JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Automated Accident Vehicle Detection & Rescue Systems using IoT

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Abstract— **This paper presents an innovative approach to provide Accident Detection and rescue systems (ADRSs) are primary prevention strategies which prevent injuries, losses, damages and property damage caused by accidents. Accident detection and rescue systems have been an important part of daily life activities since long and have number of fatal and costly accidents. Hence a detection system coupled with a rescue system is mandatorily required so that we can be able to restore the recovery activities asap. This can be done using the latest embedded systems and the integration of the same with the cloud and providing access to the medical evacs and to those who are concerned. This paper has been implemented with renovative system in the same.**

Index Terms— **IoT, Node MCU, Accident Detection and rescue systems Management, MQTT, Ultrasonic Sensor**

I. INTRODUCTION

Adaptation is mandatory for species to survive at the rate of change that occurs in the world today. With the growing population and technological development, a lot of accidents and mobility changes takes place every day. Humans are a part of these environmental changes as they do not only cause accidents but also add to it. Accidents are making it increasingly difficult to keep up with the new technology and procedures of ensuring safety in today's scenario. This is why more and more accident detection systems have been developed over the past decade or two throughout the world. The general purpose is to enable an early identification of hazardous conditions that are likely to occur during an accident, by providing real-time monitoring of parameters such as temperature, pressure, flow and vibration to identify variations that may indicate problems before they occur. Hence it is mandatory for us to decide upon and create a sustainable accident detection and rescue systems that would save hundreds of human lives that are more valuable. This detection systems should be capable to handle multiple streams of data and process the same with ease. Proper location tracking and information passing to the concerned using the latest applicable protocols can be considered useful.

Keywords – Accident Detection, IoT, Arduino, Rescue Systems, Embedded, Thing speak

I. MOTIVATION BEHIND THE STUDY

According to the World Health Organization (WHO), nearly 1.35 million people died in road accidents, making road traffic injuries the eight-leading cause of death globally. This is a staggering figure, which can be improved with the right measures. Fatal injuries caused by the accidents can be sometimes serious, such that it is mandatory to take the victim to the hospital. Sometimes it can be even more serious that the victim's life might be in danger if not provided medical attention immediately.If a casualty is found within 10 minutes from the time of accident, then there will be a decrease in fatality rate by 20% to 25%. There are several reasons behind this delay in rescue operations: One is that ambulances may not be able to reach the place where the casualty is found immediately since there might be gridlock on roads or traffic cops might refuse access to vehicles carrying injured people; Secondly, people who might help may refuse on thoughts that treatment could kill a person or worsen his injuries .It is crucial for first responders (police officers and firemen) to get involved instantaneously after an accident occurs so that they can initiate traffic blockages as early as possible while informing other emergency teams to follow suit instantly There is a need for improvements in road safety, particularly in the area of emergency response because most injuries incurred by accidents are not serious, and the victim's life can be saved if rescued timely. However, it takes additional delay to manually notify the emergency teams due to poor communication mechanisms thus leaving a victim unattended for a long time which results in an increased death rate.

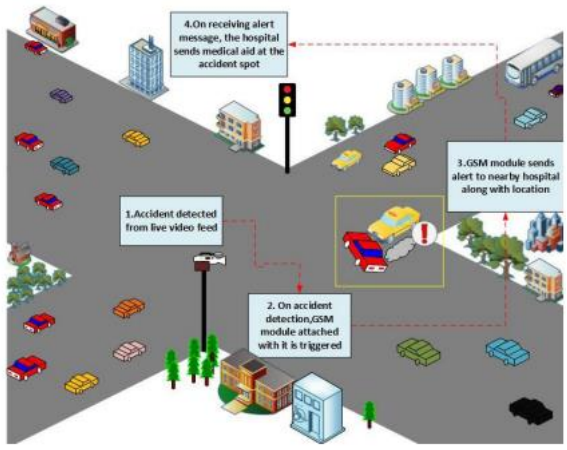

Fig 1. Illustration of the Existing System

II. PROPOSED SYSTEM

The system that is proposed gets the location data using the GSM and GPS. The location data can be passed on to the rescue team and the pre medics team before they even arrive at the location of the accident. The proposed system will constitute the latest Arduino Controller, with the sensors such as the Pulse, Temperature and the EP2866 module, that can transmit the data to the things speak cloud.

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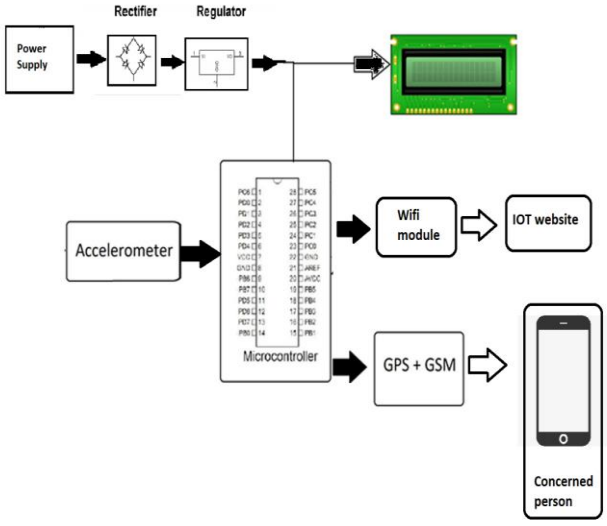


Fig 2. Block Diagram of the Proposed Accident Detection and rescue systems System

The system comprises of three sections viz a viz, Accident Detection and rescue systems Segregation System, Cloud Server System and the Data Process System.

A. IOT SYSTEM

Anything that can be connected to the internet by a suitable protocol is the IOT. It can be anything that we use in our daily to day life and need not necessarily be electrical or electronics. They are connected to the internet through some sort of communication means, e.g. they have a Wi-Fi connection or a connection to the mobile phone network or any other medium that could connect it to the rest of the world, and they can share resources and data with other objects The data collected from these objects is further analyzed to extract the useful information .The specific object depending on its structure and capabilities can make an IoT application become more effective or efficient. For example, a solar panel installed on your roof connected to the power grid will collect energy from the sun and transmit it to your house connecting it using cable under the floor in order to provide you with light and power.

This IOT System constitutes the major proration of the Accident Detection and rescue Systems. This part of the implementation holds a vital role on the entire system as this part is used for detection, communication and the process of the location and the gesture of the victim to the resource nearby. The heart of the entire implementation is the IoT Systems.

The sudden decrease in the accelerometer is detected by the controller unit and the same is passed on the display unit for the detection of the accident. This information is passed on to the Website and the alert is sent to the authorities of the person nearby indicating the accident. The value of the temperature, pressure, ECG and the Blood Pressure of the victim or the passenger is taken immediately into process and the same is compared with the normal values or the threshold values so as to compare the normal to high ratio.

ESP8266 is the Wifi Module used in connection with the Arduino Controller so as to establish a WiFi Routing communication protocol with the controller and the internet. This module enables communication of the device and hence the section is termed as the IoT Module.

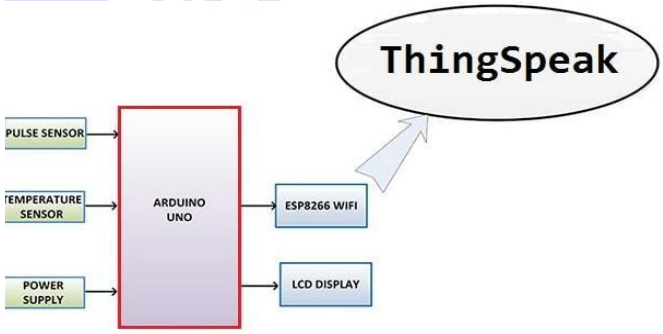


Fig 3. Process flow diagram of the Controller Module

B. CONTROL and SENSOR SYSTEM

Phase II of the proposed Smart Accident Detection and rescue Management system is the Control System and the sensor system. This system comprises of the controller as well along with the interconnections of the sensors. The controller enabled here is the Arduino Controller which as ATMEGA Family also can also be used. The controller consists of the Interfaces GPIO pins, I2C Enabled protocols and the Registers for the swift operation of the command execution. This will be able to hold the threshold values in the memory and pass on or compare the same with the real time sensor data and take actions based upon the command illustrated or executed.

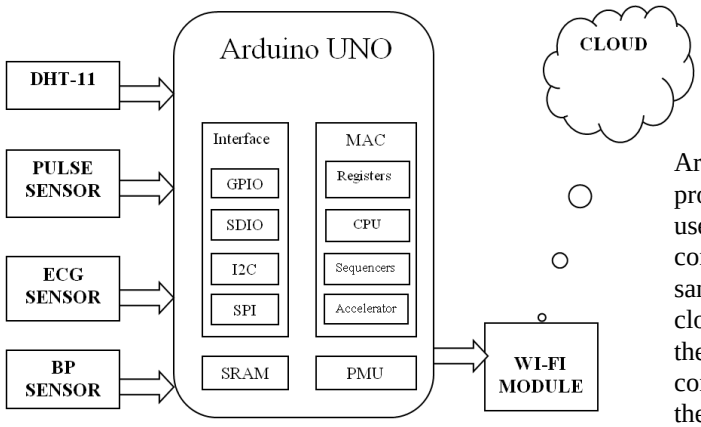


Fig 4. Controller & Interfaces

The High / Low pin can be set accordingly from the instruction from the sensor. This controller itself will act as threshold appliance so that it will be able to control the sensors and the Programmable devices that can be accessed. Any number of sensors can be added to the controller provided, they are having sufficient pins to hold upon and depending on the applications are the processes which we use. In this project to implement the accident and rescue detection systems be deployed by the Arduino controller which is very much sufficient so that the interface sensors and the outgoing placement sensors can be connected easily.

Fig 5. Fig 5Snapshot of the Ultrasonic Module & its Working

C. CLOUD & MESSAGE ALERT SYSTEM

The cloud which user is the thing speak cloud . Sensor data whether it is on analogue or Digital can be passed on to the thing speak cloud via the Wi-Fi ESP8266 through the controller and this cloud can be accessed from anywhere from desktop, mobile or laptops and the only thing that we need to control here is the IP address of the interconnected Nodes and the Gateway.

Data will be monitored by the control sensors on a regular time frame and the real time data processed, manipulated and compared with the threshold data set in the controller. Suitable actions will be taken by the controller on a limited time frame that is less than a second. This processing time frame depends upon the Controller and the cloud is merely used as a interconnecting platform for communication gateways and hosting

IV. *HARDWARE DESCRIPTION*

Arduno is used as a basic controller for this implementation project of accident and risk management system. Arduino is used for this purpose because office extendable pin configuration and inbuilt capabilities to connect to Wi-Fi. The same can be used extensively to connected to the thing speak cloud as is the requirement of the project. We can implement the same as in Raspberry Pi or Jetson Nano or any other controllers but taking into cost-effective solution Arduino is the best fit.

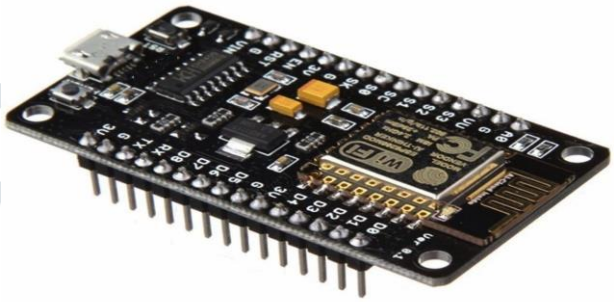
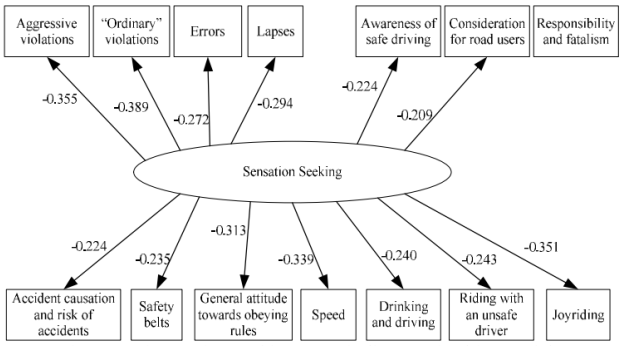


Fig 6. Snapshot of the Node MCU Unit

A. SENSOR POSITIONING & CIRCUIT DIAGRAM

The IR Sensor is mounted on a place which is predominantly nearer in proximity to the board on which the Accident Detection and rescue systems is placed. This will be handy in assessing accurate results. The circuit diagram below is the replica of the proposed system . The same circuit has to be put in the Bins.



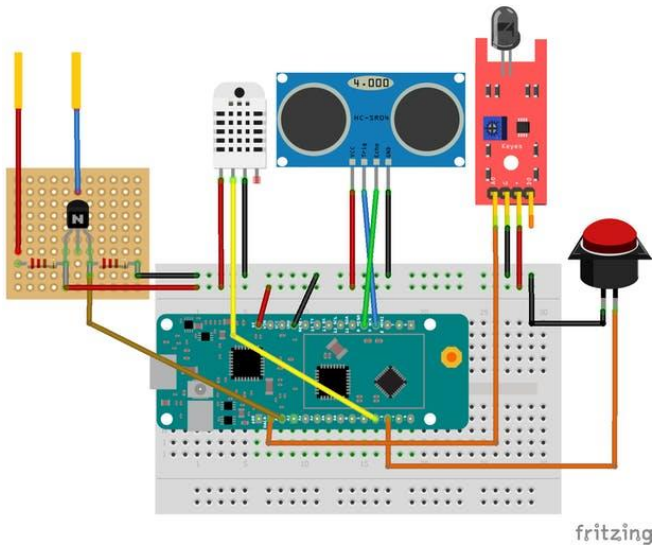


Fig 7. Circuit Diagram of the Hardware System

V. RESULTS

Results of such a real-time environment project can be very difficult to manage or justify as this can be categorized only in real time scenarios. However, we can plot the x y z axis of the real time sensors. This can be put as a graph as illustrated in the following figure8. The project has been implemented successfully and tested under rigorous conditions and in different climatic and weather conditions. The project is sustainable and holds itself at certain conditions which is the need for the hour.

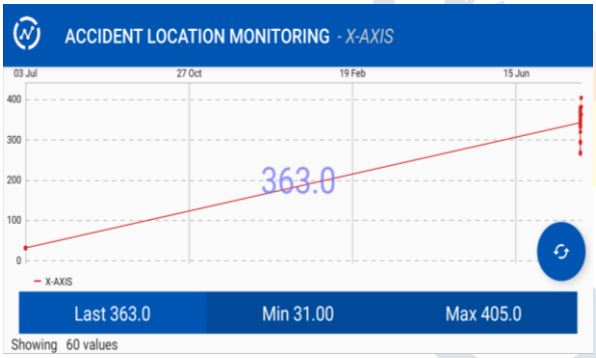
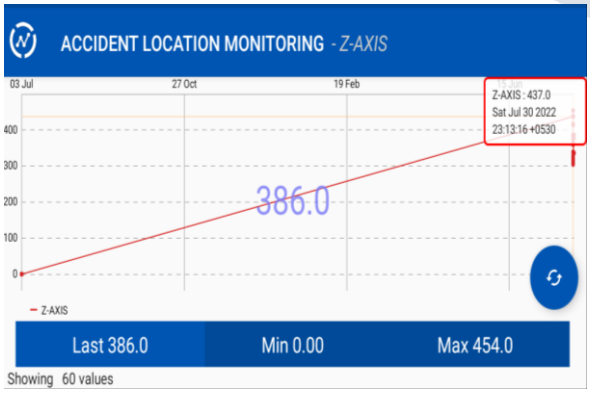
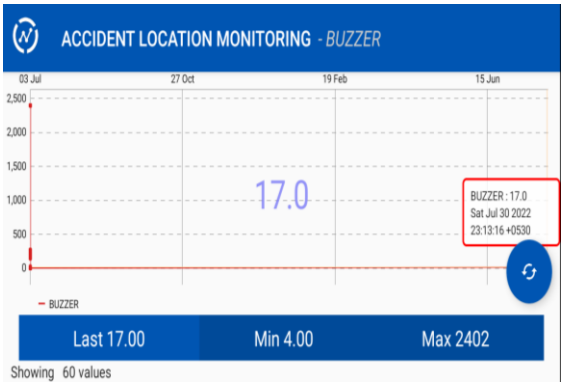


Fig 8. Thing speak Cloud Result





VI. FUTURE SCOPE

The project has been implemented in Arduino and the same can be implemented under using Jetson Nano or Raspberry Pi or any other Texas Instrument processors. Also the implementation can be done using different Machine Learning or Deep Learning applications that can be integrated into the controller as a part of implementation of the project.Apart from implementing the same in embedded systems we can also try to implement driver drowsiness or alcohol detection systems, vehicle mechanical inspection systems as a part of the future enhancement.

VII. CONCLUSION

Accident detection and rescue systems as a prototype has been successfully completed and implemented in this project real time at different scenarios. Graphical illustrations of the sensor data and the controller operations can also advocate the paper and this will be able to prove the successful implementation of the project

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