Accident Alert System with IOT and Mobile Application

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Abstract: The most common thought we have for our close ones is their safety. With cities expanding rapidly and seeing a substantial rise in traffic and road accidents, the safety of our close one's commuting on daily basis or taking long journeys is uncertain. People keep in touch with them in order to know their journey and whether the person has reached safely to the destination. The present work is to develop an em-bedded system powered by IOT technology through which we can constantly track and ensure safety of the people we care for. The system is equipped with a gyro sensor and multiple collision-detection sensors which are attached all around and under the chassis of the vehicle to detect abnormal tilt of the vehicle and/or collision if there occurs any. Location of the vehicle is constantly reported to the application and upon occurrence of an anomaly detected by the gyro-sensor or collision sensors, the occurrence of an accident and location of the vehicle is immediately notified to the family members on their application. The objective of this project is to ensure safety and be aware of the people and their situation if there occurs an accident.

Keywords: Accident Alert System; Accident Alert IOT; Family Accident Alert Application; Vehicle Collision Detection; Vehicle Accident Alert

I. INTRODUCTION

Safety is one of most essential parts of one's life and people give significant importance to their safety varying from health to driving. Driving being a most common and essential part of today's world, there exists a downside which is road accidents. With substantial increase in traffic every year, there is also a soaring rise in occurrences of accidents every year. This issue has been inevitable fear in everyone's mind when their close ones are on their commute or journey in a vehicle.Most often, the family of the person who has met with an accident is unaware of the situation and state of the person for notably long time since the occurrence of the accident. This can be a major factor that can influence crucial aspects such as getting proper aid and getting utmost care and help from the hospitals. Hospitals often does not provide their utmost services to the people whose family hasn't reached out to the hospital in a period of time and the proposed system can alter this state of unawareness and uncertainty among the family.The proposed system to designed to keep track of 2 primary aspects of the vehicle which is the state- in normal state or abnormally tilted- and the occurrences of collisions to the vehicle. If either of these factors undergo sudden abnormal

change, the system alerts all the family members about a possible accident to the person and sends the location which is accurate up to 2 meters. This can help the family in responding fast to the accident and provide utmost help and care to the person in all possible ways.

II. ABOUT THE PROPOSED WORK

2.1. Literature Survey

This section overlooks similar existing solutions and examines their advantages and disadvantages.IOT approach to Accident detection, reporting and navigation [1] is an existing system for accident detection, reporting and vehicle navigation. This existing system used shock sensor, NFC tags and GPS to identify the state of the vehicle. This system utilizes existing data of the user to identify the person. Upon occurrence of an accident, deployment of airbags would trigger the shock sensor and the location of the driver is immediately sent to the server using HTTP Request. Upon receiving request, help can be sent immediately to the location and perform appropriate medical support as person has already been identified.Automatic Accident Detector and Reporting System [2] is an ad-vanced and ideologically different system aiming at the road safety. The primary purpose of this system to provide help and medical assistance to the victim of the road accident. The methodology behind this system is by automating the alert system by automati-cally requesting for nearby medical assistance upon a collision or an accident to the vehicle. This task is achieved by usage of an application by the public at the incident and by application linked to the sensors of the system. Both these entities contribute in de-termining the location of the accident and provide medical assistance as quickly as possible.User Alerting System for Vehicle Accident Detection System [3] is another similar system aimed at providing information about the accident. This system uses vibration sensor to detect abnormal vibrations the vehicle has undergone and reports the geographical location of the vehicle via SMS to the registered members associ-ated with the person. Auto Accident App, developed by Platinum Peak LLC [5], is a mobile phone application to supply free, help to accident victims. It provides one-button access to emergency personnel and in small stages steering through data gathering process such that, there is no crucial information or proof that is missed. The disadvantage of this system is that it is a manual reportage once an accident occurs. Hence,

it doesn't very offer any sort of rescue or aid for the pas-sengers during the incident.

2.2. Proposed Work

In this section, the proposed work is elaborated at a high-level scope. The system can be mainly put into three main phases:

(a) Hardware Setup in/on the vehicle
(b) Accident Detection
(c) Accident Alert to the Family on application.

Hardware is setup in such a way that the sensors can detect acci-dents in all possible scenarios. These scenarios vary from collisions from different sides to tilting of car due to driving off the road or the railing. The collision sensors are placed inside the bumpers and chassis of the car to detect collision of higher severity. Collision sensors are prevented from being exposed to prevent or avoid unnecessary triggering and causing false alerts.
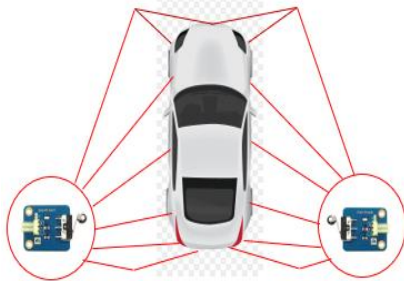

Fig. 1: Placement of collision sensors across the car chassis to detect collision or crash from all possible sides.

Along with collision sensors around the car, gyro sensor(s) are placed inside the vehicle in flat position. The gyro sensors are used to detect if the vehicle has undergone a tilt caused due to falling off the road or colliding into railing. Gyro sensors are secondary way of detecting if the vehicle has suffered a severe accident. The gyro sensors are calibrated in a way to trigger an alert only upon crossing certain tilt angle. Angles caused by the ramps, bumps or hilly regions are taken into consideration and the most abnormal angles will only be triggering an accident alert by the gyro sensor.

Fig. 2: InvenSense MPU-6050 gyro sensor which is used for measuring tilt angle of the vehicle
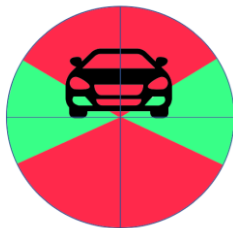

Fig. 3: Picture depicting the safe and abnormal angles of a car.

Green being a normal angle and red being an abnormal angle pos-sibly stating an accident.

Along with these sensors which are used for detecting accidents, a GPS Module and SIM800 GPRS Cellular Module is made part of the embedded system. The GPRS module is used for maintaining connectivity to the server when the vehicle is running and is capable of performing POST operations to the server even in a weak coverage area under GSM Network. The SIM800L module is primarily used as it is runs on cellular network and a vehicle is usually under a cellular coverage most of the time.

GPS Module serves one of fundamental features of the system by providing geographical location of the vehicle. The module is accurate up to 2m and constantly sends geographical coordinates to the server. Upon Accident detection, the module POST coordinates on to the server till a successful POST has been performed.

The Second phase deals with accident detection. Accident is de-tected when the collision sensors or the gyro sensors trigger to an event. The collision sensors close the circuit upon a collision from either side thus giving a signal to the Arduino. The Arduino will then POST the coordinates of the location of the vehicle on to the server along with accident alert. The system is connected to mobile network under GPRS network and is ready to POST data at any given point of time.

The third phase is accident alert system which resides in the mobile application. The android application, stated that it has active internet connection, is connected to the server 24/7 and the application runs in the background. The app performs a check every 2minutes to check for a new accident occurrence log on the server. Upon receiving an accident log, the application will trigger an alarm with sound and notification stating an occurrence of the accident. The alarm does not stop until a person addresses the alert. The figure 4 depicts the notification the user would get upon an accident.
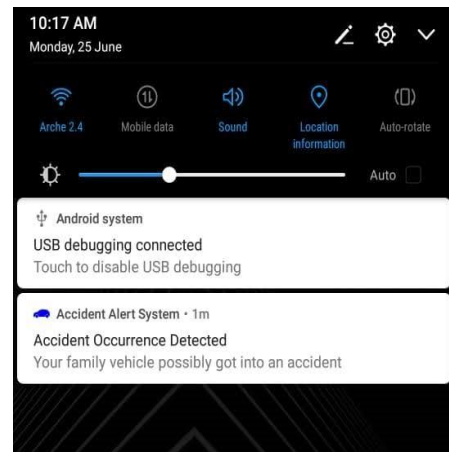

Fig. 4: Screenshot of Accident Alert on a smartphone

Upon opening the application, the user gets to see the screen with red alert symbol stating occurrence of an accident and an option to see the location of the accident. In this screen, the user also has the option to mute the alert sound.

Fig. 5: Screenshot of Mobile Application for Proposed Work

Opening the maps, the user can see the location of the accident and can take necessary actions to provide medical support to the person. The figure-6 represents the screen depicting the location of the accident.

Fig. 5: Screenshot of Maps in Application pointing to the location of the accident.

2.3. Design and Workflow

The backbone of the proposed work is an active network. The system is connected to internet and a cloud service is used as a bridge between the system and the mobile application. A cloud service is necessary for this work as the embedded system cannot directly report to the mobile application from a remote location. The Fig. 6 represents the basic structure of the prosed system.
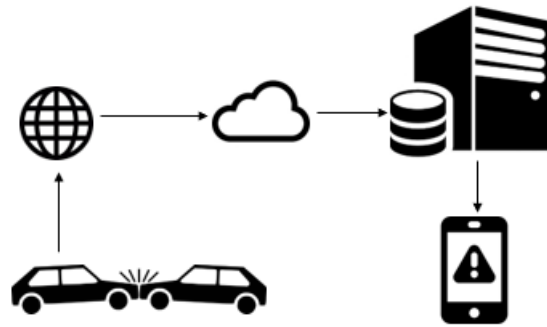

Fig. 6: Structure of the Proposed Work.

Both the embedded system and the application repeatedly checks for occurrence of an accident. The microcontroller checks for a signal from the collision sensors as they complete the circuit and give out signal to microcontroller which signifies occurrence of an accident. The microcontroller also reads values of gyro sensor continuously to keep track of vehicle's state. If either of these sensors give out a value stating an accident, the system uploads the accident log and geographical coordinates of the vehicle.

At application side, the application periodically checks for an update in database. If the application reads a value stating an accident, the application will trigger an alarm on the mobile to alert the family. The alert sound will not be turned off until the user addresses the application. Fig. 7 depicts the simple workflow of the proposed work.
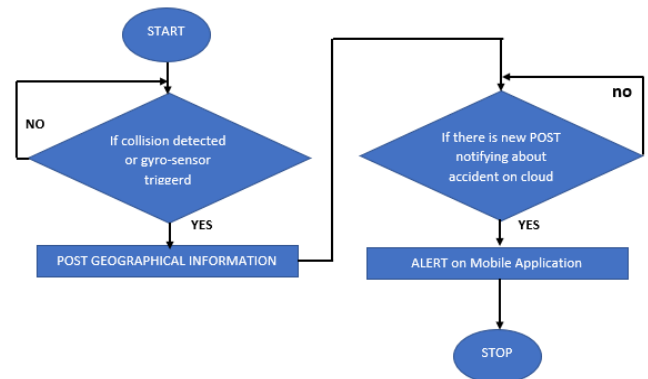

Fig. 7: Flowchart of proposed system

III. CONCLUSION AND FUTURE WORK

In this paper, the proposed and implemented IoT system may help the society in decreasing the death rates resulting from vehicle accidents. The proposed plan will help the family in obtaining information regarding the accident of their close ones as early as possible and would avoid any kind of delay that occurs in getting the information about the accident and the location. This system would help people in keeping track of their family members who commute on regular basis and get rid of fear due to uncertainty of their safety till they reach their destination on daily basis.The proposed work can be further enhanced or developed by add-ing a functionality to inform the nearby emergency services such as hospitals and fire department about the occurrence of an accident so that the person can get the

required assistance as early as possible even in the situation where there is lack of help from other people.

ACKNOWLEDGEMENT

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