



Smart Road for Autonomous Accident Detection and Warnings

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ABSTRACT

An increasing number of vehicles on the roads increases the risk of accidents. This risk almost doubled due to bad visibility as well as road conditions. If an accident happens, especially in bad weather, it is important to inform approaching vehicles about it. In this research, an accident alert light and sound (AALS) system is proposed for auto accident detection and alerts with all types of vehicles. No changes are required in non-equipped vehicles (nEVs) and EVs because the system is installed on the road side. The idea behind this research is to make smart roads (SRs) instead of equipping each vehicle with a separate system. Wireless communication is needed only when an accident is detected. This study is based on different sensors that are used to build SRs to detect accidents. Additionally, the proposed framework for the AALS also reduces the risk of MVCs

1 Introduction

Traffic accidents are a major public issue worldwide. The huge number of injuries and death as a result of road traffic accident uncovers the story of global crisis of road safety. Road collisions are the second leading cause of death for people between the ages of 5 and 29 and third leading cause for people between 30 and 44. According to statistical projection of traffic fatalities, the two-year comparison of total driver participation in mortal crashes presented a three Percentage increase from 43,840 in 2011 to 45,337 in 2012 [1]. Additionally 184,000 young drivers (15 to 20 years old) were injured in vehicle crashes, in 2012, an increase of two percentage from 180,000 in 2011. The most obvious reason for a person death during accidents is unavailability of the first aid provision, which is due to the delay in the information of the accident being reached to the ambulance or to the hospital. Thus, in the case of incidents involving vehicular accidents, response time is crucial for the timely delivery of emergency medical services to accident victims and is expected to have an impact on fatalities. Moreover, each minute is passed while an injured crash victims do not receive emergency medical care can make a large difference in their survival rate, for example, analysis shows that decreasing accident response time by 1 minute correlates to a six percentage difference in the number of lives saved. Thus, the reduction in response time would occur with widespread implementation of enhanced traffic technologies that are used to reduce the response time and thus reducing traffic fatalities. The early experiences with these technologies are concerned with development Advance traffic management system



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(ATMS) and development automatic car accident detection and notification system built-in vehicles in United States (U.S) [10]. These traffic sensors are installed in main highway.

2 Literature Survey

1) Title: Automatic Accident Detection and Rescue with Ambulance. Authors: Hrishikesh Murkut, Fazal Patil, Vishal Yadav, Meghana Deshpande. Year: 2015. Author proposed an automatic accident detection and rescue with ambulance system. The system consists of dedicated vehicle unit, which works on vibration sensors. Vibration sensors sense the unusual activity while driving and then report to microcontroller unit. Location coordinates are obtained through GPS. We found that there is need to put geographical location coordinates manually in GPS viewer application.

2) Title: Mobile Application for Automatic Accident Detection and Multimodal Alert. Authors: Bruno Fernandes, Arnaldo S. R. Oliveira. Year: 2015. Author proposed mobile application for automatic accident detection and multimodal alert system, using global positioning system receiver, radio frequency modules and a field programmable gate array. The system consists of PHY layer and universal serial bus connections for implementations.

3) Title: Intelligent Accident-Detection and Ambulance Rescue System. Authors: Bandari Prachi, Dalvi Kasturi, Chopade Priyanka. Year: 2014. The author of third paper proposed intelligent accident detection system, in which they have used GSM unit which is fitted in the vehicle. The GSM unit detects accident and sends the location to main server. The main server has all the records of nearest hospitals. Drawback of this system is that, If GSM unit in the vehicle gets damaged due to accident, the whole system collapse.

4) Author: Prof. Rahul Wantmure and Dr. Murlidhar Dhanawade. Year: (2016). Indian cities and cities around the world is gradually evolving. It is not a sudden decision with planned infrastructure in advance. The concept of Smart City has suggested in a planned city, with such impact that each activity carried out in the city is supervised and controlled by technology. Internet of things is an emerging technology in the IT world that can be explored to its zenith to achieve the goal of building a smart city. Building alone is not enough, but to maintain and sustain their identity. The integrity and authenticity is another task to be processed and implemented. There are several challenges in making a smart city in India, as there are several implicit and explicit obstacles that must be confronted. A smart city model is not a solution because each city is unique in its existence. However, a prototype development is needed by having a logical design using for Smart City using IoT.

5) Title: Accident Detection System Using Image Processing and MDR. Author: Yong-Kul Ki. Year: 2017. The author of this paper suggested detection of accident using image processing. The system comprises of CCD camera which is used to extract the accident vehicles from the video image. It used the concept of velocity and its variation rate, position area. The drawback of proposed system is that, the position of video camera is fixed at particular location. We cannot predict the accident at remote location.



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3 Existing System

There are many solutions proposed for the concerned problem and each one have some advantage over others [2]. Among the other GSM and GPS solutions, some proposed the solution of finding the accident condition using only accelerometer sensor which may be a problem as it may lead to false alarm for some of the cases [8]. The existing system also uses the external GPS and GSM modules hence increasing the cost of their project [3]. Our system cut the unnecessary cost by using the already existing infrastructure like GPS, GSM. Most of the previous techniques for accident detection apply to Evs only.

4 Proposed System

The proposed system is mainly for the detection of accident automatically without the help of GPS [4]. Our system uses more than one sensor to increase the accuracy of the system and also we have provision to avoid the intimation in case of false alarm [8]. The AALS is a system designed for nEVs and EVs to avoid MVCs [5]. Most of the previous researchers have tried to build a system in which vehicles are able to sense and communicate with each other through devices.

5 System Design

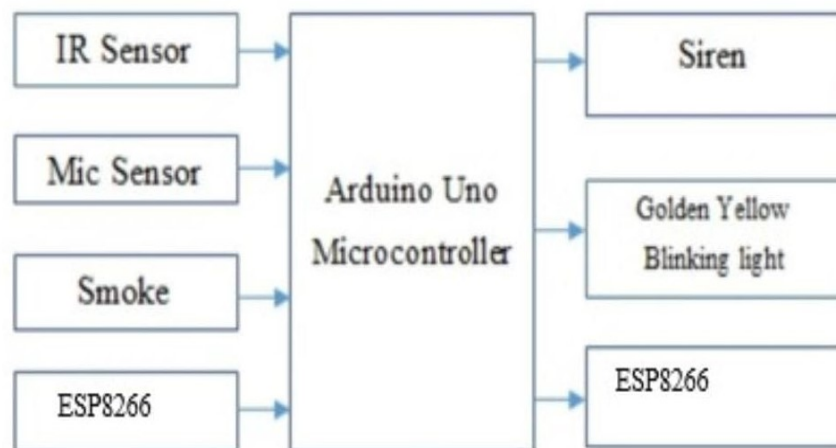


Figure 1: Hardware block diagram

6 Hardware Specification

COMPONENT	SPECIFICATION
Arduino UNO	Microcontroller
ESP8266	WIFI Module
IR Sensor	Obstacle detecting Sensor
Smoke detector	Chemical gas detecting Sensor
Microphone	High sound detecting Sensor



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ULN2003A	Power Supply
Buzzer and Light	AALS System

7 Implementaton

The main scope of this paper is to set it in a place that fully automated system design that will minimize the time gap between the occurrence of an accident and deployment of medical response [6]. The proposed design makes use of different sensors. The system uses three sensors such as IR Sensor, Microphone Amplifier and Smoke Detector. All these sensors are connected to Arduino Uno R3 microcontroller board. This can be done by combining accident detection and Health Centre systems [9].

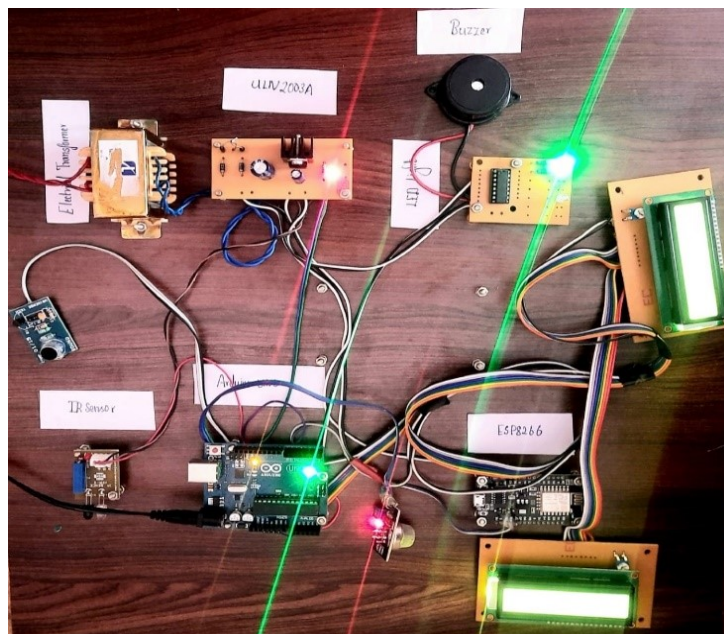


Figure 2: Implementation

8 Result and Discussion

When the car collides with any object with great impact - In this case the car is travelling with an average speed and then collides with another object with great impact, the resultant output would be that an accident has been detected and the alarm begins to ring continuously. Hence the Message has been sent to the server for help.



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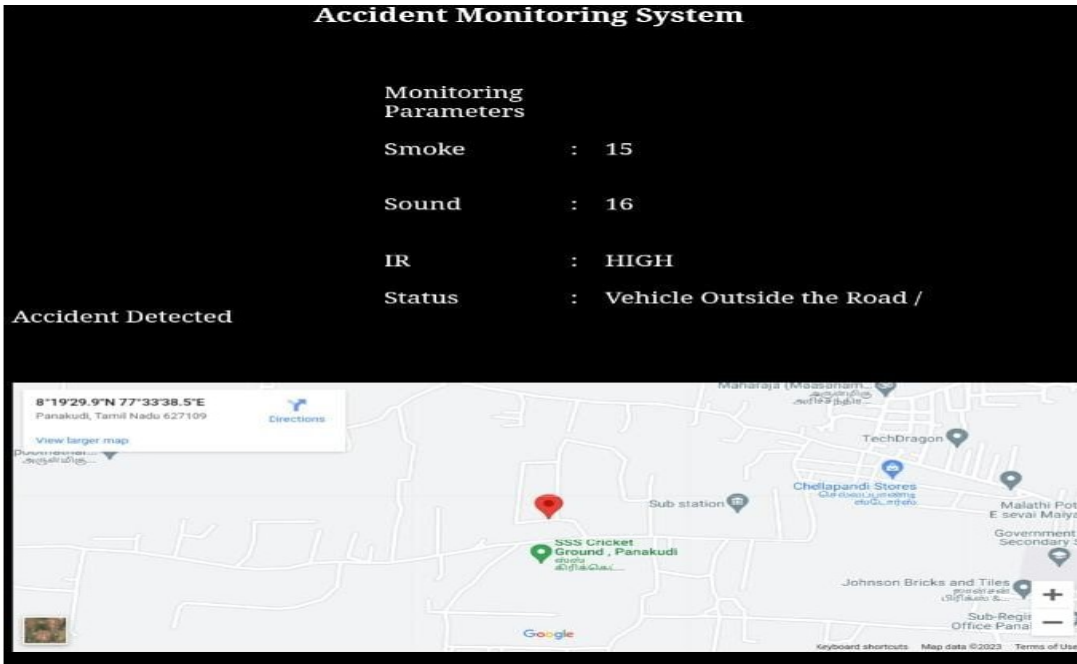


Figure 3: Vehicle outside of the road

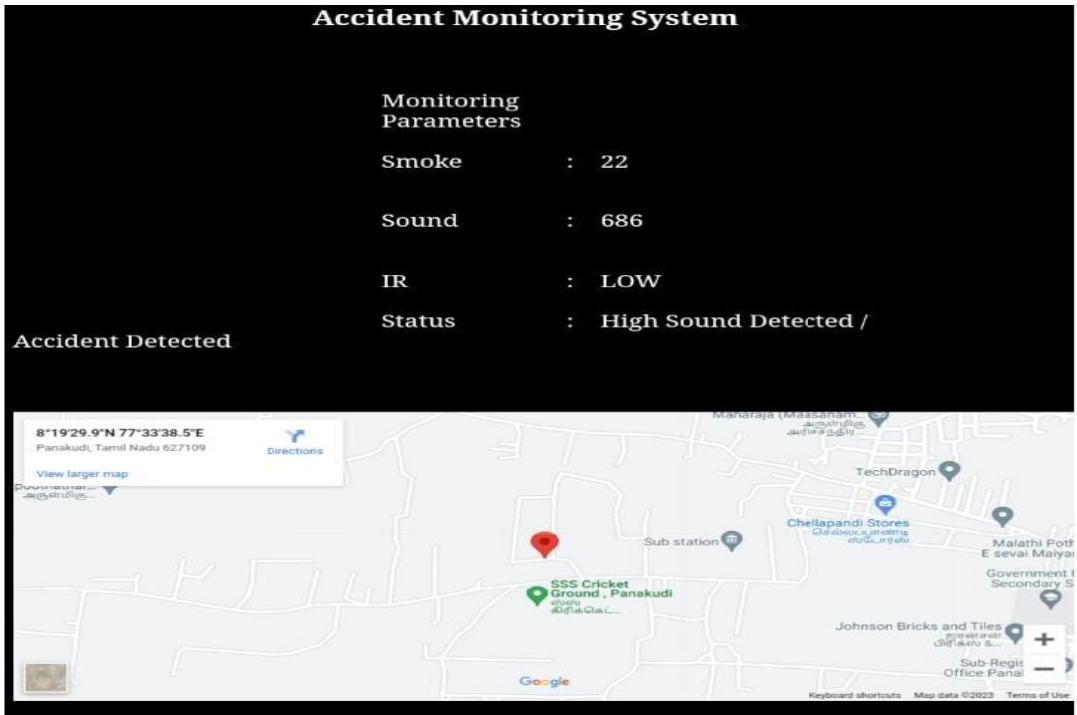


Figure 4: High Sound Detected



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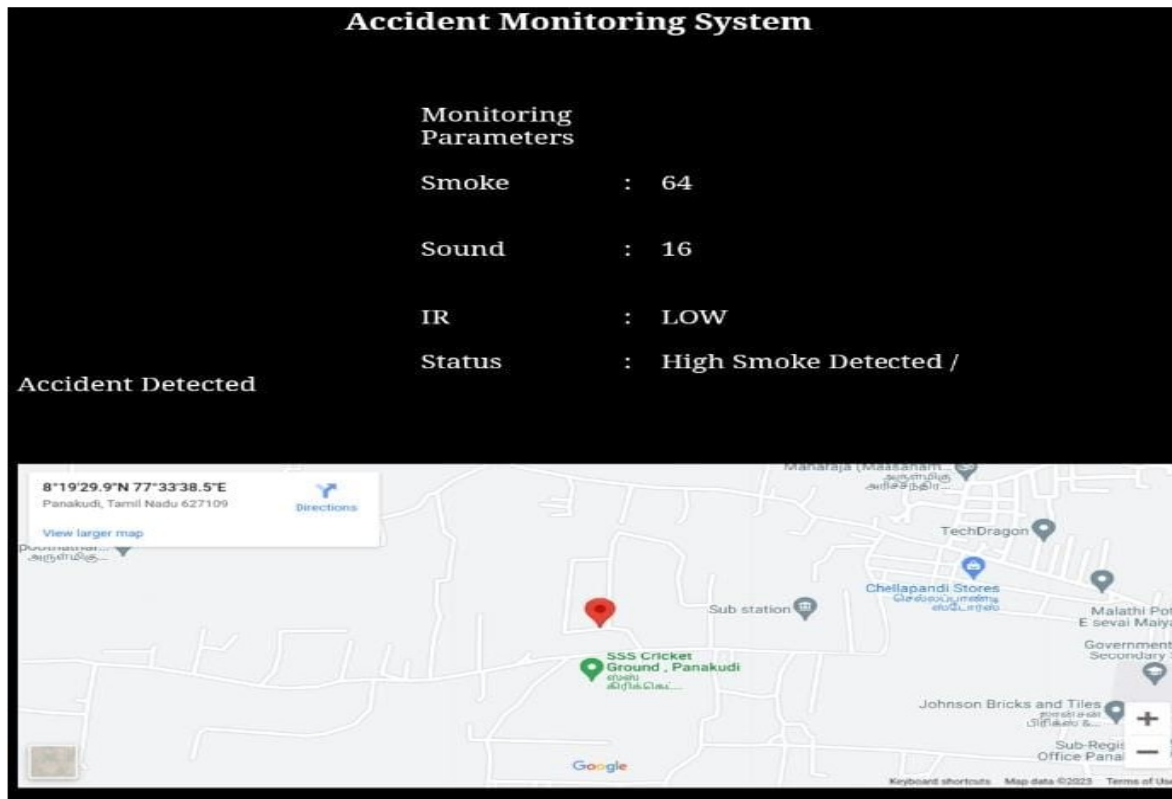


Figure 5: *High Smoke Detected*

9 Conclusion

The proposed AALS system provides a solution to the problems of actual location detection of an accident in order to protect other drivers and the authorities. It provides an alert, warning drivers of nEVs and EVs about an accident ahead. It helps the ambulance and fire brigade reach the destination easily by providing the exact location of the incident. Each node is a small but complete system that can sense its surroundings, and, in the case of an accident, generates alerts comprising a blinking light and a siren. The alerts will help drivers of oncoming vehicles to protect themselves from a mishap. Each node is responsible for communicating in one direction opposite the flow of traffic. By making smart roads using this AALS system, drivers are informed in time about any dangerous situation on the road. Moreover, in the case of an accident, the rescue team can reach the site without delay through an automatic process. Once the system is established, it works for a long time with limited maintenance. For better results, the EOCs should be at equidistant locations about 40–50 km apart at maximum. Each EOC should be equipped with an ambulance and fire brigade and should be responsible for sending a rescue team to the incident location. The EOC should also be aware of any ambulance and/or fire brigade already moving that might be near the location. Current work is limited as the proposed system was installed and tested in a lab by simulating various accident scenarios. All results were found to be accurate after


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experiments. However, differences between the lab environment and the actual road environment may cause test results to differ from those expected in the operational environment. We will investigate the detection accuracy of the proposed system in a more practical situation on the road in our future work. An enhanced version of the AALS can be developed that will detect an accident from a longer distance (more than 100 km). Automatic fire extinguishers can be used to extinguish fire switch out the need to send a fire brigade. Other sensors can be used to provide information about the road conditions to drivers of nEVs and EVs through different display mechanisms.

Acknowledgement

The author would like to thank my guides Ms. B. Shanmuga Sundari Assistant professor and Dr. S. Babu Renga Rajan Head of the Department, CSE, PET Engineering College, Vallioor.

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