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INTELLIGENT TRAFFIC MANAGEMENT SYSTEM USING INTERNET OF THINGS

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Abstract : Nowadays Traffic Congestion is a big issue in many large cities of India and traffic lights are basically used to control the flow of vehicle. Failure of signals, increasing number of vehicles, poor law enforcement, and bad traffic management has result in traffic congestion. The effectiveness of traffic control system depends on its ability to react on real-time traffic conditions.

All metropolitan cities face traffic congestion problems especially in the down- town areas. Normal cities can be transformed into "smart cities" by exploiting the information and communication technologies. Intelligent traffic management system proposes an IoT based traffic management solution for smart cities. It also coordinates with an emergency vehicle (ambulance) driver to find the signal status and choose the path through Internet to his destination. Whenever an emergency vehicle comes to the traffic signal then it will show the green path for that emergency vehicle and red to all other paths.

Key words:Smart cities, emergency vehicle.

1. INTRODUCTION

An emergency vehicle is any vehicle that is designated and authorized for emergency service (such as police, ambulance and fire). Priority-based sig- nalling will give priority to emergency vehicles and can thus save lives and property. Several WSN-based traffic management schemes and methodolo- gies have been designed and developed to prioritize emergency vehicles and have been reported in the literature. It can be found that most of the efforts are related to intelligent traffic control system design for smooth passage of emergency vehicles.The priority based intelligent traffic management system. The sensors placed on traffic signals will detect the RF signal and the code transmitted from the vehicles. The sensor sends the data to the traffic light controller. The controller checks for priority and manages the signalling. Af- ter the passage of an emergency vehicle,the traffic control system reverts back to its normal operation. If two emergency vehicles of the same priority arrive at the intersection point at the same time,then signalling of the green light is given based on distance measurements of emergency vehicles from the inter- section point. A vehicle with less distance from the intersection point will be given priority.

2. LITERATURE SURVEY

The demand for transportation too increases with the rise in population and hence the number of vehicles has also risen. It is essential that the population growth is complemented by the infrastructural development to enhance urban mobility. But in the current scenario, the conventional traffic management system is inefficient with the use of traffic lights and manual police control. This in turn leads to heavy traffic problems and jams and as a result increases vehicle emissions and consumes our precious time. Traffic Congestion is a major issue; to overcome this problem design was developing using wireless technology with IR sensor. It was used to provide Green path for emergency vehicle. But this design was implemented only for automatic mode of operation.

It was designing so that more number of vehicles are passed in signal. Priority number would be given to different category of vehicles. Emer- gency vehicles like ambulance, fire trucks etc would have first priority. Next priority is given to VIP's and Next to ordinary Vehicles. Priority was also given depending upon vehicle density in one side of road in traffic junction. The road which had higher vehicle number would get highest priority.

Kumar et al.[8] Discussed about An intelligent traffic controller is designed with components like arduino, RF module, IR sensors. Arduino is the main component which is used to control all, it acts like a controller. Density of the traffic will be decided with the help of IR sensors. And in order to give Green path (Zero traffic) for emergency vehicles RF technology is used. Along with this RFID is used to trail stolen automobiles too outcome of model is as expected.

Tendulkar et al.[15] say's about Last few Decades the traffic management it's the vital issues in a big cities. With the help of Internet of Things(IoT) we can improve the traffic efficiency. In this we describe the things using Internet to control the traffic well. Last few decades the major problem is increasing number of vehicles as same as growth of population because of it causes major traffic congestion , noise and increase travelling time due to this congestion of traffic is increases along with increase the pollution every day on road traffic is jammed. In this we can manage the traffic signals by monitoring the traf- fic density to avoid traffic congestion on road using network communication between server and hardware module. The traffic awareness it is most key problem now a days . Basically the architecture is divided into modules such as wireless sensor network, RFID, GPS.

Misbahuddin et al.[10] Defined that Nowadays Traffic congestion has become major problem in rapidly expanding in cities. This necessitates finding a new way for controlling traffic system. This has been managed through real time traffic density management using IoT. An intelligent traffic management sys- tem has been designed to control traffic system which includes components consisting of arduino, IR sensor, LCD display. Arduino is the key component which is used to control all performance multitasking.IR sensor is used to monitor the density of traffic. The corresponding data are then made avail- able on website in order to display the traffic status so that people will get early update and can avoid the traffic jams.

Javaid et al. [6] there is work entitled that smart Traffic management system is considered as one of the major dimensions of a smart city. With the rapid growth of population and urban mobility in metropolitan cities, traffic conges- tion is often seen on roads. To tackle various issues for managing traffic on roads and to help authorities in proper planning, a smart traffic management system using the Internet of Things (IoT).

A hybrid approach(combination of centralized and decentralized) is used to optimize traffic flow on roads and an algorithm is devised to manage various traffic situations efficiently. For this purpose, the system takes traffic density as input from sensors, then manages traffic signals. Besides this, RFID are also used to prioritize the emergency vehicles such as ambulances and fire brigade vehicles during a traffic jam. In case of fire on the road, To demonstrate the effectiveness of the proposed traf- fic management system, a prototype is developed which not only optimizes the flow of traffic but also connects nearby rescue departments with a centralized server. Moreover, it also extracts useful information presented in graphical formats that may help the authorities in future road planning.

Al-Sakran[1] say's about Traffic Congestion is a big issue in many large cities of India and traffic lights are basically used to control the flow of vehicle. Failure of signals, increasing number of vehicles, poor law enforcement, and bad traf- fic management has result in traffic congestion. One of the major issues with Indian cities is that we cannot expand the existing infrastructure more, so we have only one option available is better management of the traffic. The effec- tiveness of traffic control system depends on its ability to react on real-time traffic conditions. However, conventional traffic control system is not able to do this. whatever the traffic density high or low the signals are timed and run according to that time only. This result in increased traffic congestion along the roads which again result in significant air pollution an increased safety risk and negative impact on the economy and the overall quality of life. In this paper, we tend to planned development smart traffic management System based on the Internet of Things (IoT).

Janahan et al. [5] there is work entitled that 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 ma- jor advantage of this system is that it can able to decrease the more waiting time for the drivers to cross road signal. In Using this new model will

be li- able 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."

Casas et al.[3] Discussed about Real-time predictions are an indispensable requirement for traffic management in order to be able to evaluate the effects of different available strategies or policies. The combination of predicting the state of the network and the evaluation of different traffic management strate- gies in the short term future allows system managers to anticipate the effects of traffic control strategies ahead of time in order to mitigate the effect of con- gestion. This presents the current framework of decision support systems for traffic management based on short and medium-term predictions and in- cludes some reflections on their likely evolution, based on current scientific research and the evolution of the availability of new types of data and their associated methodologies.

Ekedebe et al.[4] there is work entitled that Traffic problems are very common in the growth concentration of population, rapid urbanization and economic activities of certain point of the world. In view of the above, this research work examine, toward efficient and effective traffic management system for Abakpa The methods used for data collection were mainly questionnaire administra- tion; secondary data extracted from documented information relevant to the research work; format and informal interview and data analysis technique and interpretation.

Bertini and El-Geneidy[2]say's about Intelligent Transportation Systems (ITS) for system management purposes, there is now the ability to extract archived data that can be used to evaluate the implementation of new operational strate- gies. In recognition of the need to provide feedback to decision-makers, efforts are underway to provide rigorous documentation of ITS benefits and costs. The objective of this paper is to describe how Advanced Traffic Management System (ATM) data are being used to contribute toward these evaluations. ITS compo- nents that are integrated can result in synergistic effects when considered as an entire system. It is shown that in some cases it is possible to build upon national level statistics describing ITS benefits by using data collected from the systems themselves. It is hoped that further efforts to integrate transportation planning with evaluation methodologies will incorporate the necessary empir- ical results from a wide variety of studies.

Lakshminarasimhan[9] tells about In the contemporary world, urban mobility is one of the unprecedented challenges to be tackled in the administration of a big city. An advanced traffic management system is proposed, implemented using Internet of Things (IoT). The functionalities of the system include efficient traffic light control, parking space identification and security mechanism. su- pervised learning methodologies are proposed that would help in determining the standard of roads, estimating overall traffic flow, calculating average speed of distinct vehicle types on a road and analyzing the travel path of a vehicle.

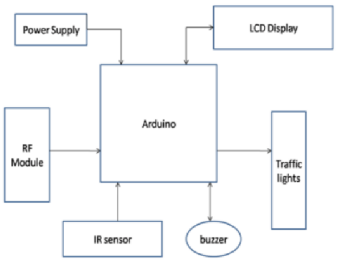
Roychowdhury and Das[13] said that It is a system that manages the road traffic in a city automatically by combination of algorithms, equipment's and communication networks without involvement of human personnel in decision making according to various kinds of situations of road traffic that arise in a city. The approach of this paper is traffic signaling at a crossing point by mea- suring traffic density in each road. Also, vehicles that will violate signals at crossing points can be tracked by this system. Sometimes, situations like road congestion and exceed of limit of maximum traffic capacity of a road can arise and this system can also take decisions automatically accordingly. Vehicles can never cross the speed limit under this system.

Kim and Tran [7] tells about I emergency vehicles like Ambulances, Police cars and Fire Brigade trucks get stuck in jams which leads to loss of many human lives. So we have done a project on IoT based online traffic congestion moni- toring and management system , which provides clearance to any emergency vehicle. Rath[12] said that Over the years, there has been a sudden increase in the number of vehicles on the road. Traffic congestion is a growing problem ev- eryone faces in their daily life. Manual control of traffic by traffic police has not proved to be efficient. Also the predefined set time for the signal at all circumstances (low and high traffic density) has not solved this problem. A model to effectively solve the above mentioned problems by using Internet of Things (IoT) is proposed. will be done on the basis of the traffic density on the lanes of a road.

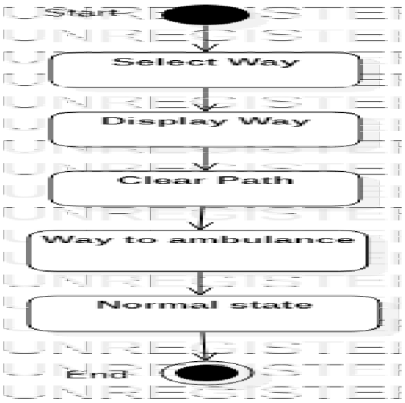
Shah et al.[14] tells about In the current context of smart city, specifically in the industrial and market zones, the traffic scenario is very congested most of the time particularly at the peak time of business hours. Due to increasing growth of population and vehicles in smart and metropolitan cities people face lot of problem at the major traffic points of the business towns. Not only it causes travelling delays, it also contributes to environmental pollution as well as health hazards due to pollution caused by vehicle fuels.To keep away from such severe issues many radiant urban communities.Morrison[11] Discussed about Right now implementing smart traffic control frameworks that work on the standards of traffic automation with prevention of the previously mentioned issues. The fundamental concept lies in collection of traffic congestion information quickly and passing the alternate strategy to vehicles as well as passengers with on-line traffic information system and ef- fectively applying it to specific traffic stream.

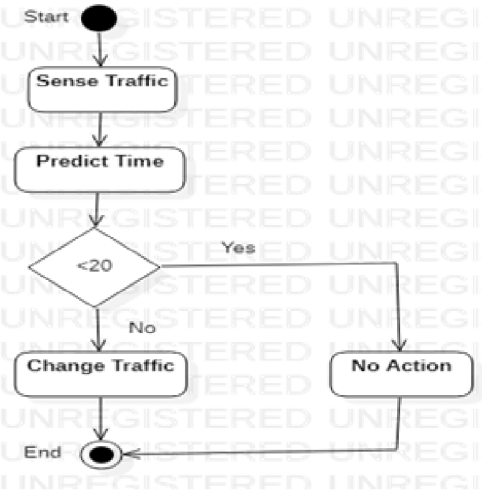
3. IMPLEMENTATION

A) Block Diagram



B) Activity Diagram





C) Module Description

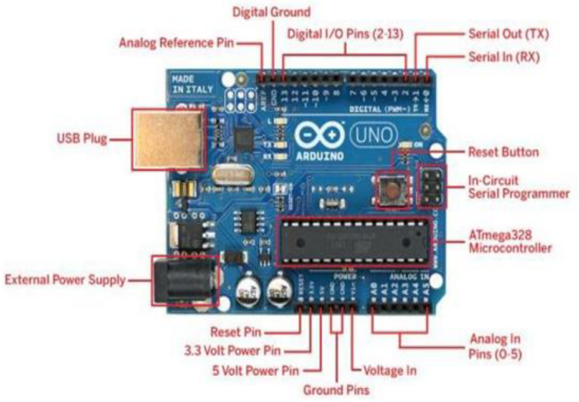
Over the years, there has been a sudden increase in the number of ve- hicles on the road. Traffic congestion is a growing problem everyone faces in their daily life. Manual control of traffic by traffic police has not proved to be efficient. Also the predefined set time for the signal at all circumstances (low and high traffic density) has not solved this problem. A model to effectively solve the above mentioned problems by using Internet of Things (IoT) is pro- posed. We use cloud for internet based computing, where different services such as server, storage and application are delivered for traffic management. A network of sensors is used to track the number of vehicles and the traffic congestion at the intersections on a road and rerouting will be done on the basis of the traffic density on the lanes of a road.

ARDUINO

The power of the Arduino is not its ability to crunch code, but rather its ability to interact with the outside world through its input-output (I/O) pins. The Arduino has 14 digital I/O pins labeled 0 to 13 that can be used to turn motors and lights on and off and read the state of switches. Each digital pin can sink or source about 40 mA of current. This is more than adequate for interfacing to most devices, but does mean that interface circuits are needed to control devices other than simple LED's. In other words, you cannot run a motor directly using the current available from an Arduino pin, but rather must have the pin drive an interface circuit that in turn drives the motor. A later section of this document shows how to interface to a small motor.

The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the

VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board.



Features of Arduino:

- Inexpensive
- Cross-platform
- Simple, clear programming environment
- Open source and extensible software
- Open source and extensible hardware

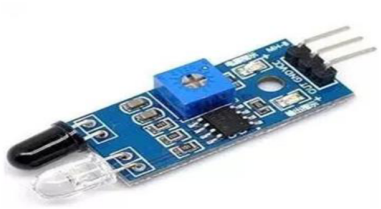
MODULES

1. IR sensor
2. RF module
3. Bread Board
4. Buzzer
5. LED Lights

IR SENSOR

IR Sensor is used to count the vehicles on the road. Traffic density at road in a junction is measured with the IR sensor. Glowing of each LED has performs with predefined time delays until if the road has high traffic density. Traffic LEDs are connected to Port B and D. IR sensors are connected to Port C. A passive infrared sensor (PIR sensor) is an electronic sensor that measures in- frared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. PIR sensors are commonly used in auto- matic lighting applications.

PIR sensors detect general movement, but do not give information on who or what moved. For that purpose, an active IR sensor is required. PIR sensors are commonly called simply "PIR"or "PID", for "passive infrared detector".The term passive refers to the fact that PIR devices do not radiate en- ergy for detection purposes. They work entirely by detecting infrared radiation (radiant heat) emitted by or reflected from objects.

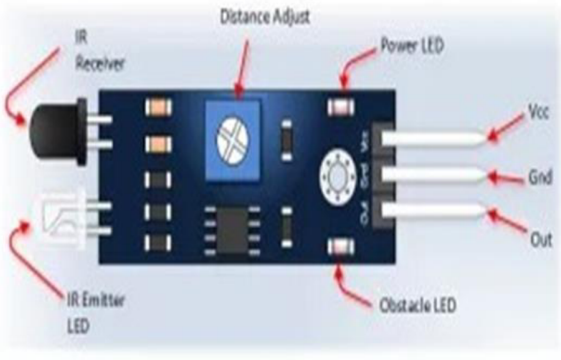


IR SENSOR INTERNAL STRUCTURE

An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings. It does this by either emitting or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion. The 5 VDC supply input is given to the VCC pin and the supply negative is connected to the GND terminal of the module. When no object is detected within the range of the IR receiver, the output LED remains off.When a object is detected within the range of the IR sensor the LED glows. Whenever a button is pressed on the remote, it sends an infrared signal in encoded form. This signal is then received by the IR receiver and given to the Arduino.

RF MODULE

The RF module, as the name suggests, operates at Radio Frequency. The cor- responding frequency range varies between 30 kHz and 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of car- rier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many rea- sons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications .Next, RF transmission is more strong and reliable than IR transmission.



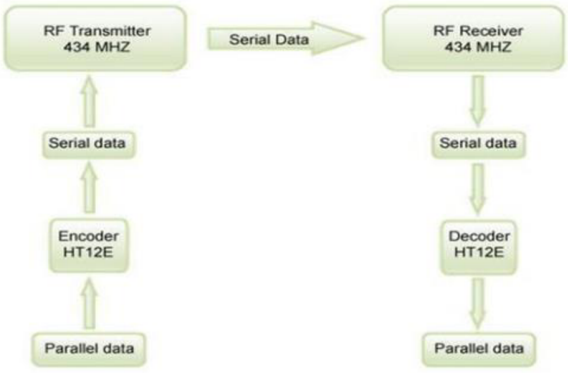
RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This

RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.

RF TRANSMITTER AND RECEIVER MODULE

This radio frequency (RF) transmission system employs Amplitude Shift Keying (ASK) with transmitter/receiver (Tx/Rx) pair operating at 434 MHz The trans- mitter module takes serial input and transmits these signals through RF. The transmitted signals are received by the receiver module placed away from the source of transmission.

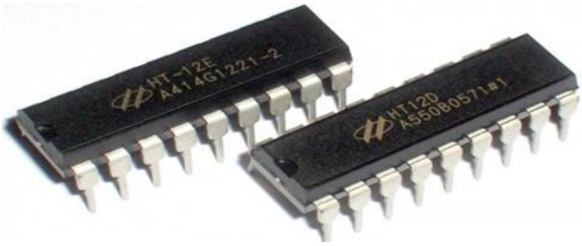
The system allows one way communication between two nodes, namely, trans- mission and reception. The RF module has been used in conjunction with a set of four channel encoder/decoder ICs. Here HT12E and HT12D have been used as encoder and decoder respectively. The encoder converts the parallel inputs (from the remote switches) into serial set of signals. These signals are serially transferred through RF to the reception point. The decoder is used af- ter the RF receiver to decode the serial format and retrieve the original signals as outputs. These outputs can be observed on corresponding LEDs.



HT12E

HT12E is an encoder integrated circuit of 212 series of encoders. They are paired with 212 series of decoders for use in remote control system applica- tions. It is mainly used in interfacing RF and infrared circuits. The chosen pair of encoder/decoder should have same number of addresses and data format.

HT12E converts the parallel inputs into serial output. It encodes the 12 bit parallel data into serial for transmission through an RF transmitter. These 12 bits are divided into 8 address bits and 4 data bits. HT12E has a transmission enable pin which is active low. When a trigger signal is received on TE pin, the programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium. HT12E begins a 4-word transmis- sion cycle upon receipt of a transmission enable. This cycle is repeated as long as TE is kept low. As soon as TE returns to high, the encoder output completes its final cycle and then stops.



HT12D

HT12D IC comes from HolTek Company. HT12D is a decoder integrated circuit that belongs to 212 series of decoders. This series of decoders are mainly used for remote control system applications, like burglar alarm, car door controller, security system etc. It is mainly provided to interface RF and infrared circuits. They are paired with 212 series of encoders. The chosen pair of encoder/de- coder should have same number of addresses and data format.

HT12D converts the serial input into parallel outputs. It decodes the serial addresses and data received by an RF receiver, into parallel data and sends them to output data pins. The serial input data is compared with the local addresses three times continuously. The input data code is decoded when no error or unmatched codes are found. A valid transmission in indicated by a high signal at VT pin. HT12D is capable of decoding 12 bits, of which 8 are address bits and 4 are data bits. The data on 4 bit latch type output pins remain unchanged until new is received.

BUZZER

Piezo buzzer is an electronic device commonly used to produce sound.Piezo buzzer is based on the inverse principle of piezo electricity discovered in 1880 by Jacques and Pierre Curie. It is the phenomena of generating electricity when mechanical pressure is applied to certain materials and the vice versa is also true. Such materials are called piezo electric materials.

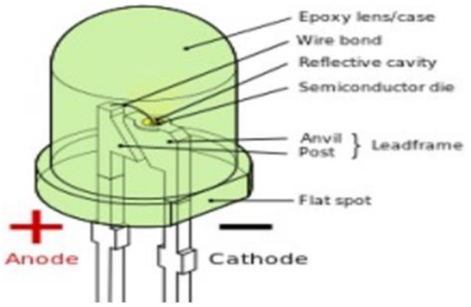
Piezo electric materials are either naturally available or manmade. Piezo- ceramic is class of manmade material, which poses piezo electric effect and is widely used to make disc, the heart of piezo buzzer. When subjected to an alternating electric field they stretch or compress, in accordance with the frequency of the signal thereby producing sound. Connection between button and Arduino uno are as follows

1. Connect the Supply wire (RED) of the buzzer to the Digital Pin 9 of the Arduino
2. Connect the Ground wire (BLACK) of the buzzer to any Ground Pin on the Arduino

LED LIGHTS

LEDs are used for the purpose of signaling according to the traffic condition LED lights are used as traffic lights. It is a diode. When the p-n junction is forward biased, it emits light in the form of photon. We can get different colours; this colour is determined by gap in the energy band.

A light emitting diode (LED) is essentially a pn junction diode. The LED lighting is a light that uses LEDs as a source of lighting and most illumination comes from an incandescent or fluorescent light bulb. This is very different from the traditional one.LEDs can be installed into traditional lights an used like most other light bulb. The LED has to be structured so that the photons generated from the device are emitted without being reabsorbed. One solution is to make the p layer on the top thin, enough to create a depletion layer. There are different ways to structure the dome for efficient emitting.



4. CONCLUSION

TMS -Traffic Monitoring Signal timing has been developed buying multiple features of hardware components in IoT. In major metropolis across the planet traffic jams are bound to happen during peak hours and therefSore Traffic optimization is achieved using IoT platform for efficient utilizing allocating 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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