

Signal Prioritization for Emergency Vehicles and Public Transit using IoT

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Abstract: Traffic management on the road has become a severe problem of today's society because of growth of the urbanization, industrialization and population. This in turn has an adverse effect on the economy of the country as well as the loss of lives. Traffic lights play an important role in traffic management. Traffic lights are the signaling devices that are placed on the intersection points and used to control the flow of traffic on the road. The emergency vehicle such as an ambulance finds itself stuck in the vehicle congestion when it is in a signal with red signature on it. The proposed idea is to provide an IOT link between the ambulance and the traffic signal system. The destination and the Route data will be sent to the traffic signal management system which will force signals in to an operation as required by the ambulance by means of a IOT based communication Protocol. The system will include an Android based tablet , an android based user interface which can post values on to internet and has access to Google maps API. The hardware on the receiver end of the signal will include a Data card or modem with internet facility enabled and Arduino Uno and Ethernet for processing the inputs at the receiving end. The ambulance with predefined destination set using IOT and GPS will find its way through the city using Google Map API and Internet service. Thus the IOT based Smart traffic signal system will pave a way for fastening emergency transportation system and help in saving precious human lives.

Keywords—Google maps API, IOT, GPS, Android, Data card , Arduino Uno

I. INTRODUCTION

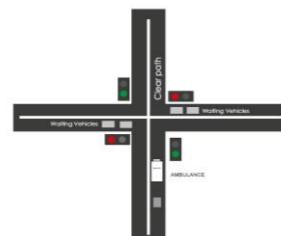
The continuous increase in the congestion level on public roads, especially at rush hours, is a critical problem in many countries and is becoming a major concern to transportation specialists and decision makers. The existing methods for traffic management, surveillance and control are not adequately efficient in terms of the performance, cost, and the effort needed for maintenance and support.

The traffic lights are used mainly for pedestrians to be protected when they cross the roads. The normal function of traffic system is to control the coordination to ensure that traffic moves as smoothly and safely as possible. It was reducing collisions, both vehicular and pedestrians. It was encourage travel within the speed limit to meet the green lights.

The emergency will occur any way, any time and on any location. In that case the speedily response is required. The number of vehicles using the limited road networks infrastructure which was slowly increased. The major consequence of this increase is the traffic management problem. One of the most critical consequences of traffic problem is the delay of emergency vehicles such as,

ambulance during accidents to reach hospitals on time, Fire brigade vehicles, police van to catch the thief, and VIP vehicles.

Particularly in India, Most of people cannot give a way for an ambulance because of traffic. The Indian ambulance experiment was done around 400 cars on the road. There was 0% response to an Indian ambulance. Suppose someone has suffered a heart attack and needs ambulance immediately. But by



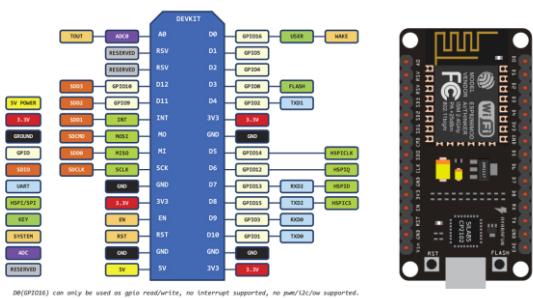
this way the patient will die before the ambulance could reach to the hospital.

This paper provides IOT based unit onboard the ambulance which will have a destination setting option on screen on an android based display system. This method of signal prioritization for ambulance will smoothen and fasten the emergency transport system and will play a vital role in saving lives of the critical patients at risk.

II. ESP 8266 NODE MCU DEVELOPMENT BOARD

A. ESP 8266 Microcontroller

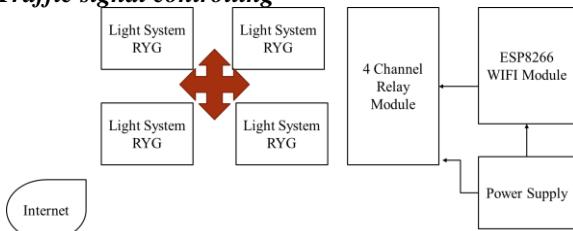
Our proposed traffic signal controlling algorithm requires an intelligent hardware platform which could give dependable performance in the harsh traffic environment. NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs. ESP8266 is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications. It uses many open source projects such as lua-cjson. The project expanded to include an open hardware platform. The NodeMCU was able to support MQTT IoT protocol. NodeUSB was designed to leverage NodeMCU for easy programming and has extra feature of USB capability.



B. Specifications

ESP 8266 is integrated low power 32-bit MCU. It is also Integrated 10-bit ADC and TCP/IP protocol stack. It supports antenna diversity. It has WiFi 2.4 GHz, support WPA/WPA2. It is integrated TR switch, balun, LNA, power amplifier and matching network. It has a deep sleep power $<10\mu\text{A}$, Power down leakage current $< 5\mu\text{A}$. It functions as standby power consumption of $< 1.0\text{mW}$ (DTIM3). The operating temperature range $-40^\circ\text{C} \sim 125^\circ\text{C}$. It has $+20\text{ dBm}$ output power in 802.11b mode. It supports STA/AP/STA+AP operation modes and integrated PLL, regulators, and power management units. AngularJS is a very powerful JavaScript Framework. It is used in Single Page Application (SPA) projects. It extends HTML DOM with additional attributes and makes it more responsive to user actions. AngularJS is open source, completely free, and used by thousands of developers around the world. **Priority based Traffic light signal**

C. Traffic signal controlling

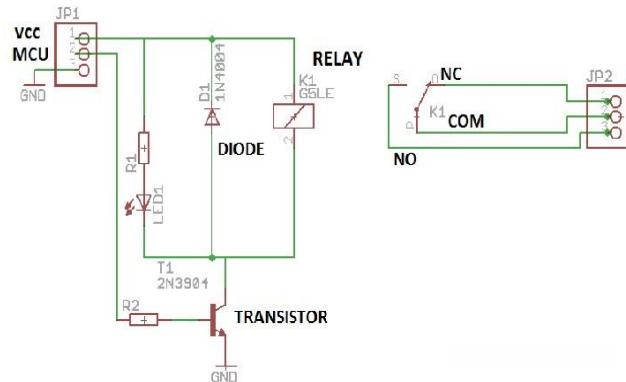


Four way traffic controller consists of red, yellow and green. It is connected to Four channel relay module. It acts as switch. ESP8266 microcontroller is a wifi module which is connected to relay. The power supply is given to four channel relay module and to ESP8266 microcontroller. Internet is connected to the microcontroller which is connected to android mobile app. Android User Interface consists of map which shows destination to reach the hospital. When the emergency vehicles reaches 1km before the signal, then signal is automatically turned to green.

D. Relay Module

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "relays.



Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts.

SYSTEM OVERVIEW

E. Internet of Things

The internet of things (IoT) is the internetworking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings and other items-embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society. The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Apache Cordova enables software programmers to build applications for mobile devices using CSS3, HTML5, and JavaScript instead of relying on platform-specific APIs like those in Android, iOS, or Windows Phone. It enables wrapping up of CSS, HTML, and JavaScript code depending upon the platform of the device. It extends the features of HTML and JavaScript to work with the device. The resulting applications are hybrid, meaning that they are neither truly native mobile application (because all layout rendering is

done via Web views instead of the platform's native UI framework) nor purely Web-based (because they are not just Web apps, but are packaged as apps for distribution and have access to native device APIs). Mixing native and hybrid code snippets has been possible since version 1.9.



F. Incident type determination

In case of any accident on road, people usually call the emergency contact number. Emergency contact center will get the information about the number of people involved in the accident, on-site assessment of any life-threatening injuries, fire threat, obstruction to fire-fighting access to rescue people and crowd control issues like riot or fight. In addition to incident report, the central traffic controller can also seek the live feed from the safety camera database for quick analysis and determination of the type of an incident.

G. Methodology

ThingSpeak is an Internet of Things (IoT) platform that lets you collect and store sensor data in the cloud and develop IoT applications. The Thing Speak IoT platform provides apps that let you analyze and visualize your data in MATLAB, and then act on the data. Sensor data can be sent to ThingSpeak from Arduino, Raspberry Pi, Beagle Bone Black, and other hardware.

The Solution for the above problem is GSM enabled Traffic Signal with GPRS. An Android application that can MAP Signals & Status on a Google map and which signals in green. A route to location & Hospital can be selected by ambulance in the app. All the signals & their current will be Displayed. The Traffic signals switch to GREEN when ambulance approaches a distance of 1Km. The Signal

maintains GREEN Signal until the ambulance Crosses it.



III. CONCLUSION

Emergency vehicle movements are challenging issues in metropolitan cities. The concept of smart cities has been introduced to give solutions to such issues. Present Traffic light controlling systems are not fully adaptive to various traffic situations. In current situation traffic flow be controlled under the supervision of onsite traffic officer. The presented scheme may be used to give privilege to emergency vehicle personnel. The emergency vehicle personnel should be able to turn the green lights on for appropriate duration of time in a specific direction. Though it is difficult to change the traffic light during driving, it saves the precious human lives during emergency vehicles. By making use of IOT technology, automatic traffic control signal is possible without human interrupt.

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