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Accident Detection and Notification System for Motor Bike.

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Abstract *-This concept utilizing the emerging technology, Internet of Things (IoT) to detect accidents in two wheelers using arduino nano BLE-33 embedded Accelerometer and gyroscope which is used to detect fall and collision of vehicle which detect accident condition and send alert notification to the authorities as well as the emergency contact of the rider.*
Keywords*—internet of things; accident detection; reporting; embedded systems;*

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I. INTRODUCTION

The public apathy is high in regard to the accidents with most peoplechoosing to ignore the accident that has happened which leads to delay in the reporting of the accident to the authorities and subsequent delay in emergency response leading to loss of life or impairment.

IoT comprises of smart machines and sensors interacting with other machines using an underlying network infrastructure. The IoT devices sense the data from the environment and send the data to each other or a central server. This leads to huge amount of data generated which can be further processed and analysed to generate useful conclusions. This gives the advantage of remote monitoring the environment and insights into real time data reported from the environment.

The main aim of the system is to accurately and reliably detect accidents that occur in two wheelers and also report the accident to the authorities and the emergency contact of the accident victim. Theaccident detection is facilitated by the use of a microcontroller which gets the data from the accelerometer and sends a notification via a GSM device if an accident has occurred. This device can be divided into 2 component parts. The first is the gyroscope sensor, which is an angular sensor that can sense angular velocity which is embedded to the Arduino Nano BLE-33 board to measure the values of the x, y, and z axes. Falling forward, back, left, or right, and fall view information will be retrieved from the database to be displayed on the website for users to see. When a accident occurs, the smart phone will alert and deliver this information to up to 4 designated contactpersons/numbers.

The various devices and services used in this system for the accidentdetection and notification purpose are –

1. Arduino nano BLE -33
2. Sim900 GSM Module/Wi-Fi
3. GPS Module
4. Web Server

II. RELATED WORK

IoT is a relatively new field which is seeing rapid advancements in technology due to the immense benefits it offers. S. Chandran et al. developed a similar system to detect and report accidents [1]. The system under development holds much more features and improvements. M. Fogue et al. highlighted the use of V2V for vehicle assistance [3]. A lot of systems have already been developedfor four wheelers to detect accidents but the field of two wheeler accident detection is still in its infancy. J. White et al. have developed a system to detect accidents with the help of smartphones [4]. This system uses the inbuilt accelerometers in smart phones to detect accidents and the inbuilt connectivity features of smartphones for accident notification. This system is not accurate and reliable assmartphones are susceptible and experience a lot of sudden acceleration changes which can be triggered as false accidents. S. Hari Sankar et. al. identify the main cause of fatalities due to accidents [5]. They have identified the critical golden hour and in this period dispatch ambulances to the accident spot. E. Nasr et. al. also have come up with a system which detects accidents and relays the accident location to the

Public Safety Organization [6]. Amit Meena et. al. have also come up with a system to combat the increasing mortality rate of two-wheeler accidents in India [7]. The system however cannot plot accidents and thus identifying trends is not possible. Bruno Fernandes et. al. aim to detect accidents in four- wheelers using a smartphone app [8]. The app interfaces the inbuilt sensors of the smartphone to detect any anomalies which may be an accident. Using a smartphone to detect accidents lowers the reliability as false positives might be triggered.

The 802.11p working group had recently passed the IEEE 802.11p standard for V2V security applications. A lot of inroads have been made for accident detection in four wheelers but a lot of research is yet to be made in the two wheeler department. Thus the need of the hour is to develop a low-cost, affordable and intelligent system which can be utilized efficiently by everyone.

III. PROPOSED ARCHITECTURE

The paper describes the prototype of a vehicle accident detection system which aims to detect and report accidents occurring in two wheelers.Ardinno nano BLE-33 and GSM module and cloud service infrastructures are utilized to achieve the final objectives of notification and reporting. It is developed in a way to detect an accident in two wheelers and send the geographical co-ordinates of the accident to the emergency authorities and the emergency contacts of the victim. Accelerometer and gyroscope is mounted on the vehical which continuously monitors the acceleration levels of the two wheeler. When an accident is detected due to inconsistent acceleration levels and exceeds the threshold, it gathers the GPS co-ordinates from the GPS module and sends a message to the emergency authorities' web server which then sends an emergency message to the assigned emergency contact of the victim.

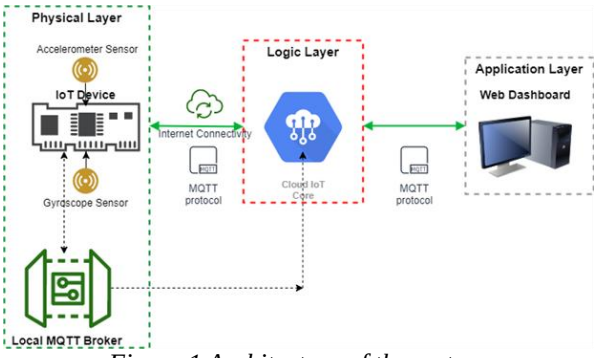

Figure.1 Architecture of the system

A. Challenges faced for the development of the system

1. Accuracy in detection of accidents

Change in acceleration is the key indicator for detection of accident. If the user accidently drops his vehicle or gives sudden acceleration or braking then there are chances that it might be treated as an accident.

B. Major Objectives

The major objectives of the system can be summarized into –

1. Detect accidents reliably by removing false positives. The threshold for acceleration change to be classified as an accident should be suitable. Too high a threshold would discard the accidents and too low a threshold would lead to false positives.
2. Report accidents to authorities and to the assigned emergency contact. The notification should also have the location of the accident so that help can be sent immediately.
3. Consolidate and plot the accidents on a map to prevent future accidents by identifying accident hot-spots. This is done with the help of Google maps.

C. Working Principle

1. Using LSM6DS3 accelerometer and gyroscope module sensor embedded with The Nano 33 will be used to collect the raw data. Then, the data will be analyzed by edge impulse studio. Arduino Nano 33 IoT is advanced Arduino dev kit designed for IoT implementation. It has a network module such as WiFi and BLE, allowing us to send the data to Arduino cloud over MQTT and HTTP by using internet connectivity.Accident Detection

Accident detection is facilitated with the help accelerometer and gyroscope which detects the acceleration values along the positive and negative x, y and z axis and the angle respectively.Figure 2 shows the embedded on board LSM9D51 IMU unit along with Arduino.

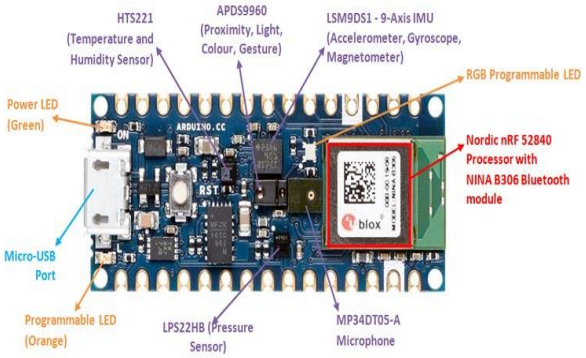

Figure 2 Arduino Nano BLE-33 Board

Consider the case when the two-wheeler is travelling on a road and a collision happens when a vehicle impacts on to the back of the twowheeler. Figure 3 represents the forces involved in the collision.
A similar change in acceleration also happens when the two-wheelermeets a frontal collision or a side collision and the respective axes show the impact.
This large change in acceleration in a short span of time is what the microcontroller aims to detect which would signify an accident. Thethreshold has to be set appropriately so as to not cause any false alarms.
The lean angle also plays an important part as the two-wheeler can also tip over sliding along the road without any significant change in acceleration.
If the change in angle is also high in a short period of time or the angle of the two-wheeler goes above a certain angle (most road going two wheelers have a max lean angle of around 45 degrees) it signifies that an accident has occurred due to the vehicle tipping overas depicted in Figure 4.

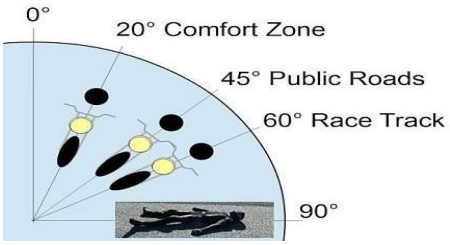

Figure 4 Motor bike lean Angle

The algorithm for accident detection can be summarised as, (the initial values of acceleration and angles are 0)

1. Get acceleration and gyroscope values from the accelerometer.
2. Save the acceleration and the gyroscope values as new values.
3. Check if the change in acceleration exceeds the thresholdor the lean angle exceeds the threshold by the help of the current and new acceleration and gyroscope values.
4. Store the new acceleration and gyroscope values as the oldvalues.
5. Repeat from step 1 every 50ms.

2. Sending notification

The exact location of accident is provided by a NEO6M-V2 GPS module. It consumes a voltage of 5V DC which is provided by a battery pack. When an accident is detected, a HTML GET request is prepared which contains the vehicle ID, latitude and longitude as well as the type of vehicle(system can be expanded to be included in four wheelers as well). The coordinates of the two-wheeler are provided every second as a NMEA string. The NMEA string is thendecoded to reveal the latitude and longitude. The decoded GPS information is then added to the HTTP GET request and sent to the web server via the GSM module. The GSM module is only active during data transmission and hence consumes very little battery.
The web server upon receiving the GET request stores the URL parameters (VID, latitude, longitude, vehicle type) into a database. Time of the accident is also added. Subsequently, an email (or otherform of notification) is generated to be sent to the emergency contact and authorities which contains the vehicle ID, coordinates of the accident, time of the accident and the vehicle type (can be expandedto other types of vehicles) also.

The algorithm can be summarised into two parts-

a. Hardware notification

1. Create a google custom map using the developer keyassigned.
2. Give the initial coordinates for the map to centre on.
3. Load all the accident coordinates from the database.
4. Bind each accident coordinate with the vehicle number inthe form of a map marker.
5. Display all the accident markers on the map.
6. Get current GPS location from the GPS module.
7. Decode the GPS NMEA string to reveal the latitude andlongitude.
8. Incorporate the vehicle ID, location data and the vehicletype into a GET request.
9. Connect to the web server using the GSM module.
10. Send the GET request
11. Disconnect from server.

b. Webserver notification

1. Receive the GET request parameters into variables.
2. Open connection to underlying database.
3. Write the accident details to the database including time.
4. Close connection to database.
5. Send notification to the emergency contact and theauthorities.

IV. RESULTS

The result of SM6DS3 (accelerometer and gyroscope) module sensor embedded on Arduino nano 33 IoT, so this dev kit is very easy to do an experiment. We will implement it to connect with the cloud. so then data sent to cloud.Figure 4 shows prototype model for accident detection system mounted on angular rotation of 360 degree.When Gyroscope is parallel to horizontal axis it shows no fall and if it tilted and make more than 60 degree angle to horizontal axis it shows fall detected as shown in figure 4.

Figure4.. Prototype model for fall detection.

data will be analyzed at the cloud. We will do deployment this project which nano 33 IoT is used to collect accelerometer data (x, y, z) by LSM6DS3 IMU sensor module embedded on dev kit. MQTT is the standard messaging protocol for Internet of Things (IoT). It is designed as an extremely lightweight publish/subscribe messaging transport that is ideal for connecting remote devices with a small code footprint and minimal network bandwidth.

.The time taken to send the notification after the accident has been detected is less than 10 seconds on an average. The cloud server receives the correct coordinates and stores the accident data before forwarding the accident coordinates to the emergency authority.

Figure 5 Accident Notification to emergency authority

Figure shows the detection of accidents on the map as markers with each marker showing the geographic location.Figure 6 shows the real time barchart of accelerometer . More the accidents are clustered in an area, darker is the colour. This allows the authorities to identify the accident hotspots in a city and can hence take precautionary and preventive measures to reduce thenumber of accidents in that area in the future.

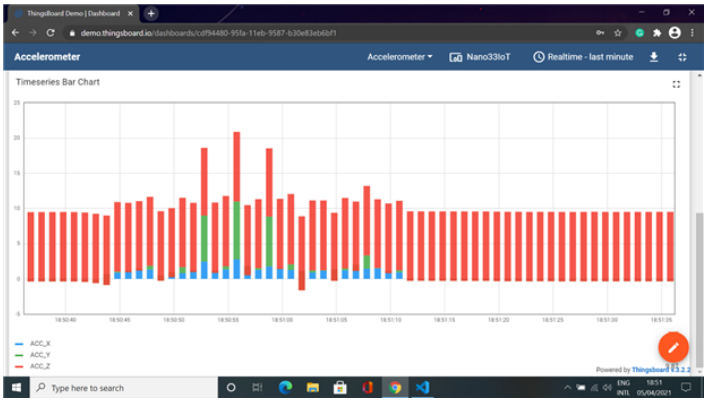

Figure 6 Heat map

V. CONCLUSION

Low cost solution has been developed to detect and notify the motor bike accident. The testing results are promising and faithful the system is tested under various condition of fall detection.

REFERENCES

[1]. S. Chandran, S. Chandrashekhar, E. Elizabeth N, "Konnect: An Internet of Things (IoT) based Smart Helmet for Accident Detection and Notification", India Conference (INDICON), 2016 IEEE Annual.
[2]. Ministry of Road Transport and Highways, Transport Research wing, "Road Accidents in India", 2015.
[3]. M. Fogue, P. Garrido, F. J. Martinez, J. C. Cano, C. T. Calafate, P. Manzoni, "A System for Automatic Notification and Severity Estimation of Automotive Accidents", IEEE Transactions on Mobile Computing, March 2013.
[4]. J.White, C. Thompson, H. Turner, B. Dougherty and D. C. Schmidt. "WreckWatch: Automatic Traffic Accident Detection and Notification with Smartphones", Mobile Networks and Applications, June 2011.
[5]. S. Hari Sankar, K. Jayadev, B. Suraj, P. Aparna, "A comprehensive solution to road traffic accident detection and ambulance management", International Conference on Advances in Electrical, Electronic and Systems Engineering (ICAEES), 2016.
[6]. Nasr, E. Kfoury, D. Khoury, "An IoT approach to vehicle accident detection, reporting, and navigation", Multidisciplinary Conference on Engineering Technology (IMCET), IEEE International, 2016.
[7]. Amit Meena, Srikrishna Iyer, Monika Nimje, Saket Joglekar, Sachin Jagtap, Mujeeb Rahman, "Automatic Accident Detection and reporting framework for two wheelers", Advanced Communication Control and Computing Technologies (ICACCCT), 2014.
[8]. Bruno Fernandes, Vitor Gomes, Joaquim Ferreira, Arnaldo Oliveira, "Mobile Application for Automatic Accident Detection and Multimodal Alert", IEEE Vehicular Technology Conference (VTC Spring), 2015.
[9]. Shoeb Ahmed Shabbeer "Smart Helmet for Accident Detection and Notification" IEEE International Conference ,2017