

IoT Based Traffic Monitoring System with Priority to Emergency Vehicles

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Abstract: Traffic congestion has been a major problem in our country from past few years, which affects modern city's daily life routine and disturb environments. Due to increase in population, size of cities expands, automatically number of vehicles increases in major scale on roads. There are number of problems such as travel time delay, fuel wastage, air pollution and create issues related to transport. So the biggest challenge on traffic management authorities is to control and monitor the traffic. We design and develop system for real-time a traffic monitoring using IoT platform and sensing technology. This system includes piezoelectric sensors which are used to detect vehicle traffic levels at the lanes and this data is received at the controller and transmitted to web server through a wifi module. The server stores and analyzes the monitored data. Traffic is controlled by traffic signal control method which depends on the detecting traffic levels at the lanes. When there is high traffic level in any lane, then it gives highest priority to passing vehicles. RF transceivers used to communicate the main system to priority system which receives and transmits traffic related message. This system is reliable, simple and low cost.

IndexTerms - -Internet of things, Emergency priority, Wireless technology, Traffic monitoring and controlling system.

I. INTRODUCTION

Due to urbanization number of roads, vehicles are increasing rapidly. Most of the metro cities in the world are still suffering from traffic congestion and related problems[1]. Many transport related problems are created such as fuel wastage at intersection, travelling time delay between two major cities, air pollution due to emission, death on roads due to accidents etc. Studies show 30% dioxide emissions are from transportation systems, inefficient traffic management leads to fuel wastage of billion gallons per year, also poor designed traffic signals produce disruptions to traffic flows and increase delays[2]. Two major cities are connected by expressways which are causing deaths due to accidents. In recent years researchers examined highway accidents involved many road users (vehicles, pedestrians, animals) and resulted in serious injury victims, which is neglected by human beings and government authorities. To overcome such problems, intelligent road traffic management systems are required in the highways which can monitor real-time traffic and traffic status at intersection in cities. This system process needs to be done at 24/7 hours to check traffic status on the roads, which could be done by using IoT technology. Latest approaches such as sensing technology is used for real time traffic monitoring. Sensors are used to detect traffic level status at an intersection. The designed system uses sensor network and collects data about the traffic level status at the lanes. Piezoelectric sensors are used to monitor traffic levels and this data is processed at controller unit and transfer data through wifi module to the web server. This IoT platform analyzes real-time data. IoT is a novel paradigm that is rapidly gaining ground in the scenario of wireless telecommunications[3].

This paper propose to use sensing technology to monitor vehicle traffic data using piezoelectric sensors, detect traffic levels and transfer data to controller unit which processes data and display on the server. This method is used to reduce traffic problems and for emergency vehicle priority at signal. If at any lane high traffic level detects then, signal gives more time to pass vehicles. This embedded system using wireless sensor network provides a frame work for monitoring and controlling traffic related real-time information.

II. LITERATURE SURVEY

A literature survey is the section which shows various analysis and research made in the field of interest and the results already published,taking into account the various parameters of the project and extends of the project

[1] An IoT based automated traffic control system with real time update capability: An automated microcontroller based traffic control system using sensors along with live web updates can be a helpful step in optimising the traffic flow pattern in busy intersections.

[2] IoT for intelligent traffic system: This paper suggests a new scheme for applying the IoT to intelligent traffic systems. The intelligent traffic system is implemented using road side units with friction motoring, vehicles with environmental sensors and data base for data transfer through different platforms.

[3] IoT based vehicle traffic congestion control and monitoring system: In this venture as we probably are aware vehicle movement clog and observing has turned out to be one of the basic issues in street transport. This paper depicts a technique to take care of the issue of intangibility of activity flag created by colossal vehicles.

[4] Internet of vehicles for traffic management: IoT is a worldwide network connecting all the smart objects together. Whenever these smart things being connected over internet are restricted to only vehicles, then it is called as internet of vehicles(IoV).

[5] A review of IoT devices for traffic management system: traffic management has become one of the vital areas to be looked into. It includes monitoring of traffic density, communication, rerouting of traffic to avoid further delay.

[6] A prototype IoT based wireless sensor network for traffic information monitoring: An IoT based wireless sensor system, solely using wireless accelerometers, is developed for traffic volume and vehicle classification monitoring in this paper.

III. PROPOSED SYSTEM

This section presents a working theory of real time vehicle monitoring and controlling system using IoT platform. In the proposed system piezoelectric sensors are equipped at roadside for monitoring traffic levels. Roadside sensors are detecting vehicles and find the traffic level at that lane. Such levels are low, medium and high which mounted at a particular distance gap. The data sensed continuous and sent to controller for detecting if the traffic level is high then controller control signal timing at that lane and gives more time to pass vehicle. If low traffic level detects then controller control signal timing at that lane gives less time to pass a vehicle. So this system gives priority to emergency vehicle at a high traffic level. The controller communicates with the priority system through RF transceivers. It is used to transmit as well as receive the warning message or any other traffic status from the controller unit to LCD display.

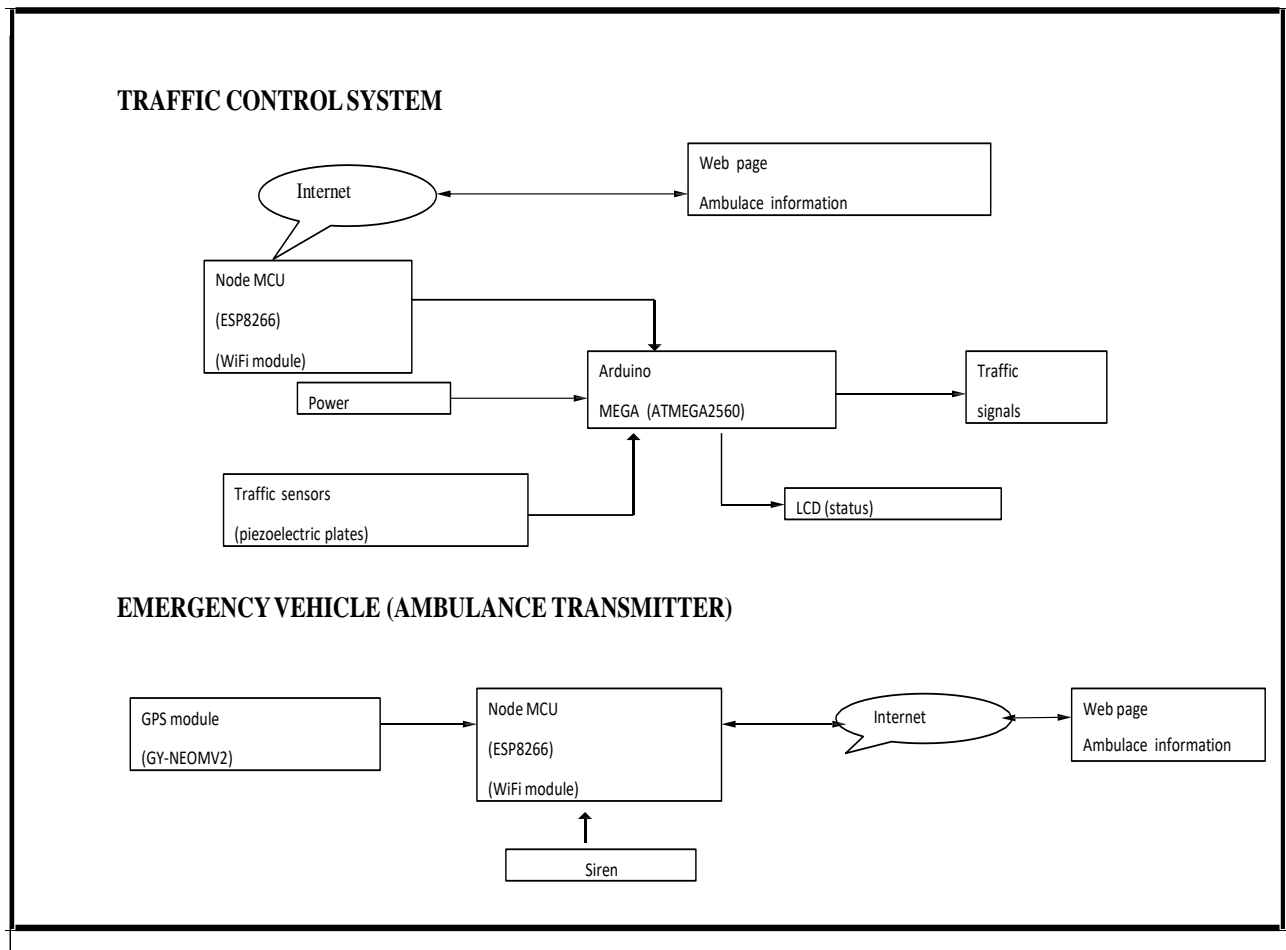


Fig 1:Block diagram of proposed system

A. Hardware

The hardware part of proposed system consists of Arduino Mega2560, piezoelectric sensors, NodeMCU, GPS module, 16*2 LCD for display outputs, Wi-Fi module(ESP8266) to transfer data to internet and RF transceiver.

- 1) Arduino Mega2560 is a microcontroller board based on the ATmega2560. It has 54 digital input or output pins, 16 analog inputs, 4 UARTs, a 16MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.
- 2) A piezoelectric sensor is a device that uses the piezoelectric effect, to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge. Piezoelectric effect is the ability of certain materials to generate an electric charge in response to applied mechanical stress.
- 3) NodeMCU is an open source IoT platform. The NodeMCU development kit based on ESP8266, integrates GPIO, PWM, IIC, 1-wire and ADC all in one board.
- 4) GPS Module- This board features the u-blox NEO-6M GPS module with antenna and built-in EEPROM. This is compatible with various flight controller boards designed to work with a GPS module.

B. Software

Arduino IDE(Integrated Development Environment) is used for programming both Arduino Mega and NodeMCU. The Arduino integrated development environment is a cross-platform application that is written in the programming language Java.

C. Flowchart

The software implementation of this system is developed using flowchart shown in Fig.2

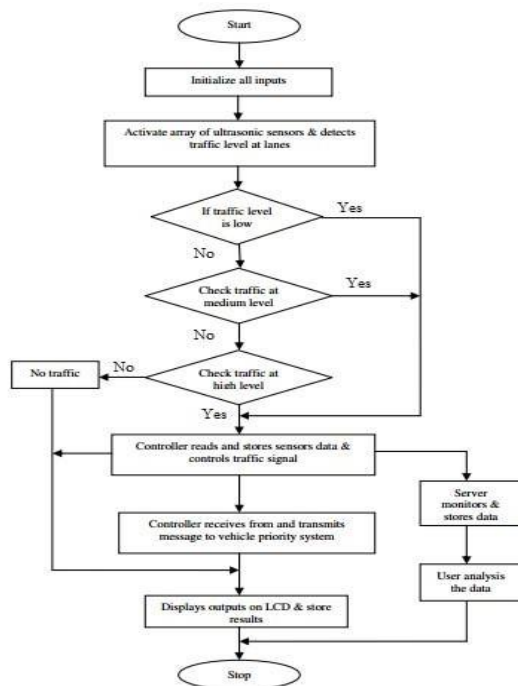


Fig 2:Flowchart of experimental steps

D. System Design Implementation

The proposed system design implemented in two parts, first is traffic monitoring and controlling unit and emergency vehicle.

- 1) Traffic Control System is based on Arduino Mega microcontroller board. It monitors traffic signalling to each road with proper delay time. The piezo-electric plates are placed on the roads which act as traffic sensors by sending signals based on vehicle movement. The controller gets this information. Based on the traffic density on road, it varies the signal delay time so as to provide clearance to road with dense traffic. The ESP8266 module is connected to internet via wifi. It accesses a web page created on ThingSpeak platform where location information of emergency vehicles is updated. It sends the information to the main controller when an emergency vehicle is approaching the junction. The controller then clears the road when the emergency vehicle is approaching the priority. The traffic signalling status is updated on a LCD for convenience.
- 2) The emergency vehicles are equipped with a control unit-NodeMCU. It is based on ESP8266 which is a wifi module. A GPS module is interfaced to the NodeMCU which provides the location information. Whenever there is emergency, the NodeMCU updates the location of the vehicle to the web page created on ThingSpeak via internet thus making it easy for traffic control systems to provide clearance to emergency vehicles quickly.



Fig 3:Traffic control and monitoring system

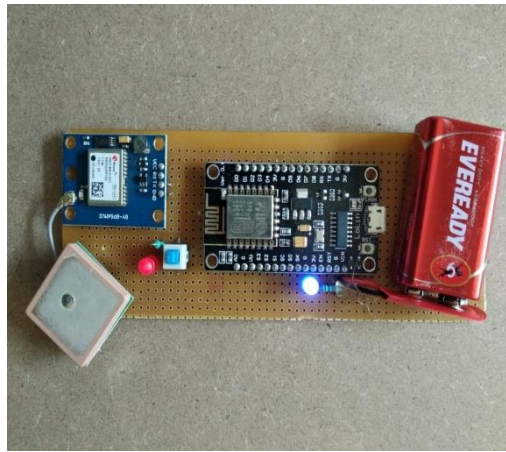


Fig 4:Emergency vehicle

IV. EXPERIMENTAL RESULTS

IoT platform for real-time traffic monitoring system using piezo electric sensors detect traffic levels at roads 1 and 2 shows on LCD display. LCD display shows vehicle traffic levels at roads 1 and 2 and signal timing according to traffic signal control algorithm. Road 1 indicates high level traffic so highest priority is given to this lane and road 2 indicates medium traffic level so it's given less signal time than road 1

V. CONCLUSION

Our country is ranked highest in the world for traffic related problems, thus there is the need to reduce traffic related issues such as long travelling time, fuel wastage, air pollution and transport related problems, this proposed system developed. Here developed system for real-time traffic monitoring using IoT platform which is reliable for users. This system also controls signal time, according to traffic levels at the lanes, gives priority to emergency vehicle. The proposed system is more reliable, easily operates by users and low cost system and easily equipped at any place.

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