A STUDY OF ACCIDENT PREVENTION SYSTEM USING AI

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Abstract
In Today's world Road accident is a major problem. . A natural consequence of the vehicle population growth is the increase in traffic congestion which in turn will lead to more accidents. Regularly accident detection and taking immediate action against emergency health care of victims by informing a hospital or a police station about the accident on time is an important role inhuman safety and road traffic management. A smart city with smart AI based traffic monitoring and reporting mechanism can help providing medical emergencies in real time and this would result in saving lots of life. So that this paper will help to detect thee occurrence of traffic accidents on a road supervised under surveillance camera

Keywords: Accident monitoring, Accident detection, Accelerometer, GSM, GPS

Introduction
Road Accidents is a very serious and high priority public health concern as the statics shows more than 1.25 million people die each year as a result of road crashes. Regarding bad road conditions due to the weather, previous studies have revealed that there is a strong correlation between road friction coefficient and traffic accident risk [1,2] Every day, almost 3,700 people are killed globally in road traffic crashes involving cars, buses, motorcycles, bicycles, trucks, or pedestrians. More than half of those killed are pedestrians, motorcyclists, and cyclists. Today, due to traffi c accidents, injuries and fatalities have become a major public health and socio-economic problem in India. According to the "WHO Report 2015: Data Tables" the total number of fatalities in India in 2013 is 238,562 and reported number of road traffic deaths is 137,572 with the estimated road traffic death rate per 100,000 population being 16.6. According to , in 2015 the 2030 Agenda for Sustainable development was launched which aims at reducing the number of deaths and injuries arising due to road crashed to half its number by the year 2020. In regard to this, authors provide a review on the existing technologies that aim to detect accidents automatically and alert the emergency centers without much delay.

Literature Review
AI can help in improved awareness of road conditions, driving behavior of the people and can avoid accidents with the help of improved active safety and enhanced traffic condition. From manufacturing or management point of view, AI can also help in making processes more efficient and digital [3].

Research has revealed that single-vehicle accidents are mostly caused by wet weather [5].

The proposed system in deals with an automatic accident detection system involving vehicles which sends information about the accident including the location, the time and angle of the accident to a rescue team like a first aid center and the police station. This information is sent in the form of an alert message. But in the cases where there are no casualties a switch is provided which can be turned off by the driver to terminate sending the alert message. A GSM module is used to send the alert message and a GPS module is used to detect the location of the accident. The GPS and GSM module are interfaced to the control unit using serial communication .The accident itself is detected using two sensors- Micro Electro Mechanical System (MEMS) sensor and vibration sensor. MEMS sensor also helps in measuring the angle of roll over the car. A 32-bit ARM controller is used as the main high speed data-processing unit. The vibrations are sent from the vibrating sensor to the controller after passing through an amplifying circuit. Similarly the roll over angle is sent from the MEMS sensor to the controller.

Causes of problem

Traditional traffic monitoring system in designed only to monitor traffic or to control the traffic, but it does not provide any solution to decrease the fatal accidental human damages rate which occur due to lack of medical aid in real time. Consider a scenario where an accident occurred but no one was there to report this accident, the victim is critical and every second counts, any delay can result in disability or death. We cannot root out accidents totally but we can improve in providing post accidental care just-in-time. There are lots of sensor based systems available in the market as well but that require vehicle owners to install those sensors in their vehicles

It has been shown that hydroplaning occurs at vehicle speeds of 80 km/h on thick water films when the water depth exceeds 2.5 mm [8].

Advantages and Results

Both the accident and the accident location can be detected as opposed to only one in the other approaches. There is also a method to stop sending the alert message and hence save time of the rescue time. The use of GPS adds to the advantage of the system being cost-effective, portable and detecting the accurate location and the time taken for the entire detection process and sending of the message is greatly reduced as compared to other methods. ACA(Ant Colony Algorithm) is used for the parameter selection of SVM which plays an important role in the accuracy that can be achieved by SVM. The IoT sensors used here for monitoring the vehicles are the highly sensitive magneto resistive sensors. SVM is trained with historical traffic information and tested on future traffic data. The algorithm tries to find a decision plane that separates the class of 'traffic accident' from the class of "no traffic accident'. This is improved by using ACA which is an optimization algorithm

Results

The metrics that have been used to detect the efficiency of detection include: (1) False Alarm Rate (FAR): ratio of error alerts to all detected events,(2) Detection Rate (DR): ratio of detected events to the real world accidents and (3) Average Time to Detect (ATD): time average between detected and happened. Results show that the IoT based method outperforms the traditional sensor based method and the improvised SVM model with ACA outperforms the traditional SVM model and also has a faster convergence speed and the Mean Square Error (MSE) is lower compared to the traditional SVM. The proposed system in aims at reducing the loss of lives due to traffic accidents and performs three main tasks – (1) detecting an accident and sending the location to the nearest hospital, (2) controlling traffic light signals in the route taken by the ambulance and (3) monitoring vital parameters of the patient inside the ambulance itself and sending this information to the hospital. These three tasks are achieved by the working of four units into which the system is divided: The vehicle unit: This unit consists of a microcontroller, sensors, GPS, GSM module and an accelerometer. The sensors detect the accident, the GPS gets the location and the GSM module conveys this information to the main server unit. The accelerometer can help avoid accidents by notifying the driver when the position of the vehicle is deviated from the normal. The entire vehicle unit must be installed in the vehicle. The control unit: This unit contains the database of hospitals and is responsible for communicating messages between all the units. The ambulance unit: This unit has a patient monitoring system to constantly measure and convey the patient's temperature and pulse rate to the hospital. The traffic junction unit: This unit turns the signal to green when the ambulance is about 10 meters away so that the path is clear for it to move quickly. This is achieved through RF communication. Thus, this system has overcome many drawbacks of the existing accident detection systems with respect to time. The proposed system in is in the form of an Android application which detects an accident using an accelerometer which is built in the smartphone. The phone must be docked inside the vehicle and not held by any person. The working of this application is as follows: When the device is tilted above a certain threshold and is detected by the accelerometer, the application waits for 15 seconds. Here, three kinds of input can be received. (1) If the user is active, he can press "cancel" if the device was tilted by mistake. (2) If the user is active, he can press "send" if an accident has occurred. (3) If the user is inactive and no button is pressed after 15 seconds, an accident is assumed to have occurred. In case of (2) and (3), the current location is fetched by GPS and a pre-recorded voice message along with the location is sent to the 108 ambulance emergency response service. A study on GPS services provided by Android has been thoroughly conducted. Thus, through the use of just a smartphone without any extra hardware components, efficient accident detection and notification has been achieved. The proposed system in [15] also uses an Android application where the smartphone must be placed in a holder attached to the vehicle. The Accident Detection Algorithm detects an accident based on three kinds of events: (1) A collision is detected if the accelerometer shows a reading above the threshold which is 4g ($g=9.8m/s^2$) and the approximate severity of the accident is determined by a metric called Acceleration Severity Index (ASI). (2) Rollovers are detected using a gyroscope and a magnetometer. If a rotation greater than 45 degrees occurs and if the instantaneous speed is found to be less than 5km/h, it is considered as a rollover. (3) And airbag deployed signal indicates an accident as well. If one of these three events is detected, an alert is sent through three different sources - a Decentralized Environmental Notification Message (DENM) message containing a Road Hazard Warning, by performing an e-Call to an Emergency Medical System (EMS) and finally by SMS. This system controls false positives by sending accident notifications only if a countdown sequence is not interrupted by any of the passengers. The proposed system in [16] consists of several components with different functions. First, the vehicles should have embedded in it an On Board Unit (OBU) responsible for detecting accidents and communicating information about dangerous situations. The notification of the detected accidents is made through a combination of both Vehicle-to-Vehicle (V2V) communications and Vehicle and the Roadside Infrastructure (V2I) communications, while the destination of the information is the Control Unit (CU) which will handle the alert notification, estimating the severity of the accident and communicating the incident to the appropriate emergency services which is done through the internet service. If the internet is unable to be used, then an infrared module through RSU (Road side Units) can connect the OBU with the CU. The layouts and street structure should be exploited for the dissemination of the protocol. The makeup of every module are as follows. The OBU consists of in-vehicle sensors to detect accidents, a data acquisition unit DAU unit to periodic data and an OBU processing unit to process and find the occurrence of an accident for which it makes use of an Accident Detection Algorithm. The two impactful events in an accident are Roll over events and strong impacts. Roll over is captured by sudden strong horizontal tilt. Applus and IDIADA provides a lot of historical data, thus information on collision. The average tilt from the current vehicle taken periodically is integrated using the rectangle rule and with the help of old data, and by setting threshold, they are classified as accidents. The internal structure of CU unit receives notification from the vehicle; it classifies the accident based on the severity and decides on the needed resources for the particular event. The various actions include storing the accident information in the database, notifying the police and emergency services with the help of information in database. The accident severity is estimated using Data Mining classification algorithms like Bayesian Network and K2 algorithm which is run on Weka platform for historical data from The National Highway Traffic Safety Administration which maintains the General Estimates System (GES), a database with information about traffic accidents that began its operation in 1988 in the US. Based on number of attributes like time, causalities and damage, the classification is done. The improvements in this work is using this system at high speed The system in detects an accident by utilizing GPS and a Map Matching (MM) algorithm. The GPS is used to send the position and speed of the vehicle every 0.1 second to a Micro Controller Unit (MCU) which compares the current speed to the previous speed every o.1 seconds and if the speed has fallen below a threshold an accident is said to have occurred and it then checks for the location of the vehicle using the map matching module and sends an alarm to an emergency center is the vehicle is found outside the road network. The location of the accident is sent using GSM. The braking distance is dependent on speed and is proportional to its square and hence the faster a vehicle is going the more bleak are the chances of avoiding a crash [20]. The forces that help in bringing the vehicle to a stand-still after the brakes are applied are frictional force and gravitational force. The maximum speed that would be achieved after applying the break and when only these two forces are in play is calculated. If the speed sent by the GSM to the microcontroller is however lesser than this maximum speed it is inferred as an accident in which additional forces have played a role in decreasing the speed. These additional forces come from the kinetic energy that is associated with a body while in motion that gets converted into destructive forces during the collision [21] The MM algorithm is used to find the location of the vehicle on the road network. The Geographical Information System (GIS) software is used for MM using which the vehicle is continuously positioned on a digital map. Finally, when an accident is detected a flag is raised and the MCU waits for 5 seconds before sending an alarm out to the emergency center. In these 5 seconds the driver can press a button to cancel the alarm and help reduce the number of false alarms. The speed, location, time and the contact details of a relative of the vehicle occupant will be sent as GPRS data using the GPRS module of the MCU and in cases where there is no GPRS coverage an SMS is sent with the same information. After this, a voice call is initiated to the emergency center if the occupant is in a position to describe the accident. This finding supports previous literature reports, where the main factor affecting traffic injury severity was determined to be the designed road geometry [6,7]

CONCLUSION

The papers provide various methods to detect accidents using both hardware and software methods which provide good results. Most of the discussed methods also provide the driver with the option of turning of the alarm in cases where the accident is not serious or false detections of an accident. These methods are either mostly dependent on some hardware like sensors that have to be present in the car or require a smart phone to be present within the car. While the use of such hardware can prove to be a more cost-efficient approach it has the drawback of being destroyed in the accident and hence giving spurious or no readings at all. Hence, an approach that does not depend on any hardware device or sensor that is associated with the car is required for the detection of traffic accidents.

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