INTERNATIONAL JOURNAL
FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Automated Intimation to Ambulance for Emergency Medical Service and Traffic Clearance Using Internet of Things (Iot)

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Abstract: Road accidents have been nonstop and traffic congestion is recognized as major problems which have created uneasiness for the ambulance to reach the hospital in time. To avoid this, Automatic Ambulance Rescue System (AARS) is introduced to provide a smooth flow for the ambulance. This scheme is to implement an Intelligent Transportation System (ITS) which would control mechanically the traffic lights in the path of the ambulance. This scheme is fully automated, thus it finds the accident spot, controls the traffic lights, helping to reach the hospital in time. Arduino microcontroller is used to detect the accident spot through Global Positioning System (GPS). Raspberry Pi is used to control the traffic signal and for health care monitoring system.

Keywords: Automatic accident detection, traffic clearance, health care monitoring, internet of things.

I.   INTRODUCTION

The development of this transportation system is being the generative power for human beings to have the highest civilization above creatures in the earth. Automobile has a great importance in our daily life. We utilize it to go to our work place, keep in touch with our friends and family, and deliver our goods. But it can also bring disaster to us and even can kill us through accidents. In today's world, we are seeing terrible road congestion problems in its cities. So it needs a traffic control solutions, which provides smooth flow for the vehicles. Intelligent management of traffic flows can reduce the negative impact of congestion. RFID is a wireless technology that uses radio frequency electromagnetic energy to carry information between the RFID tag and RFID reader. Some RFID systems will only work within the range inches or centimetres, while others may work for 100 meters (300 feet) or more. GSM modem operates just like a mobile phone. AT commands are used to control modems. More than 690 mobile networks provide the services of GSM across 213 countries and GSM represents 82.4% of all global mobile connections. Besides the voice communication it also offers Short Message Service (SMS) and General packet radio service (GPRS) to transfer data. The RFID operates at low-power and can be used at all the levels of work configurations to perform predefined tasks. It operates in ISM bands (865-868 MHz in Europe, 902-928 MHz in North America). Despite many efforts that have been taken by different organizations all around the world by various programs to aware against careless driving, yet accidents are taking place every now and then. However, many lives saved if the emergency service could get the crash information in time. A study by Virtanen et al. shows that 4.6% of the fatalities in accidents could have been prevented only in Finland if the emergency services could be provided at the place of accident at the proper time. The automatic accident detection with the automatic notification to the emergency service about the accident location is a need to save the human life. In addition to accident detection, traffic should be cleared in the path of the ambulance to reach the ambulance in time. Simultaneously, patient's health is remotely monitored by the doctor instantly, which prevents the life loss of the patient.

II.   LITERATURE SURVEY

A.   *This section contains the Literature Survey of the Proposed System.*

Bankar Sanket Anil et al [8], in this paper has presented an idea on post accident system for detecting and informing about it. Here accident can be detected using flex sensor and accelerometer, while the location of the accident spot is sent to the police station, nearest hospital and the owner of the vehicle through a message using Global System for Mobile Communication (GSM). The location is detected using GPS. The message not only contains location of the accident spot, but also the time of accident and vehicle number. In addition to this, a camera is located inside the vehicle which is used to transmit real time video of passengers inside the vehicle. The paper presented by Ayush Kr. Mittal and Deepika Bhandari [2], emphasis an idea on traffic clearance for

ambulance, police vehicle and fire brigade trucks so that they can reach their destination in time to prevent life loss of the human beings. In this system, RFID reader and tag (Radio Frequency Identification) is used. RFID reader is being installed 200 metres before the traffic signal on the top of the road and RFID tag is being installed in every vehicle at the time of manufacturing. Each vehicle is being given the priority and based on this priority the traffic signal turns to green light until the emergency vehicle crosses the signal. This system is also very useful in determining the stolen vehicle. Unlike other vehicle tracking system, this system uses GPS module which does not require any power.   The paper presented by Rajeshwari Sundar et al. [3], uses RFID reader and tag. RFID reader is set at the top of the road before the signal and RFID tag is being installed in every vehicle. It has three modules. Firstly, it determines the volume of traffic congestion by tracking how many vehicles have passed through the signal for certain time period. By this data, it sets the green signal for the path. Secondly, ZigBee transmitter and receiver is used at traffic junction for emergency vehicle, when the buzzer is switched ON. Finally, the stolen vehicle detection module is added. In this module, when the reader reads the tag, it compares with the list of stolen vehicles and gives a message to the police for taking appropriate action. In this paper [9], Sarfraz Fayaz Khan explained about the health care monitoring system, which is done by remote process with the help of internet of things. Various sensors such as ECG sensor, EEG sensor, temperature sensor, Blood pressure sensor, Motion sensor and Blood Glucose sensor are connected to the human body. These sensor continuously measure to get the exact condition of the patient. The signals generated from these sensors are in analog form which is converted to digital using analog to digital converter (ADC). This digital signal is transmitted to RFID/Bluetooth device through microcontrollers. Finally, the RFID/Bluetooth device transmits these signals wirelessly through internet to specific destination.
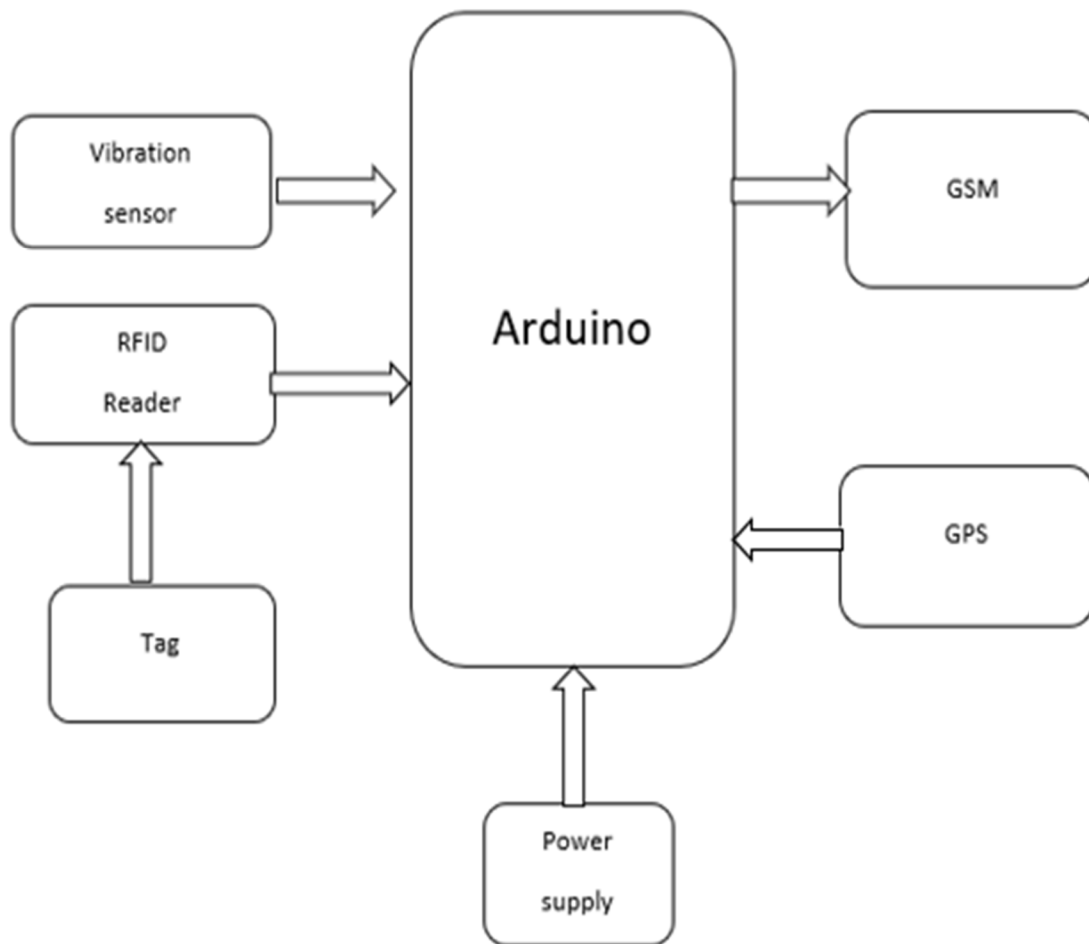
III. BLOCK DIAGRAM

A. *Accident detection section*

Fig. 1. Block diagram for accident detection section

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue III, March 2018- Available at www.ijraset.com
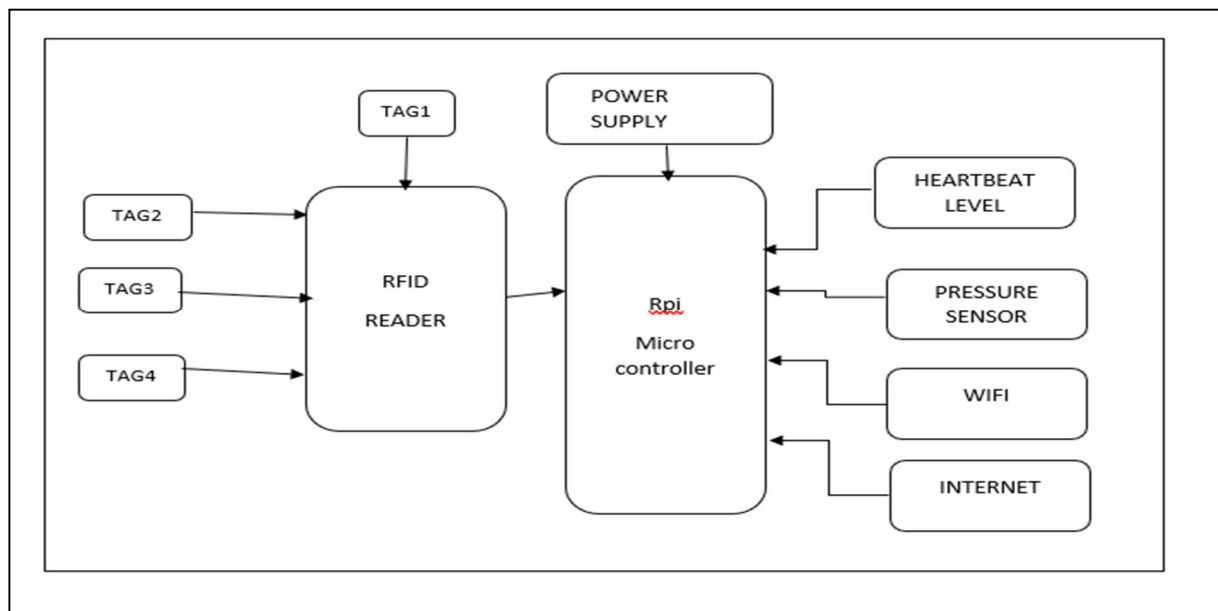
B. Traffic And Hospital Section

Fig. 2. Block diagram for traffic and hospital section

IV. SYSTEM HARDWARE

A. Arduino

Arduino is one of the open source physical computing platform which is based on a simple microcontroller board and a developed tool for writing software coding and processing it. Arduino is based on the ATmega328 microcontroller. The Uno has different feature when compared to all the other preceding boards, where the Uno has Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB to serial converter. The arduino is based on the PROCESSING MULTIMEDIA PROGRAMMING LANGUAGE. In this research work, the arduino is used to get input as, signals from the vibration sensor and RFID reader, location from the GPS and thus gives output to the GSM .

B. Global System for Mobile Communication (GSM)

Digital Cellular Communication system is the standard meant for the GSM. GSM is a name of the standardization group which was established in 1982 for creating a common European mobile telephone standard which would formulate the specifications for the European mobile cellular radio system operating at 900MHZ.The main aim of the GSM is to improve efficiency, international roaming and compatibility with the international subscriber and other telephone company. The GSM was developed by the conference of European Posts and Telecommunication. In this work, GSM is the intermediate to send the messages to the specified phone number in the program.

C. Global Positioning System (GPS)

Global Positioning System is a satellite navigation system that provides the conditions like location, time and weather conditions anywhere on or near the earth. The space-based satellite circles the earth twice a day and thus transmits the information to the earth GPS receiver. It determines four variables, they are: latitude, longitude, height and time. The GPS is implied in this work to get the location of the accident spot in terms of latitude and longitude.

D. RFID Reader-Tag

The RFID system consists of two components –RFID tag and RFID reader. The RFID belongs to a group referred as Automatic Identification and Data Capture (AIDC). This method automatically identifies object, which also collects data and enter these data into computer systems without human intervention. The RFID tag is of two types-active and passive. The passive tags have to be powered up by the reader before they can transmit data. But the active tags have an on-board supply like battery thus enabling them to transmit data at all the times. The expansion of RFID is Radio Frequency Identification. The digital data encoded in the RFID tags (or) smart labels is captured by the RFID reader via the radio waves.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue III, March 2018- Available at www.ijraset.com

E. Raspberry-Pi

The RPi (Raspberry Pi) is a mini standard personal computer. The essential requirements of RPi are keyboard for command entry, a display unit, a power supply and SD card containing Linux operating system. The power supply is given to the Raspberry Pi using the micro USB cable and the internet connection is set either by WI-FI or LAN (Ethernet) cable. The RPi is connected to various devices such as Flash Drivers/Portable Hard drives, speakers, etc. In order to control the traffic light signal and to upload the HTML page the RPi is being booted with formulated program in this work.

F. Sensors

1) Vibration Sensor: The vibration sensor is a piezoelectric sensor which is used in the flex, touch, vibration and shock measurement. It was discovered by PIERRE and JACQUES CURIE in the latter part of the 19th century. In our work, the vibration sensor is set to a threshold level, whenever the vibration measurement crosses the threshold value, it transmits the signal to the receiver of arduino.

2) Heart beat sensor: A person's heart beat is the sound of valves in the heart during the contraction and expansion of the blood vessels. The number of times the heart beats per minute (BPM) is the heart beat rate. The heart beat rate can be felt in any artery or pulse that lies close to the skin. Using this heart beat sensor a person's heart beat rate is determined.

3) Pressure sensor : A pressure sensor is a transducer which generates a signal as a function of the pressure imposed. Blood pressure is an expression of the force required to stop the blood from expanding, its unit is force per unit area. The pressure sensor is used to measure the pressure rate in a human's body.

V.   WORKING MODEL AND SIMULATION OUTPUT

This model consists of two sections as follows

A. Accident detection section

In this section, vibration sensor, switch, RFID reader and tag has been installed in every vehicle. Each RFID tag is unique and its corresponding license plate number is maintained in the data base. When accident occurs the vibration sensor gets activated. When the vibration sensor gets turned ON, two incidents begin to happen simultaneously. First, the RFID reader in each vehicle reads the RFID tag of the other vehicle which is responsible for accident. This makes easy for police to identify which vehicle is the victim of the accident. Second thing is that, when the vibration sensor is turned ON, the GPS tracks the location of the accident spot and sends a message through GSM to the mobile which is used in control room. Now, the control room sends this message to the nearest ambulance. This makes it very easy to detect the accident spot automatically. In addition to this, a switch is provided. Initially this switch is in OFF state, so when accident occurs the above mentioned process takes place. But when the accident is minor and the person is not affected, then he must operate the switch from OFF state to ON state to avoid the unnecessary call for
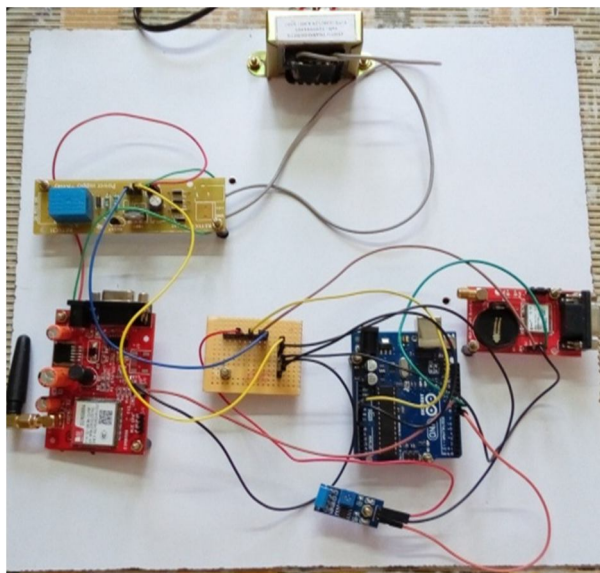

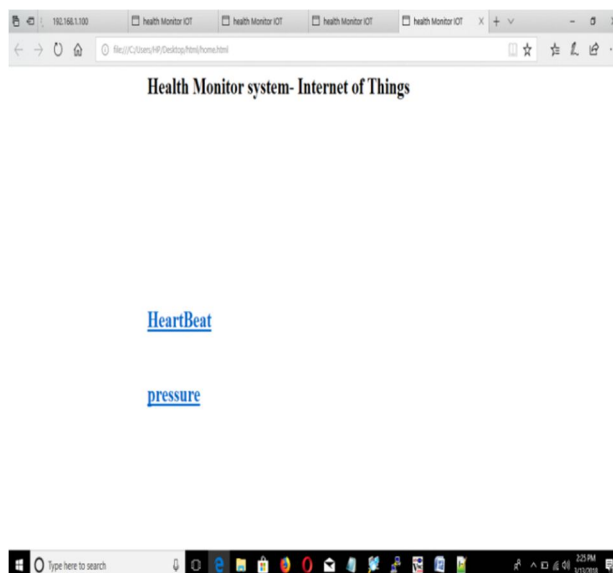Fig. 3. Circuit connection for accident detection section.

Fig. 4. Simulation output for accident detection section.

the ambulance. Figure 1 shows the block diagram of accident detection section. Figure 3 and figure 4 shows the circuit connection and simulation output of accident detection section respectively.

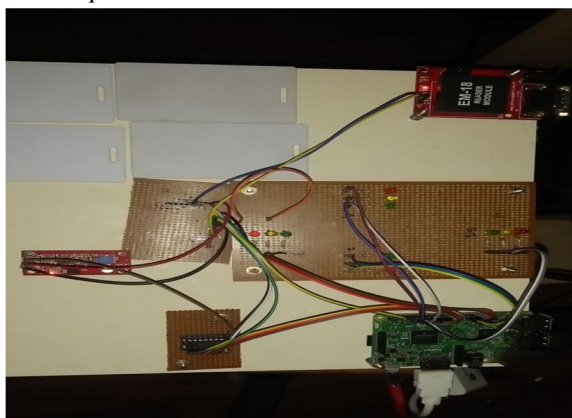### B. Traffic and Hospital Section

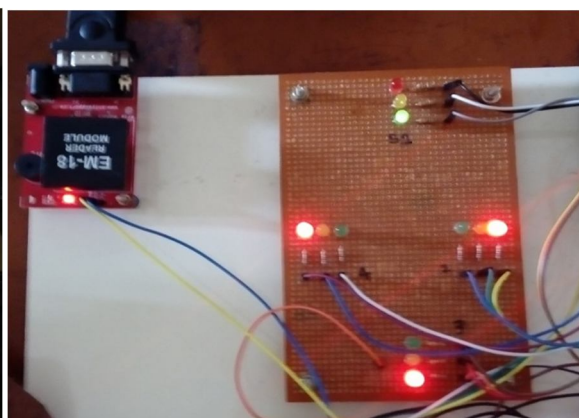Fig. 5. Circuit connection for traffic and hospital section.   Fig. 6. Simulation output for traffic section.

In this section the button acts as the key and starts the module. Figure 2 shows the block diagram of traffic and hospital section. The button is placed near the driver seat and it is operated (clicked) by the driver only when he confirms the presence of patient in the ambulance .As soon as the button gets activated, the health of the patient is monitored and the traffic light is controlled in accordance with the reader-tag communication simultaneously. In the health monitoring section, the patient's heart beats per minute (BPM) and the pressure level is checked by the heart beat sensor and the pressure sensor respectively. The measured BPM and the pressure level is in analog form ,so in order to convert it into digital form here we use MCP 3008 analog to digital converter, where the digital values of BPM and pressure level is uploaded in an HTML page and updated frequently using the Raspberry Pi. Using the IP address, the doctor could view the patient's condition in a web page in the hospital. Then the traffic signal process is started. The two tags switch-on tag and switch-off tag are specially meant only for the traffic signal controlling for the ambulance.
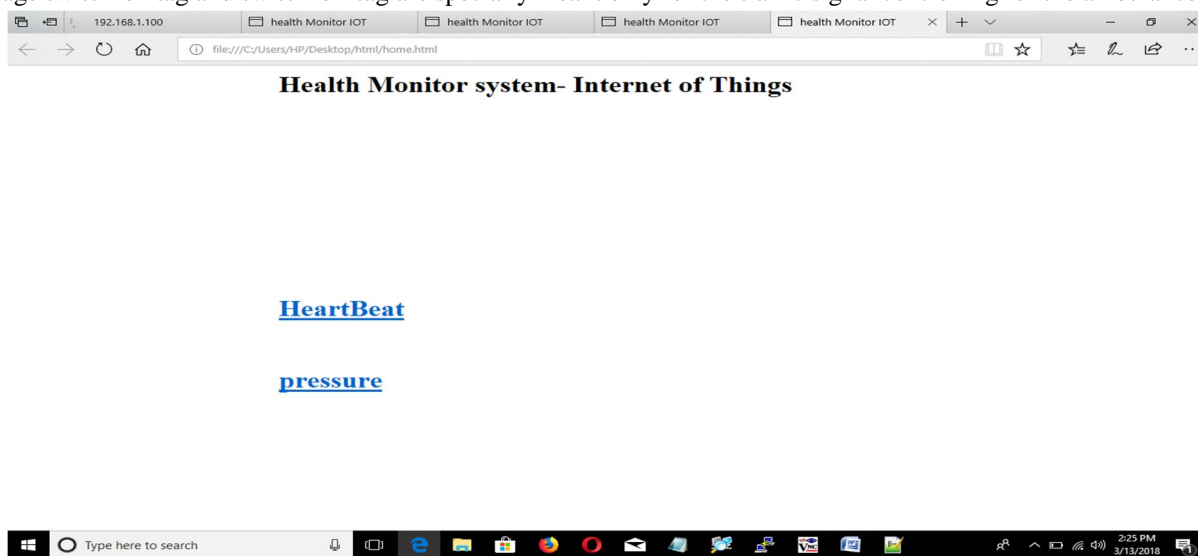

Fig. 7. Simulation output for hospital section.

C. The Two Tags Are

1) *SWITCH-ON TAG*: When the switch-on tag is read by the RFID reader which is kept in the ambulance, the traffic signal that is facing straight to the ambulance turns green and the other signals in that junction turns red.

2) *SWITCH-OFF TAG:* When the switch-off tag is read by the RFID reader, the traffic light signal which was already operating in accordance with the switch-on tag will now operate under normal condition. Figure 5 shows the circuit connection for traffic and hospital section. Figure 6 and figure 7 shows the simulation output for traffic and hospital section respectively.

VI. CONCLUSION

Now-a-days accidents have become more common and due to the lack of intimation to the ambulance at the right time there is much loss of life. This work is developed with a main intension of saving the life of a person. Whenever an accident occurs in a vehicle, the ambulance is automatically intimated without the intervention of human and secondly, the traffic is cleared for the smooth and fast running of the ambulance. And at the same time, the patient's condition inside the ambulance is monitored frequently and the information is updated in a web page, which could be viewed by the doctor at the hospital and make the necessary arrangements .

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