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Car Accident Detection and Car Health Monitoring using IoT

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***Abstract*: A large percentage of people die from traffic accident injuries in every day. Every day the road accident the death of rate is increase. In daily transport is one of the biggest problems faced by human. Aim of this project is to use IoT to detect the Car Accident and alert the required authority with intensity of accident for emergency cases and also measure the car health with specific parameters. Every device is connected to each other in IOT domain. IOT can be used to solve the current problems by getting the sensor data and detection and intimation about the accidents. A large number of people deaths due to car accidents every day. The main reason of accident is driver's mistake and late response from emergency services. There is a need fo system to detect the road accident detection. Information is send to nearby hospital and police station by using system of exact location of accident spot. In research literature, a number of automatic accident detection systems are proposed by numerous researchers. Smartphones, GSM and GPS technologies, vehicular ad-hoc networks and mobile applications are use in accident detection. The implementation of a road accident detection system is very crucial in every vehicle. This paper presents automatic car accident detection techniques and car health monitoring used to save person's life.**

***Keywords*: Internet of Things, Cloud, Automobile, Smart Cars.**

1. Introduction

Car accidents are major issues in the world wide. In India every four minutes' deaths occurred due to car accident. The serve report by world health organization shows that every year in Maharashtra '12264' people died in '35853' road accident in 2017. There are some of causes for which an accident can occur, lack of training institute, use of mobile phone while driving the car, unskilled drivers, bad road condition, overloading and poor traffic management. We observed Most of the time death occurred in the car accident due to late arrival of ambulance to the accident spot. In this paper we proposed a solution for above reasons. The Internet of Things is developing at global scale. IOT is built with the vision of uniting the physical world with the Internet, it has taken the world by a storm. With ubiquitous computing prevalent in every aspect of our lives, the IoT will add another link in this chain of global interconnectivity. Accidental deaths are increasing a lot due to careless and high speed drives. Lot of lives are lost due to late access to hospitals or not able to send any help message to respected authorities [1]. Using IOT with such problems can solve a lot of problems and also save lives. The paper proposes a system which will detect the accident and notify nearby authority with immediate location assistance and also monitor the car health. A study by Virtanen et al. shows that 3.6% 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 [3]. Following is a survey from [4] National Hospital Ambulatory Medical Care Survey:

All unintentional injury deaths
- Number of deaths: 146,571
- Deaths per 100,000 population: 45.6

Unintentional fall deaths
- Number of deaths: 33,381
- Deaths per 100,000 population: 10.4

Motor vehicle traffic deaths
- Number of deaths: 37,757
- Deaths per 100,000 population: 11.7

Unintentional poisoning deaths
- Number of deaths: 47,478
- Deaths per 100,000 population: 14.8

Deaths happen in Maharashtra in year 2017
- Number of deaths:12264

2. Existing work

In Exiting work, we can find use of different module and android support for the car accident detection and different monitoring. Previous systems use

- *GSM – Global System for Mobile Communication:* GSM can provide data services and roaming service. Roaming is using your GSM phone number in another GSM network.
- *GPS - Global Positioning System:* GPS system location and time information can be obtained by the GPS device in any weather conditions. Tracking system or navigation system, the architecture is more or less similar. If there is an accident at any place then GPS system tracks the position of the vehicle and the information is sent to the particular person through GSM. The person is alerted by either call or SMS.

$$\text{Kinetic Energy} = 1/2\ mv^2$$

where m=object mass and v=vehicle speed.

When car break is applied due to break the two forces reduce the speed of car. One is the friction force (f) and other is the gravitational force (g). Considering the friction coefficient 0.9 for a plain road surface and standard gravitational force (9.8 meters per square second), we can get the final speed of a vehicle after one second once the brake is applied. As such, if the speed is less than these maximum speed, than it would be assumed that some other deceleration force worked on the vehicle to reduce the speed and an accident has occurred [1]. Boards like arduino and xbee are also used in previous systems to make car accident detection with an approximate location.

3. Limitations of existing work

Use of GSM and GPS module may get the location and intimation to the required authority but use of traditional methods makes it more non-reliable to work as the data is not stored to cloud and the confirmation of data sent to right authority is also not obtained. Use of development boards like arduino and xbee makes the project limited and slow as they are microcontroller and have less speed of calculation and less memory. The data is only send as an sms but not as actual data for analyzing or for monitoring the car health. The existing systems are also not reliable for intimating to right authority and thus results in human loss.

4. Proposed system

The proposed system overcomes the problem of sending the alert to specified authority in a confirmation manner and also sending the data to the cloud for analyzing. Due to microprocessors used on board the data retrieval and sending of data is faster. Proposed system supports internet connectivity as well as heavy databases for faster access and use of data for reaching the right authority as fast as possible. The proposed system detects the accidents based upon values provided by sensors used in system. The retrieved values are used by CART algorithm to achieve the above objective. All the data retrieve is stored in cloud for health analysis and accident prediction. The health information is also be provided to the end user through mobile app. The higher authorities (hospitals and police stations) will be provided with a web panel to monitor and respond to nearby accident cases. The sensors playing major role in providing the accidental parameter are piezoelectric vibration sensor, GPS sensors, Accelerometer, Ultrasonic sensor. The health monitoring sensors used are temperature and humidity, carbon monoxide.

A. Advantages and disadvantages

Advantages

- Faster Sensing of data
- User friendly app for monitoring car health
- Faster Intimation to the right authority
- Easy detection of accident
- Detection of Intensity of Impact+
- Safety Intimation in app
- Less Power Consumption
- Distance detection in system

Disadvantages

- Needs Constant Internet Connect

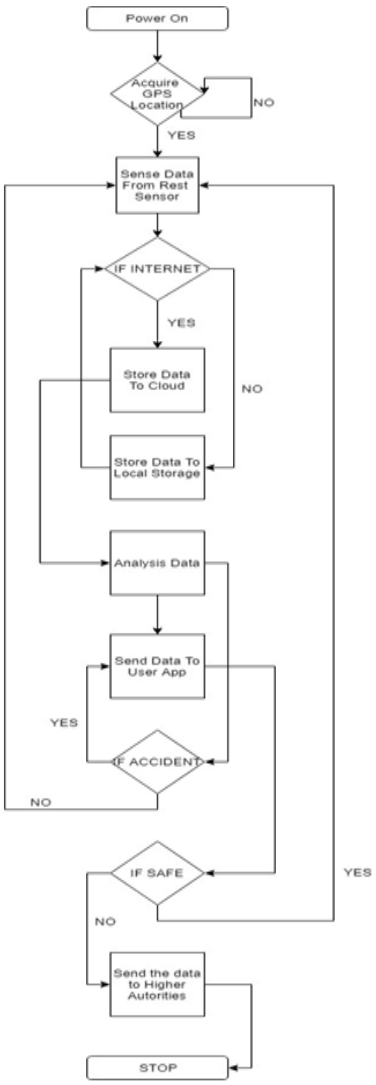


Fig. 1. Flowchart

5. Methodology

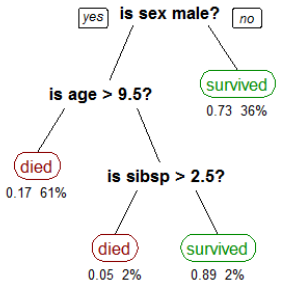
The accident detection sensors in the proposed system are vibrational sensors, GPS sensor and Ultrasonic sensor. The system is continuously monitoring the car health with the help of different sensors like Temperature Sensor, Gas Sensor, and Humidity Sensor. When the user is driving the car the GPS sensor is tracking the location of the car and the vibrational sensors are sensing the vibrations coming from the car. The accelerometer is tracking the speed of car for driving speed limits or immediate brake detection of car. When the car is hit by any obstacle or car at any side the four side vibrational sensor will detect the amount of vibration and detection the side of accident. GPS sensor is used to detect the location of car in form of longitude and latitude. GPS technology has very much

accurate result. A very sensitive and accurate. GPS signal acquiring device is required for the system The Obtained data will be further sent to cloud.

The data obtained in cloud is analyzed by the different algorithms and user is provided with car health data and graphs. The data is also used for detecting the accident and the data is saved in database. When accident is detected the data is immediately sent to the nearest Hospitals and Police authority. The authorities will have a portal with all the details of users sent by the cloud and they will get the location of the user and intensity of the accident. On the user side if the accident is not intense and user is safe than he/she can cancel the request for assistance from the hospital.

6. Algorithm

The algorithm used in the proposed system is cart algorithm from decision tree. Because of small data set Decision tree based algorithms are used. The decision tree algorithm falls under supervised learning algorithm. A training set is used with number of training data having features and label to train the algorithm. The trained model is saved for farther prediction on real time data. To predict an output the testing data and real time data is supplied to the train module.



CART algorithm stand for Classification and regression tree. CART algorithm is basic algorithm and foundation for important algorithms like bagged decision tree a random forest and boosted decision tree. The CART model involves selecting input variable and split points. The process continues until a suitable tree is constructed. Creating a binary decision tree is a process of dividing up the input space called recursive binary splitting.

7. Mechanism of system

A. Car health monitoring

The car health monitoring will be done by Temperature sensor, Gas Sensor, Accelerometer. The car engine temperature plays a vital role in engine life. If the engine is over heated the piston can get damaged and engine can be seized. The temperature sensor senses the temperature and sends the data to cloud and keeps informing the user. The Gas Sensor keeps track of pollution done by the car which will reflects the car health and exhaust condition. The more is the carbon emission from the car the more the car needs attention.

The Accelerometer keeps the track of speed and breaking of car. All the sensors are controlled by microprocessor-based board which in-turns sends the data to cloud using internet connection.

B. Middleware Cloud

The cloud contains all the frameworks and programs required for capture data and process data. Cloud is a remote computer where one can store data or retrieve anytime anywhere in world. The cloud will have Accident prediction algorithms and Data Analysis's tools. The data sent by sensors is captured by cloud and stored in database. Heavy data requires database created especially for IOT purpose. Lot of data is constantly received from sensors through the system installed in cars.

C. End Authorities

The Hospitals and Police are provided with a panel and app for obtaining the information and location of the user who had accident. The Intensity of accident is also sent from cloud for emergency situations and hospitals to take immediate action.

8. Software requirements

A. Arduino IDE

Arduino is an open-source software and hardware company, project and user community that designs and manufactures single-board microcontrollers. Arduino board designs use a variety of controllers and microprocessors. The boards are sets of analog and digital input/output (I/O) pins that may be interfaced to various expansion breadboards. he boards use single or double-row pins. The Arduino is a integrated development environment (IDE) is a cross-platform application. The Arduino IDE supports the languages C++ and C using rules of code structuring.

B. Python

Python is an interpreted, high-level programming language, object-oriented with dynamic semantics. Its high-level built in data structures, combined with dynamic binding and typing. Python's simple, easy to learn syntax and therefore reduces the cost of program maintenance. Python supports packages and modules. The Python is the extensive standard library and interpreter are available in source. Python features a dynamic type automatic and system memory management. It supports multiple programming paradigms and procedural and functional. Python's developers strive to avoid premature optimization. Reject patches to non-critical parts of the Python reference implementation that would offer marginal increases in the speed at the cost of clarity.

C. Raspberry Pi with Raspian OS

Raspian is a Debi an-based computer operating system for Raspberry Pi. There are several versions of Raspian including Raspian Jessie and Raspian Stretch. Raspbian uses PIXEL,

Lightweight, Pi Improved X-Window Environment, as its main desktop environment as of the latest update. It is Open box stacking window manager with a new theme and composed of a modified LXDE desktop environment.

D. Mongo DB

Mongo DB is an Open Source oriented document database. MongoDB supports range query, field, and regular expression searches. MongoDB provides high availability with replica sets. MongoDB can be used as a file system, called GridFS, with data replication features and load balancing over multiple machines for storing files. This function, called grid file system. It is included with MongoDB drivers. The system is lends itself and highly-scalable to "big data" implementations. Mongo DB exposes functions for content to developers and file manipulation.

9. Hardware requirements

A. Arduino

Fig. 2. Arduino

Arduino is an open-source platform. Arduino boards are able to read inputs - light on a sensor, a finger on a button and turn it into an output - activating a motor, turning on an LED. Arduino is an open-source software and hardware company, project and user community that manufactures and designs single-board microcontrollers. Arduino board designs use a variety of controllers and microprocessors. The boards are sets of analog and digital input/output (I/O) pins that may be interfaced to various expansion breadboards. the Arduino project provides an integrated development environment.

B. Raspberry pi

Fig. 3. Raspberry pi

Series of small single-board computers is a Raspberry Pi. It can develop in the United Kingdom. It does not include and cases peripherals. The Raspberry Pi consists of two arms. Raspberry Pi Foundation developed first two models. The Pi Model B was released after first two models. The Raspberry Pi Foundation, more than 6 million Raspberry Pies. A Raspberry Pi Zero with smaller size and and general-purpose input/output and reduced input/output. For the later Model B with 513 MB RAM. USB device used are Pi Zero. Raspberry Pi responsible for developing the technology developing countries and schools.

10. Sensor

A. Piezoelectric vibration sensor

Fig. 4. Piezoelectric vibration sensor

The Piezoelectric effect is used by a piezoelectric sensor, to measure pressure, acceleration, temperature, strain, or force by converting then to an electric charge. Piezoelecrtic sensor are versatile tools for the measurement of various process.

B. GPS Sensor

GPS is the Global Positioning System. It is a satellite system provides geolocation. It provides latitude and longitude as a location. It is a satellite-based radio navigation system owned by the United States government and operated by the United States Air Force. Geolocation is provided by GPS sensor

Fig. 5. GPS Sensor

C. Ultrasonic Sensor (HC-SR04)

Ultrosonic senser work on the principle same on radar which evaluate attribute of a target by interpreting the echoes from radio or sound waves. It generates high frequency sound waves. This technology can be used by measuring wind speed and direction.

Fig. 6. Ultrasonic Sensor (HC-SR04)

11. Result

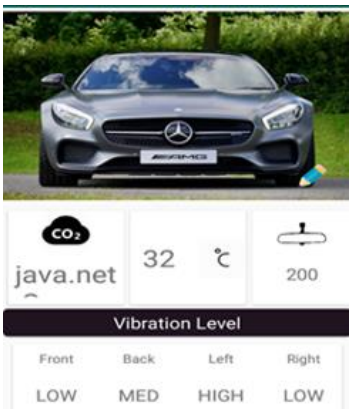


Fig. 7. Vibration level

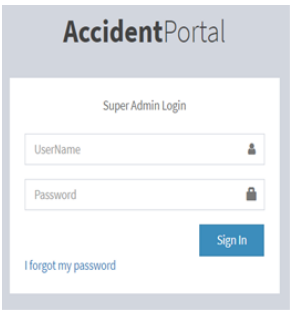


Fig. 8. Accident portal

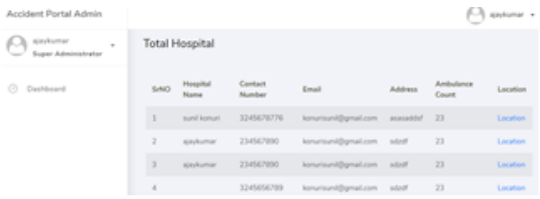


Fig. 9. Accident portal admin

Fig. 10. Map

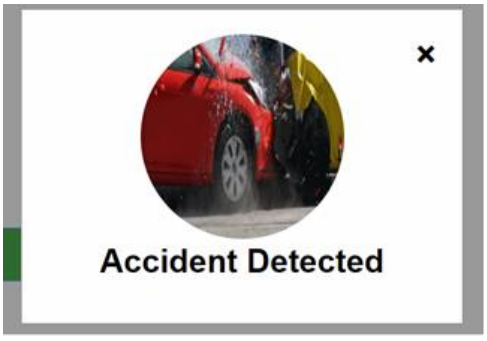


Fig. 11. Accident detected

12. Future scope

This system will be used in future for analyzing road conditions. The system can also be used for determining dense traffic area.

13. Conclusion

Use of smart algorithm and dense dataset can help in detecting accident based upon sensor input. The system will also help in saving many lives due to its direct connection with hospitals.

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