International Journal of Advanced Technology & Engineering Research (IJATER)
www.ijater.com

ALERT SYSTEM FOR EMERGENCY VEHICLES

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Abstract -In a developing country like India, the population growth is rapid which obviously increases the traffic. Due to the increase in population, there has been a rapid growth in vehicle number which has become a major problem. Increase in the number of vehicles has exponentially increased the problem of traffic congestion which interferes the smooth flow of the traffic in the major cities of the country. This traffic congestion not only wastes the time of the citizens but also many of the vehicle users does not turn their engines off. This leads to the wastage of the fuel which has become one of the major problems in the current environment. Moreover it also causes the environmental pollution. Thus traffic congestion control and maintaining the smooth flow of traffic has become the biggest challenge for the traffic department in the country. Many manual methods have been implemented in order to control this problem but none of those have been successful. Using Internet of things, we can make use of cloud technology and various sensors to detect the number of vehicles in a single lane. We try to make decisions that are labour free and makes the solution even more useful and simpler. This traffic congestion causes many problems such as wastage of Fuel, Delay of travel and other issues. The traditional traffic system can be changed by using IR sensors to note the distance of the vehicle from the traffic lights. And according to the distance we can adjust the give the "GO" light to the lane whose traffic is at a less distance. After the signal is given we shift to the next lane in a cycle order. Since we are dealing with the density at which the vehicle is far from the traffic light we named the system as "Density based Traffic Control System". The system also comprises of detection emergency vehicles such as Ambulances, VIP vehicles etc. This can be attained by the usage of RFID (Radio Frequency Identification) sensors which are deployed along with the IR sensors. RFID tags are deployed in the vehicles that are important. When these vehicles approach the junction, receiver detects the presence of the vehicle. Hence the lane having the emergency vehicle is provided GREEN signal irrespective of its density.

INTRODUCTION

a. Existing methods/techniques for application

The existing traffic system follows a basic round-robin type method. Each lane is provided with the green signal only for a specified period of time. Once the period is timed out, again it has to wait for the fixed amount of time in order to attain the green signal. A Countdown timer is also displayed which helps to know the status of the lights.

b. Drawback of existing system

The traditional round-robin based traffic system is inefficient as the every lane is provided the same amount of time irrespective of the traffic in the lane. This reduces the traffic movement in the lanes with heavy traffic which is inefficient.

1. Emergency vehicles cannot be given a special privilege in the case of emergency situations
2. During the times of heavy traffic, this system can be totally useful
3. Cannot maintain any records of traffic characteristics (i.e.., lane having frequently high traffic, emergency vehicles etc..,)

c. Proposed System

The problem of congestion in heavy traffic lanes can be solved by the usage of IR sensors. IR sensors are employed at the traffic signal and they are used to find the density of the vehicles present in the each lane. Density is predicted by sending the IR waves and noting down the distance of the farthest vehicle. Thus, the density of all the lanes is noted down in cyclic order and the one having the highest density is given the GREEN light. After a lane is provided with a specific period of time, then the sensor again finds the lane with maximum density and this procedure continues.

Salient features:

- The system also comprises of detection emergency vehicles such as Ambulances, VIP vehicles etc. This can be attained by the usage of RFID (Radio Frequency Identification) sensors which are deployed along with the IR sensors. RFID tags are deployed in the vehicles that are important. When these vehicles approach the junction, receiver detects the presence of the vehicle. Hence the lane having the emergency vehicle is provided GREEN signal irrespective of its density.
- The system is efficient in controlling the traffic congestion as it not a round-robin type. It allows lane having higher density to pass through. Thus it reduces the waiting time for vehicles in highly dense lanes.
- All the records of lights can be maintained in the cloud which can be used to analyze the data to find those lanes having higher density

d. Implementation Issues: There are certain implementation issues with the proposed model. The Regular RFID tags and IR sensors of lower range cannot be used to implement the

system. Sensors and tags of high range are costly. Moreover, user needs to have some prior knowledge on the functionality of the system. The system proposed is just a working prototype and can be used for the future development of the traffic system. If certain modifications are made in this model where it can be made feasible and more efficient, this model can be used in the real world scenarios, helping in the smoother movement of traffic in all the metropolitan cities and places with dense traffic.

e. Results

The proposed system helps in controlling the traffic congestion in urban areas. When implemented in small scale the system produced fruitful results, whereas in the case of large scale further research is required to the system in order to attain consistency in technology and cost. We are successful in attaining a sophisticated solution in this field of research and our results provide a better path to the upcoming research enthusiasts in this field.

f. Implementation:

The main objectives of this system is to attain efficiency, accuracy and to adapt a cheaper method as it plays a vital role in the real life implementation of the system. The system has been implemented in the cheapest way possible in the field of Internet of things and also to preserve the accuracy of the system without any compromise.

g. Application Domain Knowledge: We focused on learning the each and every aspect of our components used in the system such as RFID sensor, IR sensor and Arduino UNO

h. Validation: The system provides a better solution in maintaining a smooth flow of traffic and helps in preventing some environmental hazards. A well-developed smart city required a sophisticated maintenance of traffic

i. National Status: This system has not been implemented in our country

j. International Status: The system is already in force in some European countries. The reviews are positive and further improvement in this field of work improves the smooth flow of traffic and will be a great step forward in building a smart country.

k. Keywords: Arduino UNO, Radio Frequency Identification Sensor, Infrared sensor, Vehicle detection, Emergency Vehicle, LED, Traffic congestion, Traffic management

Literature Survey

The paper titled "Intelligent Traffic Management for Ambulance and VIP Vehicles" [1] concludes that the model considers not only the priority of the vehicles but also the density of the vehicles on the road and controls the traffic light sequence efficiently and more accurately. The proposed work is of great use since the accuracy of RFID is greater than that of a camera.

The paper titled "Density Based Traffic Control" [2] emphasises the need of efficient traffic management system in our country as the number of road accidents are increasing. An advance system is designed to deal with the increased chaos in the traffic and it proposes to effectively distribute the time slots of a vehicle. The prototype has been implemented in the laboratory scale and the expected outcome was good. The next step is the real life scenario and for better results we can implement it on a large scale. It can bring a revolutionary change in traffic management system and its application in the environment.

The paper titled "DENSITY BASED TRAFFIC CONTROL SYSTEM USING ARDUINO UNO" [3] concludes that the proposed method will help us to get into a traffic free future. The system is of less cost and is efficient because IR sensors are used for counting the number of vehicles in each way of the system.

The paper titled "Density Based Intelligent Traffic Signal System Using PIC Microcontroller" [4] describes a model using IR sensors and a microcontroller. By using this system we have reduced the possibilities of traffic jams and hence reduced traffic congestion. No. of passing vehicle in the fixed time slot on the road decide the density range of traffics and on the basis of count microcontroller decide the traffic light delays for next recording interval. The recorded data can be downloaded to the computer through communication between microcontroller and the computer.

The paper titled "Advanced Traffic Management System Using Internet of Things" [5] concludes that the growth in population of urban areas has been discussed along with traffic control system. A smart traffic control system is implemented by big data analysis and RFID along with IoT. Supervised learning also helps us to provide a frame work for the attributes of effective implementation of a smart traffic management system. The system if implemented will reduce the traffic congestion in big cities and also the system aims at improving the security of the vehicles.

The paper titled "Intelligent Traffic Signal Control using Image Processing" [6] concludes that a novel system for intelligent traffic control system has been generated. The volume of the traffic has successfully been quantified using various Image processing techniques. Cameras can be inserted in various parts of the city to monitor the vehicle count. A neural networking system has to be added for reading license plate. The license plates can also be read by using Optical Character Recognition (OCR) technique which is used in Image Processing.The "Density Based Traffic Signal System" [7] in future work a raspberry pi microcontroller can be used by using opencv software which is free. It is used to provide a good view for a traffic controller room and the green and a longer time in the required area in order to avoid unnecessary

waiting time in the signal.

The paper titled "Efficient Dynamic Traffic Control System using Wireless Sensors Networks" that the RFID tags are used for emergency vehicles and VIP vehicles and IR sensors are used to check the number the vehicles in that lane. The future works deals on using capacitive proximity sensors and IR based sensor tags. Capacitive Proximity sensors are used to get more accurate count of vehicles present in that lane as compared to Inductive Proximity sensors .Capacitive proximity sensors are comparatively costly. We can also use IR sensors to get the count of emergency vehicles other than of RFID tags

The paper titled "An Intelligent Framework for Vehicle Traffic Monitoring System using IoT "[9] concludes that the proposed system can be used for real time monitoring using IoT platform which can be used to control the traffic signals and hence reliable and hence can be used for designing an effective traffic signalling system to reduce the problem of traffic congestion.

The paper titled "Alarm System to Detect the Location of IOT-based Public Vehicle Accidents" [10] discusses that IoT can also be implemented in transportation. The information regarding the location and accident can also be reported to the police, hospitals,
fire fighters, related officers and it can also be used to register all the accidents in the street using SMS and google map.

The paper titled "IMAGE PROCESSING BASED INTELLIGENT TRAFFIC CONTROLLING AND MONITORING SYSTEM USING ARDUINO" [11] concludes that the proposed method uses Image processing and Arduino for effective traffic monitoring system/ A Wi-fi module can also be used in particular junctions. It is also used for emergency travelling.

The paper titled "An IoT Based Automated Traffic Control System with Real-Time Update Capability" [12] concludes that the proposed method was efficient and safe to give live updates of the traffic system. It also ensures the safety of pedestrians and hence traffic updates can be generated and can be made into a website.
The paper titled "Smart Traffic Control System Using ATMEGA328 Micro Controller and Arduino Software" [13] concludes that the proposed method can be used for effective management of traffic system. An emergency vehicle is prioritised by using an RFID tag and a reader. The proposed method can be used for effective traffic congestion.

Proposed system

I. Overview:

a. Hardware Arduino UNO, RFID reader, RFID tags, connecting wires, IR sensors, LED's.

b. Software Arduino software 2
c. Summary of the Invention

In this project, we have constructed a smart traffic signalling system which can be used for effective functioning of a smart city. There are 4 IR sensors which can be used for the generation of the distance between the vehicle and the traffic signal. First we check whether the vehicle is an emergency vehicle or not. If the vehicle is an emergency vehicle then we use the RFID RC255 to read the RFID tag attached on to the emergency vehicle. We can then display the RFID tag's number in the serial window of our Arduino Software. In real time systems, we can convert this RFID tag number into the vehicle's number plate by mapping the RFID tag number and the Vehicle's License number in the database. After the emergency vehicle gets through the traffic we check the distances generated by the IR sensors. The minimum distance generated is then checked for and finally the lane with heaviest traffic is allowed to go first in an attempt to minimize traffic congestion.

II. System Architecture:

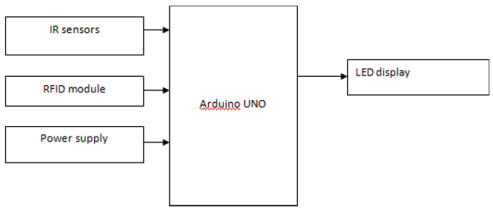

Figure 1
Figure 1 explains the basic system architecture of the system

III. Functional Architecture:

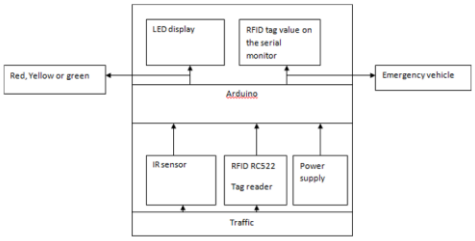

Figure 2
Figure 2 explains the functional architecture of the system.

IV. Modular design:
Module-1: Processing Module

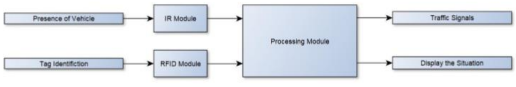

Figure 3
Figure 3 describe the modules present in the proposed system
Description:

This is the primary and important module where the whole functionality of the system relies on. This Module (figure 3) receives input signals from both RFID module and IR module Data received from the external sensing modules is interpreted and the following sequence of analysis is made by the Unit 1. Checks the density of the vehicles in all the lanes 2. Verifies the presence of a RFID Tag in any of the lanes 3. Analyze the Data provided by the Sensing Modules by above operations 4. Appropriate Action is performed by sending output signals to the traffic lights and Displays.

Module-2: IR Module

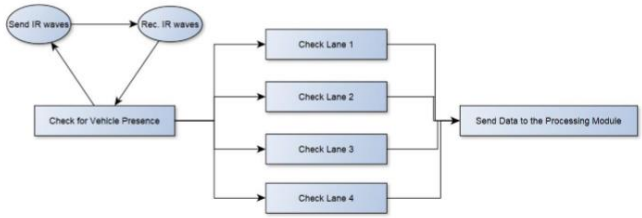

Figure 4

Figure 4 explains the functionality happening in the IR Module.

Description: The main function of this module is to check the density of the vehicle in each lane This module receives input from the Processing unit and sends output data to the processing unit This module consists of mainly two parts. 1. IR sender 2. IR receiver Sender sends the IR waves and these waves hit an opaque non absorbing body and gets reflected back The receiver receives the sent waves, the time taken for transmission is analyzed and so the distance. This data is sent to the processing module which thereby further analysis is made.

Module-3: RFID Module

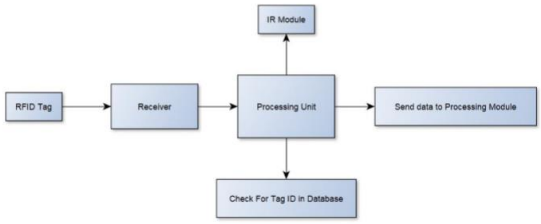

Figure 5

Figure 5 explains the functionality in the RFID Module.

The primary function of this module is to check for the presence of RFID tag This module works based on two parts 1. RFID Tag 2. RFID receiver

The receiver checks for the presence of tag which constantly omits certain frequency of EM waves and so detected. After the receiver receives the signals it checks whether the tag ID is valid or not from the data base if a valid tag is detected, then data is sent to the processing module appropriately. If the tag is invalid it proceeds to the other cycle.

Flow Diagram

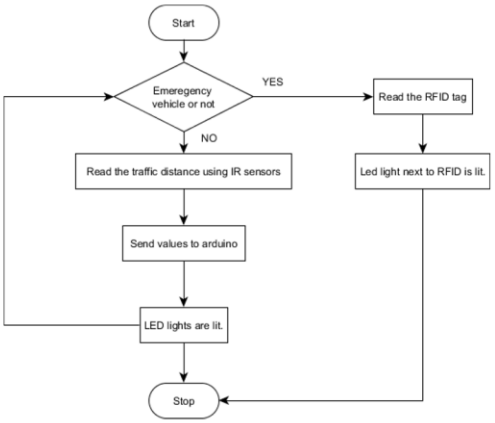

Figure 6

Flow Diagram (Figure 6) explains the flow of process happening in the system which helps us to understand the working in easy manner.

Data flow Diagram

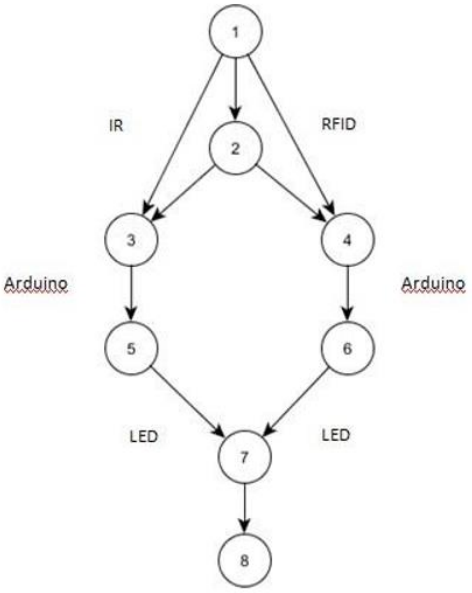

Figure 7

The data edges take the values of the variables in the figure 7

It helps in detection of the process which is happening or should happen in parallel or in individual way.

Innovative Idea :

The existing system of traffic follows the traditional way of controlling the traffic which has become quite inefficient because of the reason of increase in population which ultimately lead to the increase in traffic congestion. In the existing system, every traffic lane has to wait for the specified period of time irrespective of the density of vehicles in that lane, which has become a major trouble in getting the lanes with more traffic wait for a long time. The following are the

main innovative ideas in our project: • IR sensors are used to sense the density of vehicles which lead to a smarter way of reducing congestion. • RFID sensor and tag are used to detect the emergency vehicles which is not present in the existing method. • Cloud technology is also deployed in the field of traffic which is not present in the existing system. • All the data is stored frequently to the data base, which is reliable and labour-free. • Further data analysis can also be made with the help of data generated in the form of CSV files (i.e., Lane which is more crowded etc.,).

Implementation details and Analysis

a.Detailed description of the Invention:

Hardware Description:
The project consists of an Arduino UNO board, IR sensors and RFID RC255 as the major components. Here we describe each and every component for better understanding.

Arduino UNO: Arduino UNO (Figure 8) is a microcontroller. It is based on the ATmega328. It contains of 14 digital input and output pins in those 6 pins is also used for PWM outputs. And also it contains 6 analog inputs, 16 Mhz ceramic resonator, power pack USB connection and a reset button. It contains everything that is helpful to support the microcontroller. Powering the Arduino UNO is very easy. It is so simple that it can be connected to computer with a USB cable which is compatible to Arduino or power it with a AC-to DC adaptor or battery which also requires resistor based circuit to get started and to avoid damage

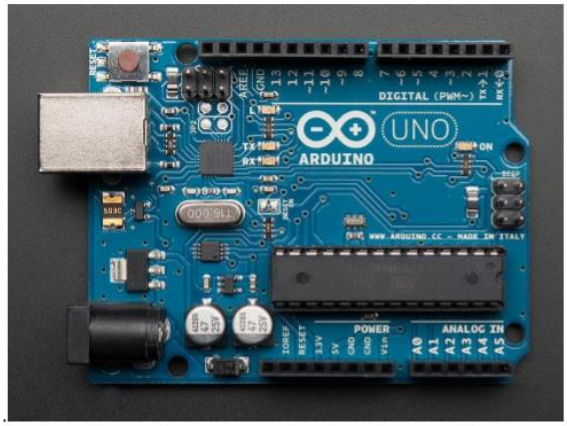

Figure 8- Arduino UNO

IR sensors: IR sensor (Figure 9) is an electronic device which senses the objects present around the surroundings. The principle is it transmits an infrared signal, this signal strikes the body of an object and the signal is bounced which is received at the infrared receiver. The system is less cost and efficiency is more because the IR sensors are used for counting the number of vehicles at each way of the junction. The Arduino UNO used is a simple prototype model which works more efficiently. When the infrared sensors emits it's radiations, as an object moves across the sensor it detects the vehicles and the output of the IR sensor is
directly proportional to this and is given by the Arduino UNO board. Here, it is seen that the measurement of vehicles count based on distance is done with the help of IR sensors.

Figure 9- IR sensor

RFID RC255: RFID (Figure 10) are those devices that use radio signals to track, sort and also detect objects. These RFID's are noncontact devices. They are automatic identification technology. These RFID's can detect many kind of objects like vehicles, assets, goods, persons etc. without needing any direct contact or any line of sight contact .This technology can be used to see and track any movement if present with the help of radio enabled devices which are used for scanning. RFID technology can track this movement over several meters. The RFID's consists of an RFID tag, commonly known as tag which is the key component of this technology. This evolutionary technology is used frequently in access control systems implemented in many smart technologies.

RFID Tag: This Tag (Figure 10)is employed within the vehicles that require the prior importance which even makes the system more likable to use. These tags are of usually two types. An active tag that is used requires a battery backup and hence not preferable in the case small scale applications. A passive is not supposed to have any battery backup and solely depends upon the RFID receiver which continuously checks for the presence of the Tag. We usually insist the usage of the passive tags in order to assure the user the robustness and also considering the ease of use.

Figure 10 – RFID

b. Brief description of the drawings

In this project we use two circuit diagrams. One to connect the Arduino UNO board to the IR sensors and the other is to connect the Arduino board to the RFID module.

The connections are done in the simplest way possible for better understanding.

First we connected the Arduino UNO and the IR sensors to detect the traffic in the cities. Then we connected RFID readers to check the tags on the emergency vehicles and the light glows if there is an Emergency vehicle on the way.

WORKING PRINCIPLE

As soon as the program gets loaded, there is a yellow light which is found to be glowing on the board indicating that the board has been connected and the program is successfully loaded into it. Then it checks whether the vehicle is an emergency vehicle or not. If it is an emergency vehicle then the RFID tag is read by the reader else the IR sensor checks the distances and the lane with minimum distance is observed and then finally the green led is lit and hence traffic congestion is avoided.

I) Working Model:

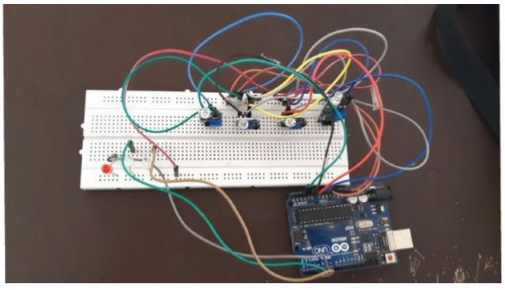

Figure 11 – IR Circuit

II) RFID connections:

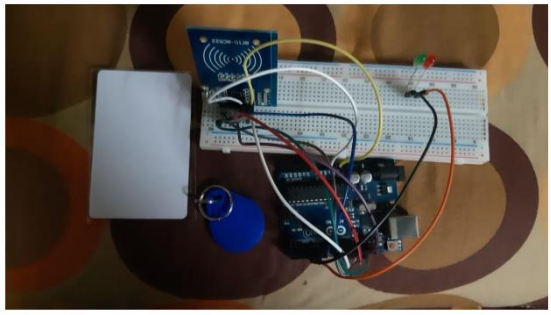

Figure 12- RFID system

Software Description:

The connections are made and then the program is loaded on to the Arduino board using Arduino software.

Arduino IDE:

The Arduino Integrated Development Environment or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

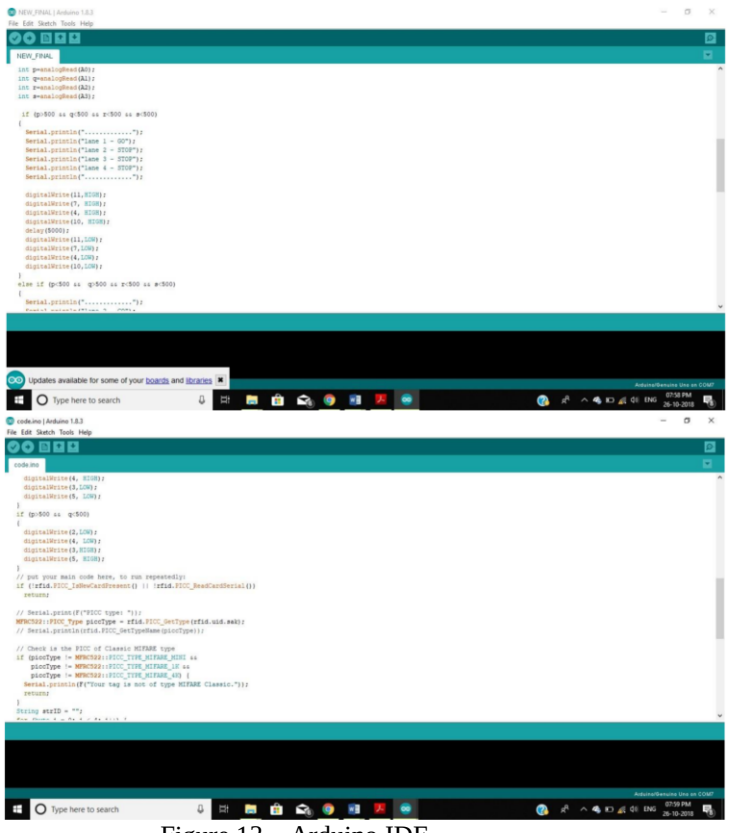

Figure 13 – Arduino IDE

ThingSpeak:

It is an Cloud analytics platform service that allows you to aggregate, visualize and analyse live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by

your devices to ThingSpeak. With the ability to execute MATLAB® code in ThingSpeak you can perform online analysis and processing of the data as it comes in. ThingSpeak is often used for prototyping and proof of concept Cloud systems that require analytics.

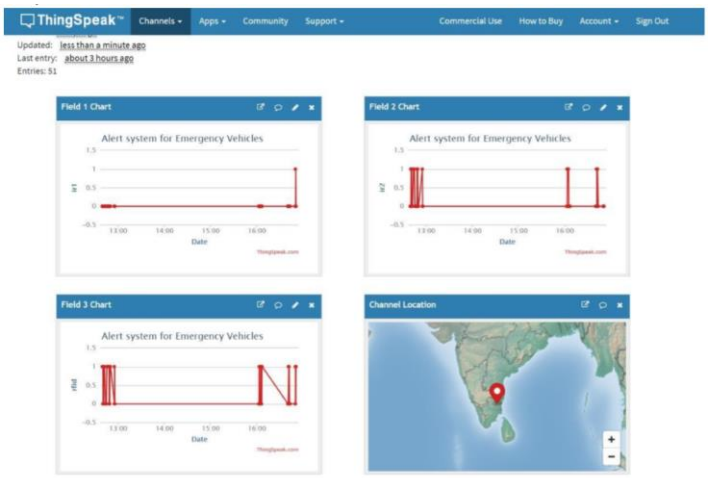

Figure 14-Thingspeak

c. TEST CASES:

Test Case	Input	Observed Output	Expected Output	Result
When Density is high in Lane 1	IR1 sensor's output	Lane 1: GREEN Rest: RED	Lane 1: GREEN Rest: RED	Satisfied
When Density is high in Lane 2	IR2 sensor's output	Lane 2: GREEN Rest: RED	Lane 2: GREEN Rest: RED	Satisfied
When Density is high in Lane 3	IR3 sensor's output	Lane 3: GREEN Rest: RED	Lane 3: GREEN Rest: RED	Satisfied
When Density is high in Lane 4	IR4 sensor's output	Lane 4: GREEN Rest: RED	Lane 4: GREEN Rest: RED	Satisfied
When No Vehicle is present in any lane	No sensor Input	Previous detected State	Previous detected State	Satisfied
When E. Vehicle in Lane 1 and Density high in Lane 2	RFID sensor's output and IR2 sensor's output	Lane1: GREEN Rest: RED	Lane1: GREEN Rest: RED	Satisfied
When E. Vehicle in Lane 1 and Density high in Lane 1	RFID sensor's output and IR1 sensor's output	Lane1: GREEN Rest: RED	Lane1: GREEN Rest: RED	Satisfied
Data when IR1 is Triggered	HTTP response by IR1	Data delivered into Cloud Database	Data delivered into Cloud Database	Satisfied
Data when IR2 is Triggered	HTTP response by IR2	Data delivered into Cloud Database	Data delivered into Cloud Database	Satisfied
Data when RFID is Triggered	HTTP response by RFID	Data delivered into Cloud Database	Data delivered into Cloud Database	Satisfied

d. Performance analysis:

Parameter	Time based Traffic System (Existing System)	RFID and IR based Traffic_System.
Consideration of the Emergency Vehicles	Not Considered, We have to do it manually	Automatic System
Signal Display	It is Time based Display	It Considers Number of vehicles in Lane
Data Generated	No Generation of Data	Data Generated will be stored in Cloud database.
Robustness	More Robustness	Less Robustness Due to Sensors.
Maintenance	Easy to Maintain	Requires High Maintenance
Response Time	It has Fixed Response Time	Based on vehicle detection it varies.

Conclusion and Future work

The model we have made will be helpful to reduce the traffic congestion to a great extent. This model is very helpful to manage the traffic effectively such that the vehicles can move smoothly without encountering much traffic. In this way, people can reach their destination quickly. Another advantage of using this system is that there will be less involvement of humans which will reduce any possible human error. In the proposed system, the IR sensors get activated as soon as any traffic is detected and the lane with the minimum distance is identified. After this lane is detected, the green LED is made to glow so that the vehicles closer to the traffic signal will pass easily. This helps to reduce the traffic congestion to a great extent. We tried to push the limits of the project as far as it goes in the field of research as part of our knowledge is concerned. Apart from finding the density of the lanes and thus analysing the traffic proportion, we further considered to identify those vehicles having high priority and provide them with the possible facilities that can be done. This model also consists of a RFID tag and reader. As soon as the emergency vehicle is read by the RFID reader, the tag of the vehicle is identified. Using this method, everyone in the road can get to know that an emergency vehicle is present in the route.
This model can mark a beginning of construction of a smart city. This model when implemented in a large scale can help control the traffic and is also helpful for the emergency vehicles to pass through the road without any inconvenience. In the future we can implement this model in a bigger scale, using more efficient techniques and a better cloud service than the one which is suggested in this model. Traffic, which is a major problem in India, can be tackled by using the concepts of Internet of Things.

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