. Future scope

In the future advancements of this TMS, a model ambulance can able to communicate with all base station to get an easy free lane to rush up reaching the hospital on time for needy people. So such scenarios signal automatically is cleared with its arrival schedule.

7. Conclusion

TMS -Traffic Monitoring Signal timing has been developed by using multiple features of hardware components in IOT. Traffic optimization is achieved using IOT platform for efficient utilizing allocating varying time to all traffic signal according to available

vehicles count in road path. TMS will helpful to client user to know timing arability and traffic flow count in any area of their nearby locality of any regions.

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