AUTOMATIC PATHWAY FOR EMERNGENCY VEHICLES AND DENSITY MANAGEMENT

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Abstract-- Traffic in metropolitan cities have increased enormously. Due to increase in population and the increased use of automobiles it has become a huge challenge for emergency vehicles like ambulance to pass through in emergency situations. A smart traffic management is a wide topic of research. Many modifications can be made to make the urban traffic flow smoothly on the roads. The increasing utilization of private vehicles and public transportation due to advancement of technology causes hectic traffic complexities for the civilians across the globe. The problem of traffic congestion is an everyday problem for human resource and therefore hinders the growth of the country by affecting its productivity as well as economy. Moreover, the traffic signaling systems have predetermined fixed operational time which fails to manage the traffic density changing with time and thus, long traffic queues are formed at the road crossings resulting in increased pollution and waiting time. The one of the major field that concentrate on the automation is Internet of Things creatively called as IoT. This proposed system is based on the IoT to save the human life at critical situation. This project is to establish the communication between the traffic signals and the ambulance so that the traffic signal can respond to the arrival of the ambulance and respond according to that. When the traffic signals are changes its states according to the position of the ambulance it can able to make a free way for the ambulance. Thus, this project will act as a life saver. In this way it acts like a lifesaver project as it saves time during emergency by controlling the traffic lights.

1. Introduction:

In a world with growing population and increasing transportation needs, the cities need an intelligent traffic management system (ITS) which works based on traffic concentration on different lanes. This system will be created to reduce waiting time at lanes and let the citizens travel to their homes, offices, schools and other destinations more quickly. The problem of unnecessarily waiting at signal, while other roads are empty is the cause of delay for people to reach their destinations. This problem is addressed here. The citizens will not be stuck in traffic for too long.

An emergency service has a very crucial role in people's life. In India, people always complain about the not getting ambulance, police, fire brigades and other lifesaving services on time. This system addresses this issue and gives the traffic control center people and authorities with a facility to manually control the traffic so that the citizens can get easy and fast access to the emergency services be it medical necessity, crime prevention measure or rescue services. The project is an application of IOT. It also aims to provide the citizens with emergency services more quickly by giving the manual control to authorities at traffic control station.

Nowadays we all face the traffic problems as a major drawback of urban cities. It may lead to lose life of anybody in a critical situation. So, we have to think to provide a solution to this problem to tackle the critical or emergency situations without the major traffic jams. The main aim of this project is to build a system in which the signaling time at traffic signaling junction will be controlled according to the movement of ambulance. The purpose of this project is to implement an automated system for clearing the traffic for ambulance to help the people who met with accidents or the people who are in emergency conditions without any disturbance or delay. By this project we can implement a traffic clearing system for ambulance and can provide support to the people with in time who are in critical conditions and can save their lives.

2. Literature survey

[1,8] IoT based traffic signaling system is based on traffic density on road where the count of vehicles is done at each side of road by placement of sensor. In this system, three traffic lights are placed on junction of road sides. Two pairs of sensor are placed across the roads which mark the distance for density zones. Here ultrasonic sensor are placed and ultrasonic receiver are placed which are opposite to each other. The logic here is that as the vehicles crosses the first pair of sensors, a digital signal is produced and accordingly sensor assumes that there is traffic congestion on the road. Arduino microcontroller sends the timing signal output by comparing with adjacent road's traffic. As the vehicle crosses the second pair of sensors, Sensor assumes that it contains high traffic density respectively. For high density traffic, there will be more time allotment and for low density traffic normal time is given. The data on traffic density and traffic signaling control are sent wirelessly to Raspberry Pi3 where analysis made as Heavy traffic and Normal Traffic with date and time. This information is finally updated

on Cloud webpage which can be used for further planning and analysis by Traffic department. The sensor here would capture the data for counting the density of that particular side and corresponding signal will be provided by Arduino Microcontroller based on heavy and normal traffic. The density traffic information with appropriate signaling along with date and time of each road sent to Pi3 where analysis done as heavy and normal traffic. This traffic analysis sent to Cloud webpage for further analysis

[2,7,10] The road occupancy measure is accurate for both highways and collector roads. Collector roads mostly have small vehicles, which has relatively low length hence a length based road occupancy measure is considered in this research. The road space occupancy measure is a spatial measure calculated by considering the length of the vehicle, the safe distance between vehicles. this research has decided to go ahead with magnetic sensors (or magnetic sensor-based PCB) for collecting traffic information as they show good accuracy in vehicle detection. The OpenStreetMap (OSM) is one of the practical projects that provide map data. OSM provides editing, exporting, and uploading functionalities. The export functionality can be used to generate row map data or map images. The raw data can be processed by other systems that use geographical information. MongoDB is a document database, and it stores the data from JSON like documents. The documents in MongoDB are stored as collections, and similar to tables. The OpenStreetMap downloaded and converted to geojson format and stored in the MongoDB for experiments. Honeywell HMC5883L is a tri-axial magnetic sensor used in many traffic monitoring research due to its high sensitivity and cost-effectiveness. Hence, this research also used the HMC5883L magnetic sensor to collect vehicle data. ESP8266 module can be used for end to end IoT system developments. Thinger.io is an open-source IoT platform that supports sensor data collection management, analysis, and visualization. The message board unit can be a Wi-Fi-enabled character type LCD unit.

[3,9] The cloud contains all the information in the database which has on users, vehicles, Traffic offences, safe limit for each Road, locations of each vehicles and roads etc. The network of these Vehicles is stored to identify and authorize and also track their features like conditions, driving range, max speed, safety measures etc. The officials are given premium benefits to monitor the vehicle registrations, available users, incoming applications, traffic violence and offence, and traffic flow. Traffic offences like riding without a helmet, speeding over the safe limit can be captured through the devices which identifies the number plate of the vehicle and the currently logged user is penalized based on the governance fines. Other traffic devices include signal lights, digital speed meter boards can also be modified based on traffic status in the road under consideration or routes under commute. A rerouting algorithm is crafted to deviate ambulances to low congestion position based on the network of sensors and vehicles employed in the IOT module. This given system takes traffic solidity as input from cameras which is abstracted from Digital Image Processing technique and sensors data, resultantly giving output as signal data, resultantly giving output as signals management.

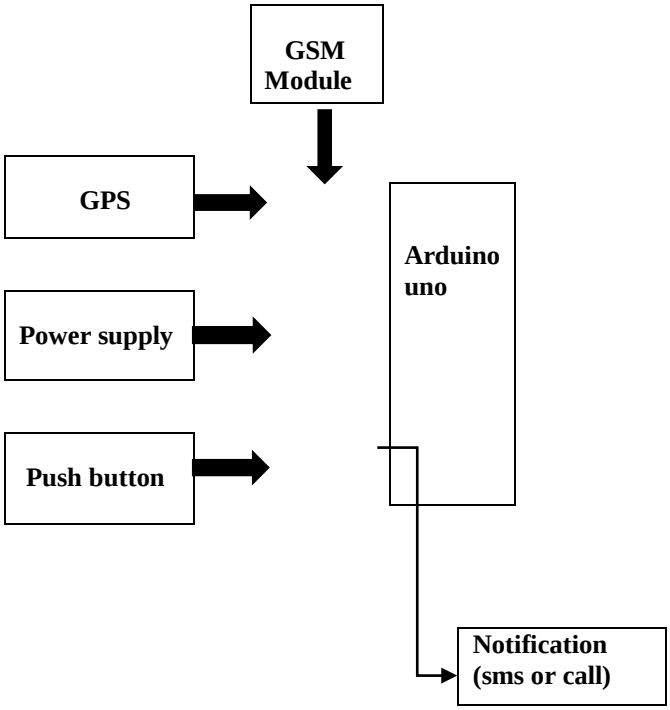
[4,6] An Intelligent Transportation System improves Vehicle to vehicle and Vehicle to Infrastructure communication for improving road facilities rather than increasing road capacities or developing new roads. This is possible because of Intelligent Transportation System , it utilizes advanced information 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. In this system, they used Infra-Red spectrum. Infra-Red spectrum 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, 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. Traffic management system controls 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.

[5] The Traffic Management System and using GIS mapping under real time support, they provide useful information to the drivers in the vehicles and help reduce the traffic congestion. Additionally, basic tourist information such as visiting places, parking area and distance are also projected on a real time basis on large digital screens installed at city centers entrance points to guide the drivers toward their destination. This helps to save fuel and finally to save a lot of time spent in searching various visiting places. The smart living style in metro cities is also fulfilled as the environment becomes pollution free and more hygienic. The smart traffic management system using the Internet of Things and a decentralized approach to optimize traffic on the roads and intelligent algorithms to manage all traffic situations more accurately. The system takes traffic density as input from cameras, which is abstracted from a Digital Image Processing technique and sensors data, resulting in output as signals management. An algorithm is used to predict traffic density to minimize traffic congestion. Besides this, RFIDs are also used to prioritize the emergency vehicles like ambulances, fire brigades, etc. by implementing RFID tags in such vehicles. In the case of emergency situations, such as an explosion or burning of something, fire and smoke sensors are also deployed on the road to detect such situations.

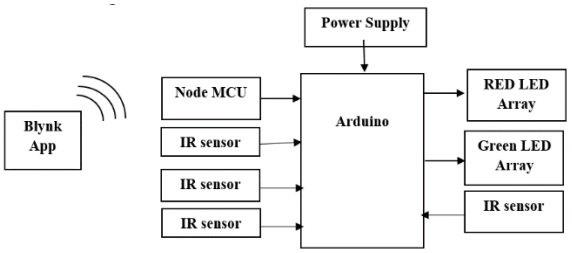
3. Methodology of the system:

In this system we are using Arduino uno to control the traffic lights when an emergency vehicle is on the way. Whenever an emergency vehicle is approaching a traffic signal, the person in the emergency vehicle will press the pushbutton connected to gps which is responsible for sending the location of approaching emergency vehicle in the form of sms or call to the traffic signal controller. The GPS receiver obtains the data as a whole NMEA format text. Only the latitude and longitude coordinates are taken from it. Then the GSM module sends SMS to

the number specified in the code. When the notification is received by the controller, they will override the traffic signal with the help of Blynk app. Blynk app is used to control the traffic signals. Whenever light is controlled by app the corresponding green light will be ON until it is switched OFF again in app. IR sensors will detect the density of the traffic based on the density the green light will ON. The vehicle concentration or density will be detected by the IR LEDs. The controller will take the data from IR communication taking place in between IR Transmitter and IR Receiver. The microcontroller Arduino uno will process this received data and show the signals through red, green LED's.



Block Diagram for notifying traffic controller



Block diagram for controlling traffic signal

4. Software requirements:

Arduino IDE- IDE stands for Integrated Development Environment which is an official software introduced by Arduino.cc, that is mainly used for writing, compiling and uploading the code in the Arduino Device. Almost all Arduino modules are compatible with this software that is an open source and is readily available to install and start compiling the code.

Blynk-Blynk is an IoT platform for iOS or Android smartphones that is used to control Arduino, Raspberry Pi and Node MCU via the Internet. This application is used to create a graphical interface or human machine interface (HMI) by compiling and providing the

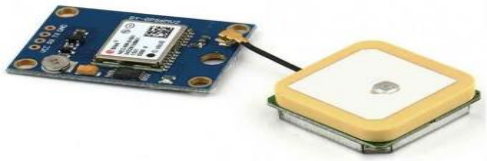
appropriate address. Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.

5. Hardware requirements:

Arduino uno- This board comes with all the features required to run the controller and can be directly connected to the computer through USB cable that is used to transfer the code to the controller using IDE (Integrated Development Environment) software, mainly developed to program Arduino. ATmega328 microcontroller is placed on the board that comes with a number of features like timers, counters, interrupts, PWM, CPU, I/O pins and based on a 16MHz clock that helps in producing more frequency and number of instructions per cycle.

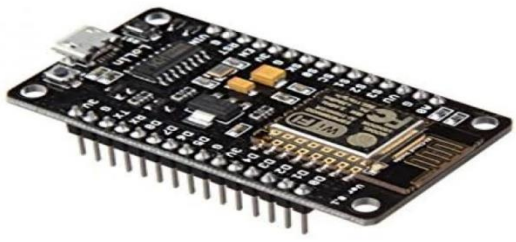
Arduino uno

GPS **-** The Global Positioning System (GPS) is a space-based radio-navigation system consisting of a constellation of satellites broadcasting navigation signals and a network of ground stations and satellite control stations used for monitoring and control. Currently 31 GPS satellites orbit the Earth at an altitude of approximately 11,000 miles providing users with accurate information on position, velocity, and time anywhere in the world and in all weather conditions.



GPS

Node MCU - Node MCU is an open-source firmware and development kit that plays a vital role in designing your own IoT product. The interface of the module is mainly divided into two parts including both Firmware and Hardware where former runs on the ESP8266 Wi-Fi SoC and later is based on the ESP-12 module. Multiple GPIO pins on the board allow you to connect the board with other peripherals and are capable of generating PWM, I2C, SPI, and UART serial communications.



Node mcu

IR Sensor- An infrared sensor is an electronic device, which emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, which can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.

IR Sensor

Light Emitting Diodes (LEDS)- The lighting emitting diode is a p-n junction diode. It is a specially doped diode and made up of a special type of semiconductors. When the light emits in the forward biased, then it is called as a light emitting diode. The LED is a special type of diode and they have similar electrical characteristics of a PN junction diode. Hence the LED allows the flow of current in the forward direction and blocks the current in the reverse direction.

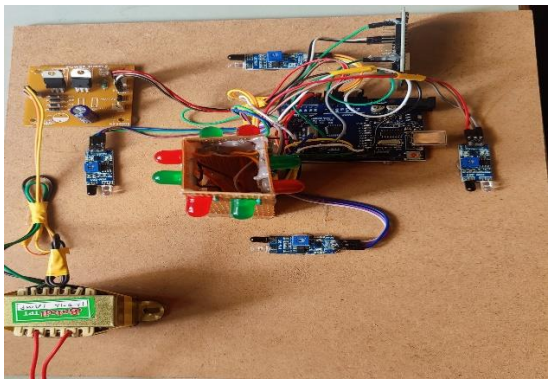
LED

GSM Module- SIM900A GSM Module is the smallest and cheapest module for GPRS/GSM communication. It is common with Arduino and microcontroller in most of embedded application. The module offers GPRS/GSM technology for communication with the uses of a mobile sim. It uses a 900 and 1800MHz frequency band and allows users to receive/send mobile calls and SMS. The keypad and display interface allows the developers to make the customize application with it. Furthermore, it also has modes, command mode and data mode. In every country the GPRS/GSM and different protocols/frequencies to operate. Command mode helps the developers to change the default setting according to their requirements.

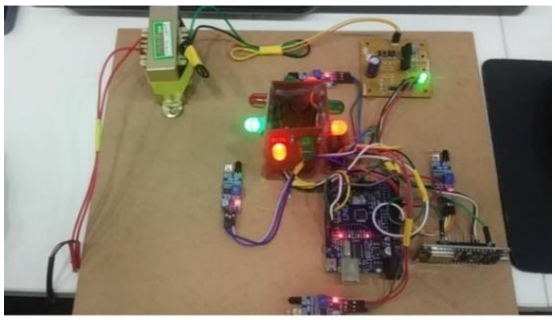
GSM Module(Sim900A)

6. Implementation for Hardware System:

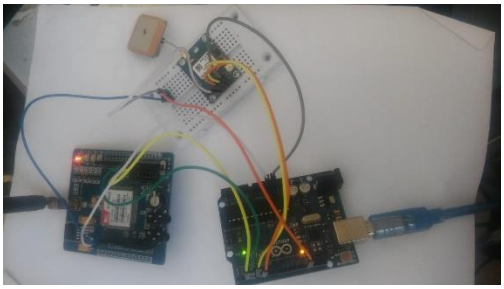
In this system we are using Arduino uno to send sms or call to the controller present at control room. The sms is sent with its vehicle location with the help of the gsm(sim900A) module and gps. Another Arduino uno that are we are using is for traffic signal control the lights when any ambulance is on the way. Blynk app is used to control the traffic signals. Whenever light is controlled by app the corresponding green light will be ON until it is switched OFF again in app. IR sensors will detect the density of the traffic based on the density the green light will ON. The vehicle concentration or density will be detected by the IR LEDs. The controller will take the data from IR communication taking place in between IR Transmitter and IR Receiver. The microcontroller Arduino uno will process this received data and show the signals through red, yellow and green LED's.



Hardware connections of traffic controlling system



Working model of the traffic system



Hardware for notifying the controller

7. Analysis:

Here we present automated traffic signal monitoring based on IoT as well as a control system that automates the full working of the traffic signal system and also allows manual override.

The controller can rewrite each light and turn it green when ambulances or other high-priority vehicles pass by, while the other signals remain red.

It has a traffic signal monitoring and control system that can be remotely controlled via the internet from anywhere with the possibility of manual overriding

The system controls the density of traffic signals using an Arduino-based circuit system and sends the data to the controllers via the Internet.

We use Blynk App to develop an online GUI based system for traffic congestion management. The system displays current densities and thus helps to control the traffic situation on the roads.

8. Conclusion:

In this paper, we have successfully designed and analyzed an automatic traffic light controller for emergency vehicles and also density management. Arduino Uno is used as the micro controller and the system can be operated wirelessly using blynk application during emergency cases. To alert the controller we are sending notification through ambulance with the help of gps and gsm modules. The proposed system is a self-organized system for providing a way for the emergency vehicles and controlling the congestion of the traffic. In this system the microcontroller is utilized to control the traffic light system and it can be easily reprogrammed. The components used in this system leads to low cost and easy installation.

9. References:

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