

# Automatic Identification and Alert Systems for Vehicle Accidents: A Review

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**Abstract:** The increasing population has indirectly increased the count of transportation vehicles and which leads to the increase in number of accidents. The studies from the various survey reports states that millions of deaths are happening per annum due to vehicle accidents. The main cause for the transportation vehicle accidents is because of rash driving, long duration driving, exceeded speeding etc. Also reported that 50% of the deaths on the road accidents happens due to the ignorance of the vehicle accident notification of the patient by vehicles specifically during the night or in lonely places remain unnotified. A person who survives requires emergency medical rescue response. A Vehicle Accident Identification and Alert system developed as an existing work by various researchers for emergency notification system which could save the life of patient. Whenever a road accident happens the variety of sensors such as vibration type of sensor or the accelerometer type of sensor present in the such systems, provides the signals to the controller platform. Latitudes and longitude's location information have been accumulated from the Global Positioning System, transmitted with the help of the GSM module to the rescue center and provides a text SMS to the mentioned people listed in their respective emergency List. Retrieving the sharp location definitely could assist the rescue team to reach the particular location within less time. The different methodologies and technologies such as Global system for Mobile, Wi-Fi have been utilized for constructing such type of systems. Even if the vehicles whether two wheelers or four wheelers have been insured, a vehicle crash might end up having major injuries and post-death stress. Main objective of this paper is to identify these key issues to a larger extent. In each year millions of people died, approximately 1.5 million people as per the WHO reports. Detection, Identification & Rescue during the road accidents, consecutively definitely reduces the rate of mortality & economic loss.

**Index Terms**— GSM, Smart Cities, GPS, Wi-Fi, WHO, Accelerometer, Internet of Things.

## I. INTRODUCTION

The existing systems developed for the identification and notification of road accidents over the years uses different sensor devices, communication technologies and the controller platforms. The study of these existing systems has been done based on different parameters. These parameters are namely the controller platform, communication technology used, sensors used and IoT platform. The common objective of such accident identification and notification systems is to monitor the vehicle accidents by the use of smart sensor devices at the same time providing the information the concerned authority about the location of the accident.

The IoT is a major component of modern world. Where common people's tendency to be connected to different things and it impacts on major automation sector. Normally there are following different forms of Internet Communication i.e., machine-to-machine human-to-human and human-to-machine. Till now, the major impacted form of communication is human-to-machine communication types. The IoT is further enabling and enhancing machine-to-machine communication as a primary interaction type. It is becoming an integral part of smart transport applications, smart cities, smart homes and smart industrial applications, and having significant impact on the academia, industry, government, and society. In these systems by the use of advanced communication technologies the accident information is provided to nearest Healthcare systems so that rescue team can rush the accident location and primary treatment will be provided to the victim of accident. Such systems comprising of GPS module which provides the latitudes and longitudes of the accident location.

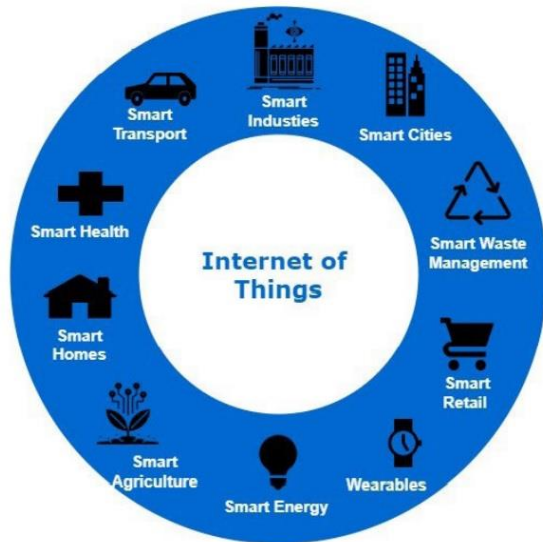


Figure 1.1: Applications of Internet of Things [1]

These systems also include the GSM module which provides the text notification to the concerned authority, relatives of person and nearest medical healthcare systems. In this paper review of such systems have been done in order to classify such systems and comparative study of such system have been presented.

With increase in population, the need for transportation has grown terrifically, as it impacted an alarming condition in terms of traffic rules and vehicle accidents. The percentage of vehicle accident is increasing exponentially along with the fatalities caused due to road accidents. However, the primary cause of the increased rate of fatalities is due to the delay in emergency services. Many lives could be saved with efficient rescue services. The delay happens due to traffic congestion or unstable communication to the medical units. The implementation of automatic road accident detection systems to provide timely aid is crucial. Many solutions have been proposed in the literature for automatic accident detection. The techniques include crash prediction using smartphones, vehicular ad-hoc networks, GPS/GSM based systems, and various machine learning techniques. With such high rates of deaths associated with road accidents, road safety is the most critical sector that demands significant exploration. In this paper, we present a critical analysis of various existing methodologies used for predicting and preventing road accidents, highlighting their strengths, limitations, and challenges that need to be

addressed to ensure road safety and save valuable lives [1].

## II. LITERATURE REVIEW

As per the study from literature review in which different systems have been studied for road accident detection, monitoring and intimation over the years. The parameters on the basis of which these systems have been classified as:

- Microcontroller platform used
- Communication Technology used
- Sensors Used
- Communication Protocols Used
- IoT Platform used

Dr. Bharat Naresh Bansal and Vivek Garg [5] systems discussed above in the paper are entirely different from one another in terms of hardware and technology used but have the same purpose i.e. to detect accident and notify the registered users. There are various advantages of each system but there are a few disadvantages as well for example the problem of false alarms is a major drawback.

Kodali, R.and Sahu, S. [6] describes a MQTT based vehicle accident detection and alert system. This system is based on Wi-Fi technology. NodeMCU is used as a controlling device. But unlike the other 3 prototypes, an accelerometer module is used as a sensing device. An accelerometer continuously senses the X, Y, Z direction coordinates of the vehicle and the NodeMCU publishes the to the LOSANT cloud platform using MQTT protocol. These values are uploaded to the LOSANT dashboard continuously and whenever it senses any deviation from the preset values, a system generated email is sent to the registered email address regarding the accident of the automobile. Kalyani, T., et. al. [7] describes a prototype Embedded system for accident detection and alert system. Arduino Uno R3 is the heart of this prototype system, this system makes use of GSM (Global system for Mobile) technology. Here a vibration sensor is used as the sensing device, which constantly senses the vibration values and sends them to the Arduino board where the vibration sensor value is compared to preset value in the program and if the received value exceeds, a message using GSM is sent to the registered numbers. In this prototype and LCD module is used for displaying the message sent by Arduino. Along with this a GPS (Global Positioning

System) module have been used for identifying the exact coordinates of the location of the vehicle i.e. for tracking down the vehicle. Bansal, B., Garg, V. [8] describes a prototype IoT system for accident detection and notification using an ESP8266 NodeMCU as the controller and a simple vibration switch as the sensing device. This prototype system makes use of Wi-Fi technology. Here in this prototype vibration sensor continuously senses the vibrations and the sends them to the NodeMCU controller which is a Wi-Fi enabled controller. NodeMCU acts as a gateway between the vibration sensor and the Adafruit Cloud platform.

Woranon et. Al [9] proposes the importance of preventing road accidents using black box which include intelligent collision warning systems and intelligent braking systems. They have used Interactive accident-avoidance system with Two steps movement detection to reduce and prevent accidents with more efficiency. This study focuses on the feature of this system, which is forward movement detection and automatic obstacles' avoidance. However, such systems are not able to cover every case and could even cause more accidents.

In [10], the authors proposed a novel system for human activity detection with the help of three, one-axis accelerometers. Focus of the paper was on calibration of accelerometer reading to improve the results and sensor fusion was used for the same. Researchers in [11], [12] proposed a smart phone based system for human activity recognition system(HAR) for detecting activities like sitting, walking, standing, running, walking downstairs and upstairs. It was assumed that the smart phone was in right pocket of the trouser. Sensor fusion results were discussed by using combinations of accelerometer, magnetometer and gyroscope sensors present in phones.

In paper [13], the authors proposed a system to determine the nature of the accident occurred and decision can be taken upon it. For this vibration sensor are integrated with ARM processor to send the alert information through GSM module. Victor in [14], developed a system called as "Vehicle Accident Alert and Locator", shortly called as VAAL is helpful in emergency rescue during accidents of auto crash. The system is installed with machine to machine (M2M) device namely GSM modem, mobile operator along with emergency operating devices to find the exact location. Supriya and Ashutosh [15] has discussed

about the Automated Accident Intimation and Rescue System (AAIRS) which uses the vibration sensor and GSM modem to rescue the victim. When the sensor senses the vibration, it checks whether the sensor value is above the threshold or below it and sends the alert message accordingly.

### III SYSTEM DEVELOPEMNT

The existing systems makes use of acceleration movement sensor and such type of various sensors to record the various driving data parameters. These sensors will also monitor the humidity and temperature level of the car and additionally seat belt status will also be updated to the controller. The Raspberry Pi controller (RPI) and Arduino controllers are used to regulate these sensors. The data received from the sensors are stored on the SD card mounted on development board for retrieval after the accident. The system uses external sensors such as camera and Global Positioning System (GPS) to collect video and location data. In addition, the Black Box sends an alert message to a pre-stored mobile number via Short Message Service (SMS) in the case of occurrence of an accident. And the analysis data and the accident intimation will also update to the monitoring section through using Internet of things.

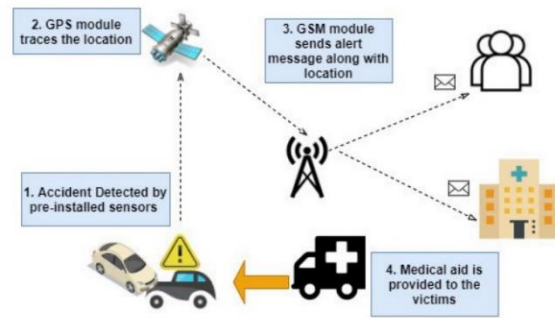


Figure 1.2: Overview of Accident Detection Systems [1]

### IV CONCLUSION

The number of fatalities impacted due to road accidents is increasing rapidly. If accident patient is rescued in less time, several lives definitely will get saved. In this paper different methods have been discussed which focuses on accident detection and rescue mechanisms. These methods employed different sensors like as shock sensors, accelerometer sensors, Vibration sensors, pressure sensors etc. and neural networks, representation learning, support

vector machines etc. such machine Learning algorithms for accident detection. Different methods for accident rescue mechanisms were also discussed. Whenever Accident happens, the information is intimated to emergency systems to provide timely help to the victims.

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