A Survey on IOT Enabled Detection Mechanism of Road Accidents

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Abstract— them is increasing on daily basis. The cause of such road accidents can be carelessness, speeding, traffic rules breaking, etc. It is seen that a large portion of the accidents happens because of many driver's carelessness of traffic and security rules. Contingent upon the territory, and other basic circumstances, speed limitations might be forced on drivers occasionally. In this paper, the (Internet of Things) IoT devices are utilized to gather the details during the severe mishap, and it is transmitted to the police headquarters and the closest vehicle. The sensors are associated with the particular vehicle to distinguish all of the parameters like a tally sensor, directing edge, speed, crash, safety belt worn or not. Every one of these details is put away in the web server, and in the wake of examination and investigation, it very well may be recovered. It acts like a black box. At the hour of the crash, every one of these details is moved to the protection offices to recognize the genuine explanation.

Keywords: Road Accidents, Sensors, Immediate Recovery, and Investigation

I. Introduction

According to the report on 2015 Global Road Safety Status [1], the overall number of deaths caused by road accidents has reached a record of 1.25 million annually. India is the world's leading source of injuries and premature deaths. There are several places in India such as hilly plateaus, with more accidents and more death rates caused by such accidents due to improper road installations[29]. In the transport sector, both on-road and on the rail, the highest number of accidents are registered. Around 105,000 accidental fatalities have been reported by Indian roads in 2010 alone. That is 15% of the world's road incidents, with India responsible for only 1% of world vehicles. Accidental death events showed a growing pattern between 2000 and 2015, with a 50 percent rise in 2010 compared with 2000. As per the Indian Planning Commission, the cumulative loss annually is 2.5% of India's GDP with a rise in the number of road accidents. The Ministry of Road Traffic and Highway (Indian Law Commission) reports that every single minute one critical road accident takes place in India and 16 people dies every hour on Indian roads. The overall death rate in India in 2013 was 238,562, and a confirmed death toll on roads was 137,572, while the death rate calculated at 100,000 is equal to 16.6, according to WHO 2015: Data Tables[2]. Specifically, road traffic accidents among young people are especially the most prominent cause of death and cost about 1-3% of the gross domestic product in the country[3].The delay in reporting injuries to emergency facilities such as local police stations and health centers is a key factor increasing this figure. Sustainable Development Agenda was developed in 2015[1] to reduce the number of road accident fatalities and injuries to half before 2020. The impending paragraphs reviewing the current technologies for automatically detecting incidents and alerting emergency centers immediately.

II. Literature Review

The program suggested in [4] describes the automated accident detection that involving vehicles sends accident information to a rescue department, such as the police station, including the locations, time, and angles of the accident. These data are forwarded as an alert message. However, in the event of no injuries, a switch may be turned off by the driver for the warning to stop. For the transmission of the warning message a GSM Board is responsible, and the GPS sensor detects the accident's current location. Using serial communication [5], the GSM board and GPS board are connected to the Micro-Controller. Two sensors, the MEMS and the vibratory sensor-are used to detect the incident. The MEMS sensor helps to calculate the roll angle over of the car as well. The key high-speed data processing unit is the 32-bit ARM controller.

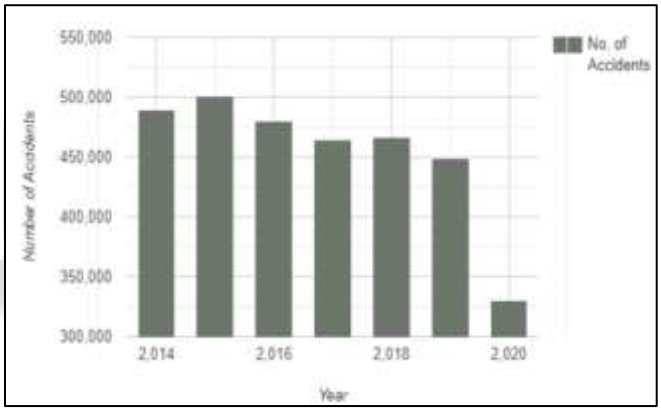

Fig. 1: Road Accidents in India (2015-2020)

After passing through an amp circuit, the data are transmitted from the vibration module to the microcontroller. The roll-over angle is also transmitted to the microcontroller from the MEMS sensor. The survey on the number of road accidents per year in India is calculated and plotted in figure 1. The number of accidents per year in India and the number of death to injured cases is plotted based on the year in figure 2.

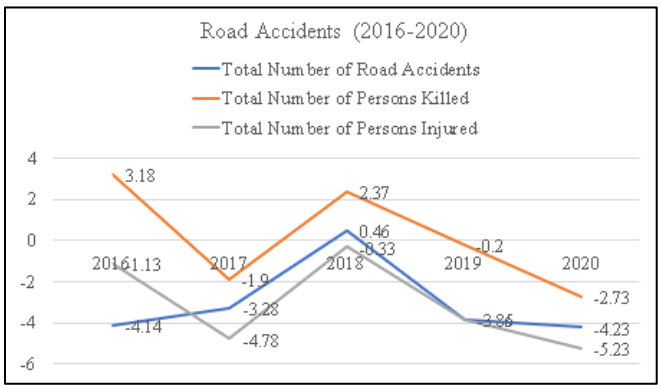

Fig. 2: Road Accidents Statistics in India (2016-2020)

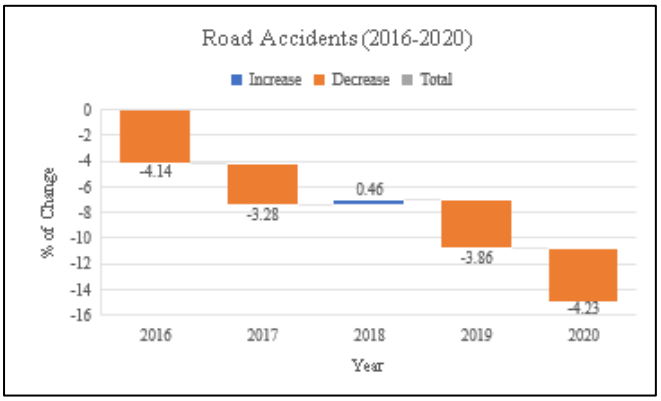

Fig. 3: Cumulative Differences on Data Effects of Road Accidents

Figure 3 illustrates the cumulative effects on positive and negative samples from the previous years. In comparison to the other approaches, both the accident and the accident position can be found out. There is also a way of avoiding the alarm alert and thereby saving time from the rescue. GPS benefits from the cost-effectiveness, portability, and accurate position detection [6] as well as considerably reduced the time for detecting accidents and to further pass the message compared to other methodologies. The machine itself is compact, small, and cost-effective and can be extended. The Internet of Things (IoT) and the cloud computing platform were successfully used in [7] traffic incidents. The use of the Support Vector Machine (SVM), including the Ant Colony Algorithm (ACA), was used to detect traffic accidents. ACA is used to pick the SVM parameter that plays a significant role in the precision that SVM can accomplish. The highest sensitivity of the magneto resistive sensors is the IoT sensors used. Several sensors are used to detect the position of the vehicle, including detection of the changes in the magnetic field, the data from brake collision signals, and two sensors to sense the vehicle's position. The algorithm attempts to evaluate a decision plan that distinguishes the 'traffic accident' class from the 'no accident' class. The optimization algorithm ACA is used to make the correct decision [8].

The detection efficiency metrics included: (1) False Alarm Ratio (FAR): error warning ratio to all detected events, (2) Detecting ratio (DR): real-world incident ratio of events detected (RWIRE), and (3) Average Detecting Timeline (ATD). Evidence reveals IoT-related outperformance of the conventional approach related to the sensors and the experimental SVM model with ACA is higher than that of traditional SVM and has a quicker level of convergence. The program [9] aims to reduce road accident casualties by carrying out three key functions, namely (1) incident sensing and moving the site to the nearest hospital, (2) traffic light controls on an ambulance route [10] [11], and (3) monitoring and transmittal of the hospital details for critical details of the patient in the ambulance vehicle. The role of four units into which the device is divided is to perform these three tasks:

The Vehicle Unit: contains a controller, GPS, sensors, Accelerometer, and GSM board. The sensors detect the accident and locate the GPS, while this information is passed to the main processing device by the GSM module. By informing the owner when the vehicle is deviating from normal, the accelerometer can help avoid accidents. Installation of the whole vehicle package in the car. This unit includes the hospital database and exchanges communications between the various units. The patient's monitoring unit monitors the patient temperature and pulsation to the hospital continuously and transmits them to the doctor.

Area junction: Ambulance Vehicle is Ten meters away, this device changes signal to green so that the route is clear for rapid movements. This is accomplished by RF communication. Thus, the existing accident detection systems have overcome many inconveniences as regards time. The system proposed in [12] is an Android app that uses the smartphone accelerometer to detect an accident. The mobile should be inside the car and should be held by nobody. When the vehicle is moved beyond a maximum value and the accelerometer detects, the program waits for 15 seconds. There can be obtained three forms of data. (1) When the computer has been tilted by mistake the user can press "cancel." (2) If the user is involved, if an accident happened, he should press 'send.' (3) An incident is believed to have happened if the driver is not active and button is not pressed in 15 seconds. In the case of (2) and (3), GPS helps in locating current position, and 108 Ambulance Emergency Response Service is provided with a recorded Voice Message. An extensive study has been undertaken on GPS services offered by Android [13] [14]. Therefore, effective accident detection and warning have been accomplished by using a single smartphone without external hardware components. The device suggested in [15] uses a program in which the phone should be put in the vehicle. The detection of the accident is done by an algorithm which is based on three different types of accidents: (1) A crash is reported if it is calculated above the threshold of 4 g (g=9.8m / s2) and an ADS-Severity Index (ASI) is used as a metric. (2) A gyroscope and a magnetometer are used to track rollers. If the rotation reaches 45 degrees and the immediate speed reaches 5 km / h, the spinning speed is known as a roll-over. (3) And the signal used for airbags indicates an incident.

In case of detection of one of these three events, a warning will be sent from three different sources-a messages conveying a Road Accident, an EMS call, and an SMS. By submitting incident alerts this program only monitors the false positives if no passenger violates an accounting sequence. The framework proposed in [16] contains many components with various functions. A board unit used for accident detection and transmission of info about hazardous circumstances should be included in the vehicles. The notification of the identified incidents takes place through the combination of communications with the Vehicle to Vehicle (V2V) and also one more combination Vehicle to Infrastructure (V2I) as well as a Control Unit (CU) for the warning, the evaluation of the extent of the incident and the transmission of the details to services The RSU (Road Side Units), if the Internet can be used, will connect the OBU to the CU through an infrared module. For the distribution of the protocol, the designs and the street layout should be used. It is the structure of all modules. The OBU[17] comprises in-vehicle accident detection sensors as well as a DAU data acquisition unit for data in intervals and a board unit recovery device for collection as well as monitoring in event of the accident using an algorithm to do accident detection.

Roll-over accidents and heavy impacts are the two impactful accidents in an incident. Subsequently, heavy horizontal tilt captures rollover. There is a wealth of historic information available in ApplusandIDIADA[18], which is collision material. Using the rectangular law, the average movement from the current vehicle device is stored regularly is incorporated and labeled as incidents using old data and with threshold setting. The internal CU unit structure is alerted by the vehicle; it classifies the accident according to its seriousness and determines the resources available for this specific incident. The numerous activities include the collection of information on incidents in the database, the transfer of information to police departments and emergency departments.

The magnitude of the incident is calculated with the use of data mining classification algorithms such as the K2 algorithm and the Bayesian Network, which is used for historical dataon the Weka Highway Database. The developments in the work are performed using this method with high speed. In the case of the method in[19], Map matching algorithm and GPS are used for identifying an incident. the detection process is based on a variety of characteristics such as time, causalities, and injury.The GPS can be used to relay the location and velocities of the vehicle to the Micro Controller Unit (MCU) every 0.1 seconds, whereby it differentiates the current speed from previous speed in every 0.1 second, and if the speed is below the value of a threshold, an accident occurs. The accident site is transmitted via GSM. The distance of braking is speed-dependent and proportional, so the more dreadfully a car gets, the more likely it is to avoid crashes[20]. Freeze force and gravitational force are the forces that help to keep the vehicle still after the brakes are applied. After the split and only these two forces are involved, the maximum speed is determined. Furthermore, if the speed transmitted from the GSM module to the controller is lower, this happens as an event in which additional forces are involved in the speed decrease.

The kinetic energy associated with the moving body, which is converted into destructive forces during the collision, is responsible for these additional forces[21]. For finding the position of the vehicle on the road network is the MM algorithm. GIS software for MM is used and is used to continuously locate the vehicle on a digital map. If there is an incident, a flag will be raised and an MCU is attentive to the emergency room for 5 seconds before it is sent an alert. The driver will click a button in these five seconds to stop the alarm and helps to determine lower numbers of falsified incidents.A relative of the car user gets the GPRS info with the help of the GPRS unit of the Arduino if in case of GPRS cover is provided a message is sent with details. The data is sent in the name of speeding, location, time, and contact details. A voice call to the emergency center will then be initiated when the occupant can explain the incident.

The device uses a GPS unit which is available in almost all cars and it is inexpensive. The device also helps emergency units like police stations and hospitals to calculate the level of the collision by transmitting the car speeds and, also helps driversin disabling the alarm manually for minimizing false alarms. GPS, GPRS, and Ios are the tools used in the project [22]. Software modules for the accident detection used to restrict Arduino and the switches are included as the key modules and their features. Such programs are then registered through the Web-based central registration system. The application helps to control the board, and also makes use of driver interaction in-vehicle alerts the user and initiate operations for other results[23]. Notifications will be provided from a web-based Central Assistance Program. The job of the system is to include a new vehicle registration system with the mobile version of the Android app. All services including ambulance and insurance [24] will be recorded. The limits switch is pressed and the signal is passed on Arduino if the vehicle crash with another vehicle or object.

The microcontroller is attached to the switches and the Bluetooth system and also it is connected to the phone. GPS, accelerometers, and Kalman filters are among the various equipment. The important thing for this algorithm is greater accurate GPS since they have a low sightline and update speed, and thus the accelerated data generated from GPS is not accelerated at instantaneous speeds. Instead of GPS, the IMU (Inertial Measurement Unit) can acquire high and instantaneous information. The device proposed for [25] monitors the GPS and IMU accelerometer deceleration data. The Kalman filter combines these two forms of data[26].Whenever the GPS deceleration is usable, this function changes the IMU deceleration and updates it. The info of IMU is stored into account in GPS module fault. In GPS errors, Razor INS will fill in the gaps. Through integrating with accurate GPS data, IMU data is modified. In all three axes, the IMU provides accelerometers, gyroscopes, and magnetometers. By combining the gyroscope with the accelerometer, the vehicle's inclination to gravity can be calculated and the position of the vehicle is measured using a device calleda magnetometer. The Attitude Heading Reference Device (AHRS)[27] is constructed by integrating these sensors into three axes. for combining the magnetometer, accelerometer, or gyroscope the matrix of Path Cosine is used. This matrix is a form for rotating by a matrix of 3X3 R. As IMU sensors, the DCM matrix mentioned in [28] was used for the construction of the AHRS. The ARHS data is compromised and included with GPS module-info with the help of Karman's filter. In case the brake is used, the car decelerates. if deceleration is greater than 5 G is taken by the proposed algorithm as an accident situation. The outcome is based on the established 5 G threshold, which sends out a warning when the deceleration is below it. In this case, for the position detection module, an alarm will be raised by the device.

III. CONCLUSION

Various methodologies are used to detect as well as find the cause of the accidents to reduce the number of accidents that take place here and there, every minute in the world. This paper gives various methods for accident detection using software and hardware to yield good performance. Some of the methods mentioned will allow the driver to toggle the alarm when an accident happened and it is not serious as well as if it is a false alarm. These methods rely more on certain equipment, such as sensors, or a phone. Whilst the use of this equipment is an inexpensive approach, it has the disadvantage of being manipulated in an accident as it can stop working

after a shock or it may not show the correct information. Therefore the identification of travel accidents involves an approach that should not be dependent on hardware present in the vehicle.

REFERENCES

[1] "Global status report on road safety 2015", World Health Organization, 2016. [Online]. Available: http://www.who.int/violence_injury_prevention/road_safety_status/2015/en/. (Accessed: 22-Mar- 2016)
[2] "Data", World Health Organization, 2016. [Online]. Available: http://www.who.int/violence_injury_prevention/road_safety_status/2015/GSRRS2015_data/en/. (Accessed: 22- Mar- 2016).
[3] M. Ruikar, "National statistics of road traffic accidents in India", Journal of Orthopedics, Traumatology, and Rehabilitation, vol. 6, no. 1, p. 1, 2013.
[4] V. Goud, "Vehicle Accident Automatic Detection and Remote Alarm Device", International Journal of Reconfigurable and Embedded Systems (IJRES), Vol. 1, no. 2, 2012.
[5] GSM User Manual, SIMCOM Ltd, August 2006.
[6] GPS Beginner`s Guide, Garmin Ltd, 2008.
[7] G. Liang, "Automatic Traffic Accident Detection Based on the Internet of Things and Support Vector Machine", IJSH, Vol. 9, no. 4, pp. 97-106, 2015.
[8] S.L. Lin and Z. Liu, "Parameter selections in SVM with RBF kernel function", Journal-Zhejiang University of Technology, vol. 35, no. 2, pp. 163, 2007
[9] B. Prachi, D. Kasturi and C. Priyanka, "Intelligent Accident-Detection And Ambulance- Rescue System", International Journal Of Scientific & Technology Research, Vol. 3, No. 6, 2016. IJSER International Journal of Scientific & Engineering Research, Volume 7, Issue 4, April-2016 79 ISSN 2229-5518 IJSER © 2016 http://www.ijser.org
[10] Mr.S.Iyyappan and Mr.V.Nandagopal , "Accident Detection and Ambulance Rescue with Intelligent Traffic Light System?", International Journal of Advanced Technology and Engineering Research, 2013.
[11] AmneshGoel, Sukanya Ray, Nidhi Chandra, "Intelligent Traffic Light System to Prioritized Emergency Purpose Vehicles based on Wireless Sensor Network", International Journal of Computer Applications, Volume 40– No.12, February 2012.
[12] K. Patel, "Utilizing the Emergence of Android Smartphones for Public Welfare by Providing Advance Accident Detection and Remedy by 108 Ambulances", International Journal of Engineering Research & Technology (IJERT), Vol. 2, No. 9, 2013.
[13] Xinhua Shu, Zhenjun Du and Rong Chen, "Research on Mobile Location Service Design Based on Android", 5th International Conference On Wireless Communication Networking and Mobile Computing, Beijing, pp. 1-4, 2009.
[14] J. Whipple, W. Arensman and M.S Boler, "A Public Safety Application of GPS-Enabled Smart Phones And The Android Operating System", IEEE International Conference on System, Man and Cybernetics, San Antonio, pp. 2059-2061, 2009.
[15] B. Fernandes, M. Alam, V. Gomes, J. Ferreira and A. Oliveira, "Automatic accident detection with multi-modal alert system implementation for ITS", Vehicular Communications, Vol. 3, pp. 1-11, 2016.
[16] Pranav Dhole, Saba Shaikh, NishadGite, Vijay Sonawane "Automatic Accident Detection: Assistance Through Communication Technologies and Vehicles", IJETST- Vol. 02, Issue 04 Pages 2285-2288 April 2015
[17] OSGi Alliance, ''OSGi service platform,'' Core Specification, Release 4, Version 4.1. San Ramon, CA: IOS Press, Inc., 2007.
[18] Applus+ IDIADA Web Site. (2011, June 9). IDIADA: Instituto de Investigacio ´n AplicadadelAutomo ´vil. [Online]. Available: http://www.idiada.es
[19] M. Amin, M. SobhanBhuiyan, M. IbneReaz and S. Nasir, "GPS and Map Matching Based Vehicle Accident Detection System", in 2013 IEEE Student Conference on Research and IJSER International Journal of Scientific & Engineering Research, Volume 7, Issue 4, April-2016 80 ISSN 2229-5518 IJSER © 2016 http://www.ijser.org Development (SCOReD), Putrajaya,Malaysia, 2013.
[20] A. Chandra, S. Jain, and M. A. Qadeer, "Implementation of location awareness and sharing system based on GPS and GPRS using J2ME, PHP and MYSQL," in 3rd International Conference on Computer Research and Development (ICCRD), pp. 216-220, 2011.
[21] M. S. Amin, J. Jalil, and M. B. I. Reaz, "Accident detection and reporting system using GPS, GPRS and GSM technology," in International Conference on Informatics, Electronics & Vision (ICIEV), Dhaka, Bangladesh, 2012, pp. 640-643.
[22] P. Dhole, S. Shaikh, N. Gite and V. Sonawane, "Smart Accident Detection & Assistance System",International Journal of Emerging Trends in Science and Technology, Vol. 2, no. 4, pp. 2285-2288, 2015.
[23] Chin Feng Lai, Chen Ying Liu, SungYen Chang and Yueh Min Huang, Department of Engineering Science, "Portable Automatic Conjecturing and Announcing System for Real-Time Accident Detection" National Chen Kung University, Tainan, Taiwan.
[24] Ohn Whipple., William Arensman., Marian \Starr Boler.,"A Public Safety Application of GPS-Enabled Smartphones and the Android Operating System", Proceedings of IEEE International Conference on Systems, 2009.
[25] M. Amin, M. Bin IbneReaz and S. Sheikh Nasir, "Integrated Vehicle Accident Detection and Location System", TELKOMNIKA

(Telecommunication Computing Electronics and Control), Vol. 12, no. 1, pp. 73, 2014.
[26] Mahony R, Hamel T, Pflimlin JM. Nonlinear complementary filters on the special orthogonal group.IEEE Transactions on Automatic Control. 53(5): 1203-1218, 2008.
[27] Building an AHRS/Head-tracker using the "9DOF Razor IMU" or the "9DOF Sensor Stick" by SparkFun. Available online: https://dev.qu.tuberlin.de/projects/sf-razor-9dofahrs/wiki/Tutorial Accessed on 20 October 2013.
[28] Zaldivar J, Calafate CT, Cano JC, Manzoni P. Providing accident detection in vehicular networks through OBD-II IJSER International Journal of Scientific & Engineering Research, Volume 7, Issue 4, April-2016 81 ISSN 2229-5518 IJSER © 2016 http://www.ijser.org devices and Android based smartphones. Proceeding of Local Computer Networks (LCN)
[29] RamyaKeerthi, G.Shanmukh, Dr. R. Sivaram, Various Accident Detection Technologies and Recovery Systemswith Victim Analysis, International Journal of Advanced Trends in Computer Science and Engineering
[30] Road Accidents Report available: morth.nic.in

