

INTERNET OF THINGS BASED SMART TRAFFIC SYSTEM FOR HEALTH AND SOCIO CARE

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Abstract- In most of the Indian cities it is very difficult for the emergency vehicles like ambulance and fire-engine vehicles to reach the destination in time, especially during rush hours, when, much traffic congestions are observed. This situation arises because of not having any smart system installed on the roads to control the free and secured movement of these emergency vehicles to their destinations. This paper proposes a solution for the said problem where in, the commuters on the road at different important junctions and at different equally distant points throughout the road, are notified in advance with the expected time of arrival of these emergency vehicles, so that, they can be given the way to reach the destination without any halt. The proposed solution will be having each ambulance and fire engine vehicle fixed with an RFID tag, all junctions and other significant points on the road will be having emergency vehicle detecting unit consisting of a microcontroller interfaced with an RFID reader and Global Positioning System module, and at significant places Display Units will be fixed which intimate the arrival of emergency vehicle with suitable messages like “Give the way to AMBULANCE and SAVE the LIVE” or “Give the way to Fire Engine Vehicle and Stop Disaster”, etc. on the screen.

Keywords- RFID, Arduino, Internet of Things, GSM, Real-Time System, ThingSpeak.

I. Introduction

It is been experienced by many of a citizens and observed by almost everyone on roads that, in Indian cities, it is very difficult for the emergency vehicles to reach their destination in time specially during rush hours in spite of general public co operations into their best efforts, due to high traffic congestions [1][2][3] and having no smart system installed on the roads to solve this critical issue.

This paper proposes a solution to the afore mentioned problem, in the form of a system which senses the presence (arrival) of the emergency vehicle like ambulance or fire engine at the Emergency Vehicle Detection Units (EVDU), by reading the RFID tag fixed with the vehicle, at different entry points to the main road where traffic congestion is expected, and passes this information to the first Emergency Vehicle Arrival Alarming Unit (EVAAU) which is fixed at one kilometre distance from point of vehicle arrival detection that is Emergency Vehicle Detection Unit fixed at road entry points. EVAAU displays and reads the message such as “Ambulance is approaching, Give the Way and Save Life” and “ Fire-Engine is approaching, Give the Way and Stop Disaster” in case of ambulance and fire engine arrival respectively, this unit also displays the expected time of arrival of emergency vehicle.

When the emergency vehicle reaches the first EVAAU, display and sound alarm is made off and the event of emergency vehicle arrival is sent to the second EVAAU which does the same job as done by the first one, and the second EVAAU sends the emergency vehicle arrival event to the third EVAAU and so on, till the vehicle

reaches the hospital or fire spot. As each EVAAU is interfaced with one GPS module, it sends the current location of ambulance and/or fire-engine vehicle to the destination hospital or fire brigade control room through cloud (using Internet of Things technology) so that hospital management and fire brigades can take the necessary actions accordingly.

The rest of the paper is organized such that the section-II discusses the significance of Arduino Uno board, section-III talks about the Emergency Vehicle Detection Unit, section-IV presents the functioning of Emergency Vehicle Arrival Alarming Unit, section-V discusses about Internet of Things communication, and section-VI concludes the paper.

II. Significance of Arduino Uno Board

Arduino Uno board is an embedded system prototyping platform, its software development tools are all open-source, the associated hardware is easy-to-use, and its programming language generally called as Arduino programming language is easy to learn without much programming background[4]. The Arduino software runs at all the three familiar operating systems Windows, Mac, and Linux. These boards can be extended too, by virtue of this; we can have boards with our own version of modules [4][6]. This board is available in a substantial compact form as illustrated in figure2.

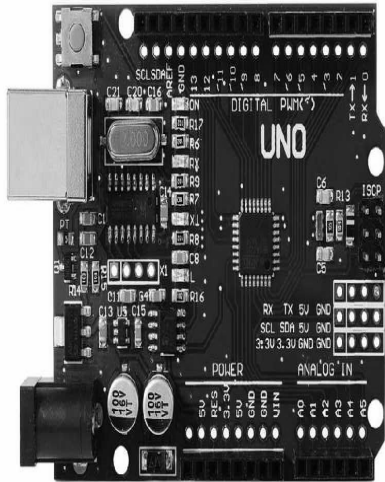


Figure1: Arduino Uno Board

III. Emergency Vehicle Detection Unit

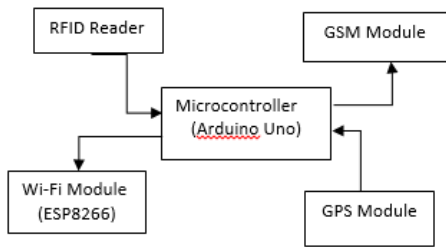


Figure2. Emergency Vehicle Detection Unit

All ambulance vehicles will be fixed with active RFID tags having same unique ID and all fire-engine vehicles will be fixed with the active RFID tags having some other same unique ID. When the emergency vehicle arrives at some entry point to the main road where the Emergency Vehicle Detection Unit (EVDU) is installed whose block diagram is shown in **figure1**, the RFID tag fixed with the vehicle will be read by the RFID reader and the vehicle will be identified by comparing the read tag ID with the registered tag in the memory of the microcontroller that is Arduino Uno, if it is matched with that of the ambulance vehicle then message “Ambulance is approaching, Give the way and Save the Life” will be sent to the first Emergency Vehicle Arrival Alarming Unit (EVAAU) through GSM module. If the read RFID tag is matched with that of the fire-engine tag registered in the memory of the microcontroller then the message “Fire-Engine is approaching, Give the way and Stop disaster” will be sent to the EVAAU. The EVAAUs (discussed in the next section) will be installed on the road after every one kilometre distance in the direction of the vehicle movement. Obviously the first EVAAU will be at one kilometre away from the EVDU.

At the time emergency vehicle reaches the EVDU, Global Positioning System (GPS) module interfaced with

EVDU receives the geographical location from satellite which is read by the microcontroller Arduino Uno, and this information is sent to the hospital in case of ambulance or to fire-brigade control room in case of fire-engine vehicle using the Wi-Fi module shield which is ESP8266 and internet technology, in the prototype demonstration ThingSpeak open source Internet of Things platform was used to send the location of ambulance or fire-engine vehicle to the hospital or fire-brigade control room.

ESP8266 Wi-Fi module is interfaced to Arduino Uno board so that the information received from GPS module about the location of the emergency vehicle be transferred to the hospital or Fire-brigade control room. This is done by acquiring an IP address on ThingSpeak which is a platform for data aggregation online and available freely [5]. After creating a user name and password a channel on ThingSpeak will be provided to us that can be used at the hospital or fire-brigade control room to trace the current location of the emergency vehicle at the time when the vehicle is at EVDU or EVAAU.

IV. Emergency Vehicle Arrival Alarming Unit

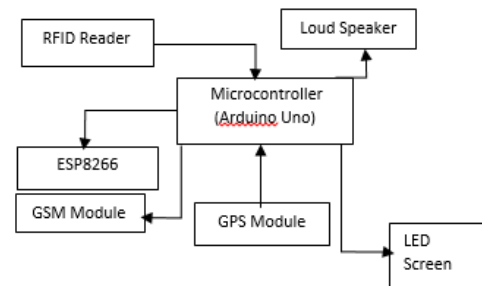


Figure3. Emergency Vehicle Arrival Alarming Unit

The main function of Emergency Vehicle Alarming Unit (EVAAU) is to display the message received from EVDU or preceding EVAAU and play a loud speaker to read the same message as announcement make commuters not to use the reserved space on the road for emergency vehicle (on right hand side of the every road there should be reserved space for emergency vehicle with suitable marking. This can be used by general public when there is no emergency vehicle on the road.) the voice message played on loud speaker will be pre recorded and the file will be loaded into the microcontroller memory. The expected time will also be displayed, this time will also be pre computed by considering the average speed of the vehicle and the distance which is always fixed between two EVAAUs and between EVAAU and EVDU.

When the emergency vehicle reaches an EVAAU, it will be detected by micro controller after comparing its RFID tag read by reader and the registered tag in the micro controller memory, if it is matched either with that of ambulance or of fire-engine vehicle then the LED screen

and Loud Speaker announcement will be made off and this event of emergency vehicle will be sent to the next EVAAU using GSM module and its current location will be sent to the hospital or fire-brigade control room using internet of things technology with help of ESP8266 Wi-Fi module and GPS module in the same way as already discussed above.

V. Communicating Through Cloud

Whenever the emergency vehicle will be at the location of EVDU or any EVAAU, this status will be sent to the destination hospital or fire-brigade control room based on whether the vehicle is ambulance or fire-engine using Internet of Things (IoT) technology. This is possible by creating a data logger channel on the open source Internet of Things platform ThingSpeak [5]. The location of the emergency vehicle at the aforementioned locations are sent first to the nearby router fixed for our purpose or for multipurpose options, from the Wi-Fi module ESP8266 which is fixed at both the units EVDU and EVAAU. At the hospital and fire-brigade control room the location of the emergency vehicle can be known on the website assigned to us with our user name and password.

VI. Conclusion

The prototype of the proposed system is tested and found working fine and if the same is implemented solving some more real time issues related then the smooth movement of emergency vehicles on the roads is possible and they can reach their destinations in time to save the lives and properties.

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