Signal Automation through IoT by Using IR Sensors

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Abstract

Traffic controlling and detection systems are oriented by the Internet of Things. The suggested framework is centered on this evolving idea to collect the information and share with others in effective decision making. Automating the present crowd control framework is the main goal of the Dynamic traffic control structure in India. Within the present crowd control structure, the stable timing switching signals control the traffic lights. This system contains numerous disadvantages due to not considering the traffic's actual intensity, hence, the vehicles may stay for longer time. The actual detection of the traffic density can solve this problem. Within the suggested system, the traffic density is found through IR sensors, consequently, switching the traffic lights is controlled by the micro-controller. Hence, in this study, the system is demonstrated upon the traditional and static crowd-control framework. . Within this system, the traffic is accurately detected consequently effectively diverting the traffic.

Keywords: *Traffic detection, Internet of Things (IoT), crowd intensity detection Traffic controlling, Arduino, IR sensor Android.*

1. Introduction

Internet of Things (IoT) does not only connect objects, rather connects individuals. Things connected to the internet are extensive since they are allowed to start sharing their knowledge and experiences with others. It acts like taking a thing and adding capability of sensing, communicating, touching, and controlling. The IoT has started a considerable step to connect 4 pillars—things, process, information, and even individuals, which results in Internet of Everything (IoE). The IoT is the inner-network of electronic tools, solid tools, buildings, vehicles, and numerous further items fixed with actuators, sensors, network and software connectivity allowing these items to record, gather, and exchange information. An enormous field of IoT exists with intelligent city as is one of the IoT's influential implementations to generate interest within the population of the world (Figure1). It contains smart grids, virtual power plants, urban security, smart homes, smart transit, smart observations, smart traffic managing, clever energy management methods, and climate control.

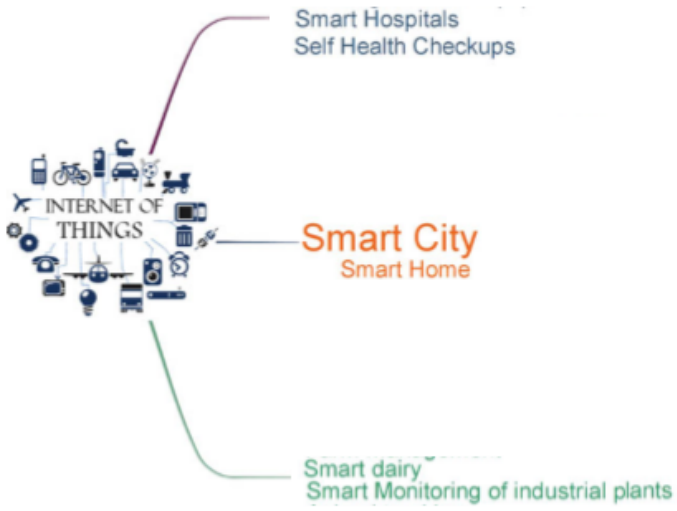

Figure1: Classes of internet of things (IoT)

The smart city is developed by the positive use of city resources to enhance the quality of life. In this regard, developing the IoT paradigm powerfully inspires the vision of a smart city all over the world. IoT tools are integrated in terms of the geo-position and assessed by investigating system. This gathered information can be then utilized with various features of smart cities such as public parking lots, monitoring vehicles, whether forecasting, vehicular traffic control, water systems, smart homes, Surveillance systems, and environmental contamination. Among all the above-mentioned fields, the traffic-associated information is among the most vibrant sources of information in a conventional smart city. According to The Times of India [1], the amount of daily-listed carriages is about 53,700 in India indicating the incrementing number of vehicle at a quicker rate than ever. Therefore, a precise technique has been existed controlling the traffic. Moreover, the objective of the system is to detect and control the traffic precisely in real-time. This, in turn, helps decreased fuel use, increased saved time and quicker traffic clearance. Traffic controlling includes two sections as (1) detecting and (2) controlling the traffic density. Within the traffic detecting numerous systems utilized tools such as image processing cameras, RFID, Loop detectors, IR sensors, smartphone and others by which it is possible to use IR sensors by the suggested system.

2. Related Work

Here, other related studies and various procedures are provided for detecting and controlling traffic. Various approaches and some loopholes within the method resulting in inaccurate traffic detection or controlling are represented in Table 1. In the table, most of traffic detection and controlling techniques are covered including IR, RFID, in which RFID is built up in emergency carriages and a GSM module is utilized to communicate crowd updates with Android applications [2]. IR sensor is used in pre-mentioned technique contrarily from the suggested system.

Table 1 : illustrate review done to find out the present techniques

Paper	Method	Tools	Result
Smart traffic control system[3]March,2016	•Infrared sensors are mounted in the dividers in order to detect the vehicles •Equipped with Bluetooth and GPS to identify vehicles •Message is sent using GSM to the control room also when an ambulance is approaching at the junction it will communicate to the traffic controller via Bluetooth	•IR •Bluetooth •GS	•What if traffic is too long that Bluetooth of vehicle cannot connect(cause of out of range) •Equipped with GPS so, then why need IR sensors and Bluetooth to sensor identify the traffic or vehicle you can do it using GPS itself
A video surveillance system for traffic application[4]December, 2014	•Image processing •The roads are divided sections, the back ground sections which has few changes •Section can be extracted by motion accumulation •Difference off ramies usually used to detect move mention vehicle, inconsecutive sequence off rams	•Camera	•Not useful for individual vehicle detection •Insufficient to accurately track the occluded vehicles and tracking on each vehicle need to be initialized separately to handle occlusion better •Vehicle with higher height blocks vehicle behind it
Traffic surveillance by counting and classification of vehicles from video using image processing [5]Nov,2013	•Image processing(canny edge detection method) •Identifying and locating sharp in coherence in an image •The incoherence are a brut changes in pixel intensity that characterize bound arise of items in a scene	•Camera	•It uses a video to count and classify vehicles, so in any case such as rain or fog it would not be able to find centroid and distance between marked borders
Piezo based self-sustain able traffic light system[6]June,2013	•Piezo electric power •Piezo electric elements convert mechanical stress into electric impulses. The mechanical stress can be applied on the piezo electric elements in the form of vehicles moving on the road •Energy produced by the piezo electric cells is converted into½CV2and then used to power the traffic light system	•Piezoelectric Cell •Piezoelectric converters	•Cost of this system is too high has the cost of piezo electric elements is too high(40,000/-as mentioned) •Require sigh maintenance as this is a delicate system

Follow Table 1 : illustrate review done to find out the present techniques

Paper	Method	Tools	Result
Priority vehicle system control[7]September, 2010	•Preemption Normal signal sequence is interrupted in difference to the special vehicle such as an ambulance •Priority green is held longer for the vehicle or the time in graver s to green a.s.a.p.(light emitter/ receiver is used to detect light code)	•Light emitter/ receiver	•In case of same light code uses by another vehicle system may detect it as priority vehicle and change its signal sequence
Vehicle identification concept[7]September, 2010	•Signature loop detector Vehicle has amounted transmitter to signal the controller and road has loop to detect the signal and its priority, the detector unit has discriminator module •This detector recognizes the vehicle passing over the loop	•Loop detector	•In case of matching pose of vehicle detector may identify it as apriority vehicle •Higher cost
Traffic detection system using Android[8]June, 2015	•Uses GPS-enabled Android phone and when uses is stuck in traffic he sends the notification to others of traffic •There are four factors based on which we can decide which detector to use	•Android smartphone	•There is a possibility that the user does not communicate to others and that may increase the traffic •Problematic while network problems •Does not work with other than Android phones

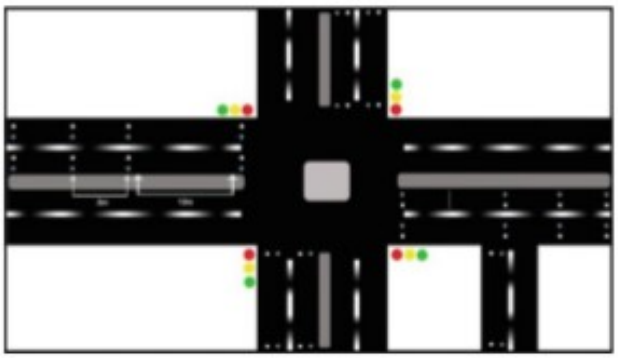

Figure 2: Pictorial representation

In this project, the sensor's location is under the road. The sensor grid will exist under the road sensing the road traffic. Since it is a grid, we should understand the traffic exact density based on the length. A determined gap exists within the first and the second sensors' blocks (Figure 2). It is caused by the fact that traffic is regarded as a normal traffic reaching the second block over the time period with the traffic signal working normally. Three traffic levels exist as "NORMAL", "MEDIUM", and "HEAVY" (Figure 2). Each road's density will be calculated in these 3 classes with allocated time (Figure 3) thereby to each road. In the

scenario where any or all the sensors break working, then the signal contingency initiates to work as normal with constant time intervals. Moreover, the Android application exists controlling the traffic signals. The suggested system is represented schematically in (Figure 2) with top view. The blue and white dots show the IR detectors grid and the darts represent the space within two groups (in mtr). The groups dimension relies over the width and length of the path, generally rectangular area. Figure 3 indicates that the path with higher vehicle density receives greater priority and timing over other paths. (Figure 4)represents the testing flowchart to uphold the suggested framework.

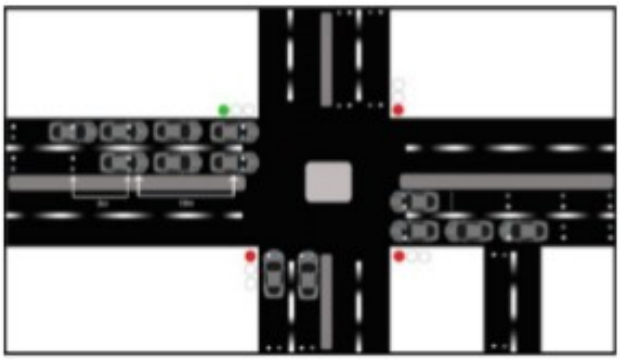

Figure 3: intensive traffic takes preference

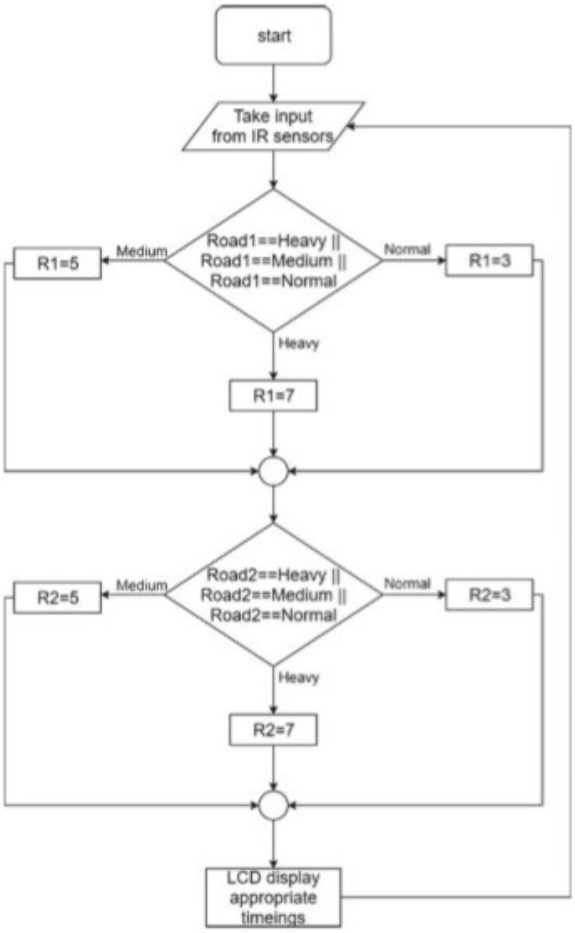

Figure 4: Method flowchart only demonstrates for two passages

In emergency cases, the retreat system Android application (Figure 5) can be utilized as well, indeed, in case existing an accident victim in any car waiting for the traffic, the driver calls the authority to verify the vehicle as emergency vehicle getting the green light for the vehicle as soon as reaching the signal. Moreover, utilizing this application, the higher priority is allocated for the priority vehicles such as ambulance.

Figure 5: Fall back system

3. Suggested System

IR sensors are used by the system to detect the traffic (vehicles). In our work, the roads are divide into logical blocks* (Figure 1). The multiple IR sensors are then checked by the system to read the traffic density. In case of greater density compared to the other paths, then the greater priority and longer time course are received by the path (green signal) to clear out of traffic.

4. The Elements for the Working Model

The elements utilized for a active model include IR sensor (Figure 6), Arduino mega, Bluetooth Module HC 05 (Figure 7), 16 × 2 LCD display (Figure 8). Arduino Mega 2560 planned for blueprint needs higher number of I/O pins, memory, and RAM. It contains 16 analog input pinpoints, 54 digital I/O pins, and a greater space for your sketch [9]. IR Sensor is utilized for detecting hindrances or object's motion. This releases and finds the radiations not observable to people sights that are detected with an infrared sensor. In the suggested system, to find the traffic density, the customized IR module is utilized (Figure 6).

Figure 6: Customized IR module

Figure 7: Bluetooth module HC 05

A (Liquid Crystal Display) 16x2 is an electronic display with two-lines. It can show sixteen items in a line and their 2 rows. Each item in the mentioned LCD is represented in 5 × 7 pixel matrix. A Bluetooth chip of HC 05 is utilized for transporting radio serial connection system. Using Serial Port Protocol module is easy. The information is accepted by it and sent through the TX pin linked to Arduino's RX [10]. Blueprint of Model for which the circuit diagram is represented in (Figure 8).

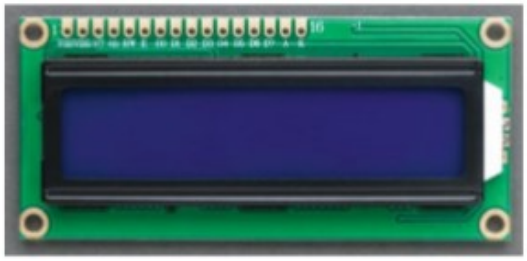

Figure 8: 16 × 2 LCD display

5. Analyzing the Result

The conclusion was made based on the investigational works by comparison of the present system [11] and the suggested system. The time interval is provided in (Figure 9) correlated to the vehicles' density for different kinds of traffic circumstances such as high, medium, and normal. Furthermore, it is indicated the recent system is motionless, however, this suggested method assigns time to greater effectiveness dynamically. (Figure 10) represents the green signal's free time based on vehicle density. This indicates the time wasted followed by passing the vehicles while other paths waiting for the completion of the timer. This wastes resources and time and is not very effective, as well. (Figure 11) illustrates the number of vehicle stopped followed by changing the signal to red from green in the existing framework against this suggested system, in which no stopped vehicle exists in different scenarios such as high, normal, and medium.

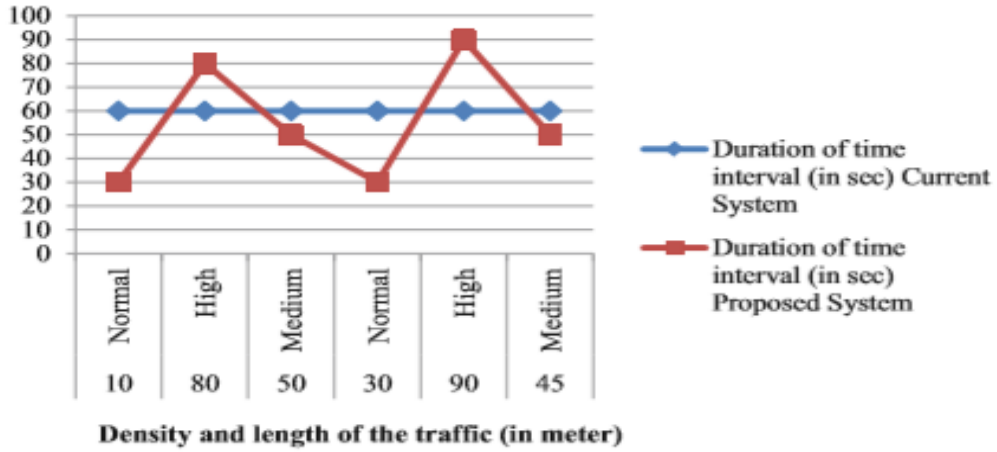

Figure 9: Period of time interval in current versus suggested system

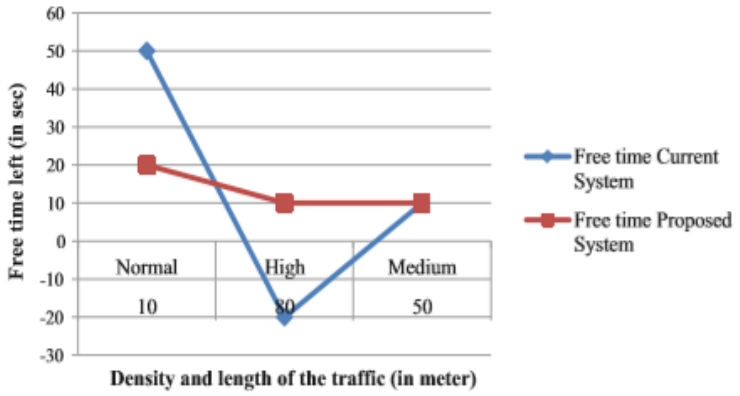

Figure 10 :Free period left in recent opposite suggested system

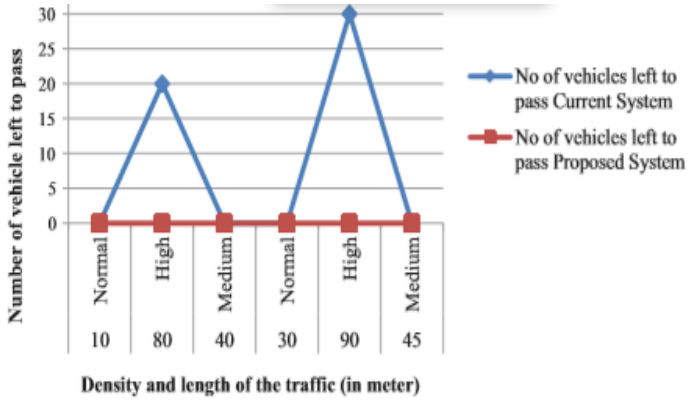

Figure 11 : Amount of carriage left to pass in current opposite suggested system

6. Conclusion and Future W0rk

After comparing the outcomes and representing the suggested method, it was concluded that the proposed system is cost-effective as a result of using elements like IR sensors inexpensively accessible compared to other methods such as Loop detection, Image processing, GPS systems, and piezoelectric items. The suggested system is time-effective since it assigns suitable time to avoid the individuals coming up for the subsequent repetition, indeed, Dynamic Time intervals in terms of the traffic density. In addition, this model is capable of detecting traffic circumstances within the sub ways of the main ways with no struggle with vehicles after heightened vehicles. Moreover, it contains an emergency structure and manual-control system in emergency states making it further effective and adaptable in different circumstances. It is possible to extend the scope of the suggested system to inform the real-time traffic quantity for the public at a signal. Furthermore, it is possible to further extend it for calculating the time required for reaching from initial to end point and sufficient path with signal of live timer vision. By collecting these knowledge, it is additional possible to respond the inquiries regarding the weekday with a higher traffic on, or the weather causing the most traffic jams and several other questions. Within this system, the traffic is accurately detected consequently effectively diverting the traffic.

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