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## Wreck Watch: Accident Detection

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**ABSTRACT:** A lot of damage is caused by accidents and it has become a necessity to detect them early and provide a timely action for avoiding any further damage. A method has been proposed for analyzing the sensors mounted on vehicles which server the purpose of collection of data. Instead of independent analysis, the data should be correlated and analyzed the pieces of data altogether to get a bigger picture. There is another type of data that needs to analyzed which is obtained from the human wearable devices. For analyzing and correlating these two types of data, a big system and bigger framework is required. In this paper, design methodology and architecture has been proposed for proper analysis of the data given by sensor on vehicles and human wearables for the purpose of detection of any accidents in real time. After the accident has been detected, the impact is also assessed by the system. The needful action is taken which can either be contacting the relevant person or contacting the domain experts.

**KEYWORDS:** Internet of things, accident detection, smart cities, mobile phones, accident notification.

### I. INTRODUCTION

Cause of death of more than half a million humans is road accidents every year and around three thousand seven hundred every day. The number of persons who are injured or disabled is around a fifty million. More than ninety percent of road accidents occur in lower countries with lower and middle- income that are contributing for less than a half of total vehicles in the world. The reason for these accidents is collision of vehicles with each other, debris on the road, with pedestrian, animals, or any stationary object like a pole, building or tree. Some of the causes of this is environment of the road, design of the road, bad driving skills, disablement because of drunk and drive, over-speeding or rash driving. If there is any absence of system that is designed for detecting and reporting accidents to any service of ambulance, police or family member, proper and immediate medical attention is not provided to the victim. The various types of accidents are side collision, rear-end, road departure, rollover, fall-off. Various ICT technologies were developed in past with the motive of reducing response time of accident. Majority of the systems for accident detection are customized for luxury cars and cannot be modified for other austerity cars. Also they have very limited range for detection of accidents. In the paper, a system for accident detection has been proposed that detects as well as reports the accident type, thus providing the correct medical aid and support[1].

A lot of damage is done by accidents. If it is detected early and within the minimum time a lot of help will be provided. Sensor technology along with the global positioning system can give the information about the exact position of vehicle or person with parameters of longitude, latitude and altitude. The information of altitude is given only when the vehicle is travelling in hilly area. Any sudden change in the acceleration of the vehicle is sensed by the accelerometer. Various other sensors are shock, rotation, vibration, smoke which are installed inside the vehicle. The sensed information is send by the sensors but if they work independently, a clear picture will not be provided. But with the amalgamation of information

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provided by all these, a better picture of any miss-happening will be obtained and avoided. But this is not effective in overall avoidance of the accident. Since in case of any fault, health condition of the person should be monitored. For monitoring the health conditions, a number of sensors are provided inside the vehicle. Information about the blood pressure, breathe rate, heartbeat, rate of eye blinking and other movements can be detected by wearable sensors. If we want to understand the picture in a better way, then health data needs to be analyzed with sensor data of vehicles. Thus an architecture is needed for analyzing the data in order for detecting and properly reacting to the accidents. The knowledge of accident detection and reaction for this detection resides with domain experts. Detection of accidents and operation rescue mission is an operation which is time critical. For developing an automatic system, the architecture should be able to facilitate communication with the expert domain so that the system can act according to it. The system should have the capacity for proper detection and reaction to situation in real time. For proper architecture designing, real time architecture should be developed. Because of dense traffic, it becomes a necessity to have a system for detection of accident and rescue has become a necessity these days.

For reaching out to a large mass and have a large scale, the construction should be able to sermon the following 4V's: Volume, Velocity, Variety, and Veracity. The system should be self-learning.

It should learn from its past and from the feedback given so that it is able to improve continuously.

Thus, there should be a module for meeting the purpose of learning and improving continuously[2].

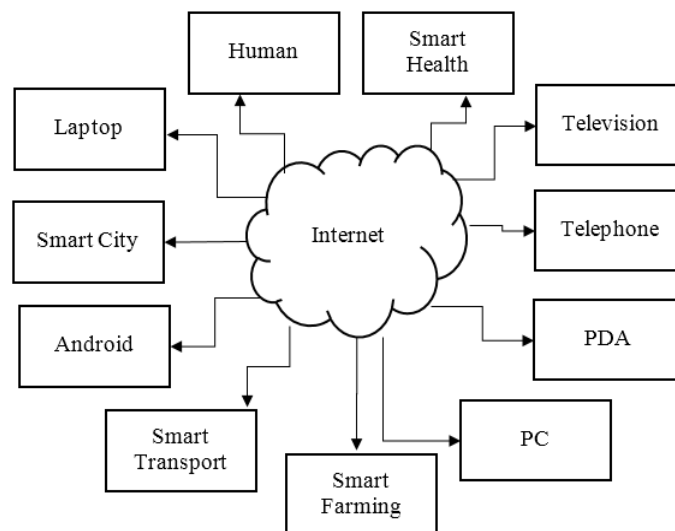


Figure 1:IoT Eco-system

## II. LITERATURE REVIEW

Authors Fizzah Bhatti, Munam Ali Shah, Carsten Maple and SaifUI Islam have proposed an IoT based transportation system which can be a solution to increasing road accidents. In the system the vehicle is embedded with a number of sensors of different variety. An android application was developed for gathering information related to g-force, speed, sound, pressure and location[3]. Authors Jules White, Chris Thompson, Hamilton Turner, Brian Dougherty, Douglas and C. Schmidt have presented a model that serves the purpose of detection of accidents, showed that to provide situation related awareness sensors of smartphone, connection of networks and empirical formulas were provided to show the effectiveness

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of various approaches[4]. Authors Nikhil Kumar, Anurag Barthwal, and Divya Lohani have presented a smartphone which has the capability of detecting, locating and determining the type of accidents. It is cheap, accurate and can be put on any type of vehicle. The information of the accident is sent along with the intensity. Authors Venkata Krishna Kota, Nagendra Kumar Mangali, Thirumal Kumar Kanakurthi, A. Rakesh Kumar and T. Velayutham have designed architecture for accident detection and rescue system which is automatic. The system has for V's, velocity, volume, variety and veracity. While the design of architecture big data technology was used.

### III. METHODOLOGY

The architecture for the system is proposed in the system for identification and avoidance of the accidents. For this purpose, it uses Continuous Query Model which is based on Complex Event Processing Technique.

1. **Data Sources:** The live data being recorded can be categorized into three categories. Data from sensors mounted on vehicles, data from human-wearable sensors, and data from sources that are at various locations of the accidents. The architecture should be capable of adding any other type of data in future. The data sent by sensors mounted on the vehicles is speed, shock information, acceleration, location with altitude, latitude and longitude, rotation, vibration or any other requisite information. Information such as blood-pressure, heart-beat, movement, breath rate is sent by human-wearable sensors. Images, videos, traffic information is sent over by other sources. For example, camera can capture images and videos and send it over to the system. The system will request for this data for getting information related to locations for the purpose of processing and gaining an insight. A few historical data can also be used. These are:
  - a. Personal data base - containing details such as emergency contact details of the victim.
  - b. Medical database - containing the medical history of victim so that proper medication can be provided.
  - c. Social Network Database - Containing call logs of recent calls to contact immediately.

These sets of data have gigantic information and thus framework should be designed as such for handling the gigantic information. It is not necessary that the sensor used by all the vehicles is same. The sensors used in vehicles and the human wearables will be of different companies. Thus the framework should be capable of handling a wide variety of data from the sensors. The framework should be capable of handling data with very high velocity because a number of vehicles will be sending a lot of information. Thus among the four V's of the framework, volume, velocity and variety has been discussed.

2. **Detection of the accidents and rescue:** Detection of accidents is a very complex event. All the data from sensors on the vehicle and the wearable devices should be correlated and assessed for checking the impact of the accident. Any accident is complex event which is combination of simple event. Requisite framework should have the capability of defining the complex events. It should monitor the existence of such events and also analyze them for giving proper reaction. In order to meet these demands, the technology of complex event processing is used. A few accident scenarios have been modeled as complex. The rescue engine for identification of accident is based on CEP will monitor continuously the information provided by the sensors in vehicles, human wearables and intermittently check for existence of any unwanted event. If identification of any such event takes place, its impact will be assessed and the required action will be triggered. The relevant action can be either contacting the nearest hospital, police station, emergency contact. In Figure 2, the architecture of the system can be identified. Complex situations are those in which multiple accidents have taken place and are modeled as S1, S2 to Sn. With the help of domain experts, the actions for various accidents have been defined and modeled as A1, A2, to An. The

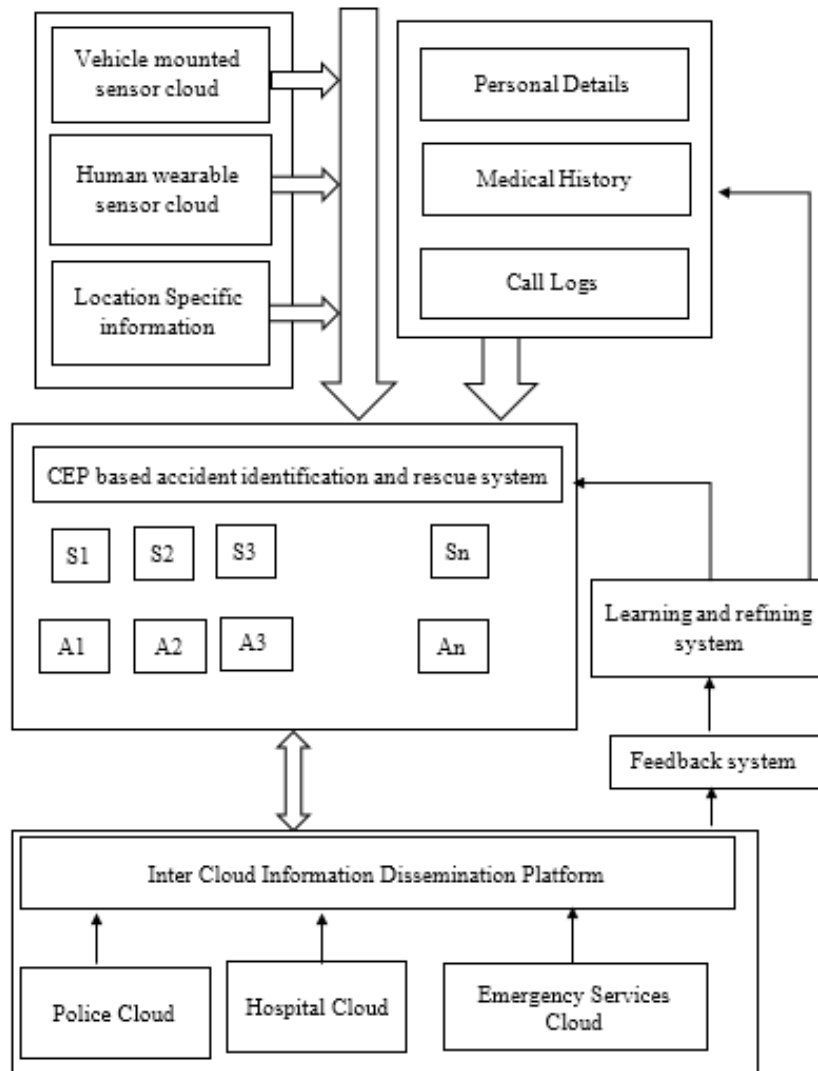
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information will be send by the vehicle sensor’s cloud, wearable sensor’s cloud and information related to location to the engine that identifies the accident and rescues it.



**Figure 2: Block Diagram of the system**

By correlating data from the sensors, continuous monitoring will be carried out. By making use of “Inter Cloud Information Dissemination Platform”, the situation related to accident will be sent over to hospitals, emergency contacts and police so that these can react to it after acknowledging the data sent over to them. They will give update according to current condition to CEP along with their feedback. The system for learning and refining will

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act upon this feedback, analyze it and learn from it by making use of machine learning. The accidents and the corresponding actions are refined according to the knowledge learnt. Thus fourth V, veracity is also addressed.

## IV. RESULTS AND DISCUSSION

The information is sent by sensor mounted on vehicle and by wearable sensors. They are modeled as POJO which is Plain Old Java Object or Java Maps. Java script object notation and Extensible markup language formats also have the support feature for this information. The web services and cloud services are being used for gathering information from information services which are specific to a particular location. Also the web services and cloud services help in gathering information from databases having personal details, medical history and call logs. Complex event processing is commendatory choice while considering the applications for event detection, filtration and then correlate so that identification of complex events can be done and in reaction can be given to them in real-time. CEP technique can find application in domain of operation management for monitoring of business activity and management of business process. These are also used for detection of fraud and management of risk. For such requirement, CEP is chosen as the best alternative. The software of ESPER CEO is highly suggested because of its nature of open source, large availability and ability of supporting wide-variety of data and processing the data even at higher velocities. Thus the four V's Volume, Velocity, Variety, and Veracity are satisfied. The information related to police, emergency services and hospitals is on different clouds. Thus, for exchanging information among themselves technologies if information exchange is used. For realizing the learning and refining system various tools of machine learning such as octave, R and spark machine learning are used.

## V. CONCLUSION

There has been drastic rise in volume of vehicles in past years and resulted in an increase in traffic and accidents. There are still a few existing systems for detection of accidents but they are not fully efficient and hence the rate of fatality is rising. Because of lack of a quick and timely response to the accidents rising due to insufficient detection of accident automatically, inadequate notifications and routing of the response. Because of unavailability of systems that are effective, affordable and capable, this problem is only worsened. Thus for proper addressing of these issues, a system has been proposed which is based on IoT in which a number of sensors have been used for serving the purpose of detection of road accidents with higher accuracy. The location of the accident is detected in minimum time by the proposed system and then nearest hospital is searched where the emergency request for assistance is sent to the department of hospital. The deciding factor for the decision taken are data from the sensors and about the status of the vehicle. Any false alarms generated will be reduced by the proposed systems. The only limitations are that the study of the proposed system has been carried out in an artificial environment and then simulated. The future work that can be carried out is that the lagging can be reduced and security and privacy be enhanced by making use of technology of mobile computing. Analysis of full security and privacy needs to be done for the system, this can be worked upon in future.

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