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IOT ENABLED IMMEDIATE RESPONSE SYSTEM FOR PEOPLE IN CASE OF ROAD ACCIDENTS

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Abstract- Every day, a large number of people die from accident injuries all over the globe. An effective approach to control the post accidents impact which may help in saving the life of the people by sending alert notifications to hospitals, police station and their relatives. Alert notification will help in getting the quick response in case of accident occurnce. Few systems are already in place as built in vehicle accident detection systems. However, these systems are very costly and lack in terms of availability. Whereas, to detect traffic accidents using smartphones is easily possible now because of the advances in connectivity and sensors deployed on the smartphones. The aim of this paper is to reduce the response time using Internet of Things(IOT) . The proposed system includes two phases; the detection phase and the notification phase. The detection phase detects car accident in all speeds. The notification phase is used to send detailed information such as the accident location to the hospital, police station and relatives of the person who met with an accident immediately after an accident is detected, for fast recovery. This paper includes two contributions; of using smartphone-based accident detection systems. First, it provides solutions to critical issues such as fake/false alerts by deploying onboard sensors to detect large accelerations. Second, it presents the system architecture of the prototype smartphone-based accident detection system.

Keywords – Internet of Things (IoT), Response System, Sensors, Road Accidents

I. INTRODUCTION

Today the role of IOT in everyday life is increasing day by day. There have been a tremendous increase in the positive effect IOT has brought into people's life. The number of causalities in case of road accidents has been increasing and is found to be critical in a number of cases. A major reason for these causalities can be due to the late message/information to the doctors and the people concerned.The proposed system helps to reduce the response time of the ambulance reaching the accident location and hence reduce the number of causalities. The proposed system takes the data from the sensor and send the message using bluetooth to the smartphone which further sends the sms (including the accident location) to the recovery number whenever the accident is detected.Immediate response system in case of road accident is an IOT based system which enables reduction in time to provide the medical facility. This proposed scheme targets the long distance road journey on the national highways, where there is not much provision for medical help immediately after an accident. After implementation of the proposed system results can be analyzed in order to get the causalities reduced.
This paper is divided in 6 parts; Introduction is followed by Motivation behind the proposed system in section 2. In section 3 works on the related system is discussed. This is followed by the methodology used for developing the proposed system in section 4. The results obtained from various trials on implanting the model are listed in section 5. In section 6 the discussion of the results obtained is done.

II. MOTIVATION

In this section the motivation behind the proposed system and the need/ importance are discussed. There has been a tremendous increase in case of road accidents in the past few years. Many of the causalities happen because the medical help did not reach on time. In India there has been a 2.5 percent increase in the number of accidents on the roads from 2014 to 2015. And the number of causalities increased by 4.6 percent in the same duration of time. India bears a loss of 17 lives every hour in the form of road accidents [1].

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Accidents mainly happen due to driver's fault which include intake of alcohol or drugs, poor condition of roads or rash driving. In any of the case if the medical help reaches on time the statistics can be turned positive. One of the reason for the late response by the medical staff could be that they are informed late about the accident and when they reach it is already too late for any recovery. Automating this scenario so that alert is directly sent to the medical staff and family will be a great accomplishment. The main scope of the project is for long road journeys, because usually in the accidents inside the city there has not been much delay in the response time. It is mainly the long journeys where there is no immediate help or even other people to inform about the accident to the hospitals. There have been cases where the vehicle had to wait for as long as 10-12 hours for any help. And the victims are generally not in a state to even make calls to inform their family.
The proposed system is important for the society as it will help in saving the lives of people who die in road accidents just because of the medical help reaching late. The proposed scheme will reduce the number of causalities by providing a system immediate alerts on the smartphone as well as on the cloud when accident happens.

III. RELATED WORK

In this section, in order to understand the current studies of work done in their area, total four papers are considered and are discussed as follows.

In [2] C. Thompson et al have built an accident detection and notification system based on smartphone. In this system, a prototype smartphone based application called Wreck Watch was developed which implements a methodology to detect and notify accidents by using sensors which are inbuilt in the vehicle and interfaces. The major problem with WreckWatch is that the system gets deactivated when the speed is below the threshold level as its detection process begins to record the data from the accelerometer and looks for accidents only if the vehicle and smartphone speed is greater than the threshold level and thus, this filtering will shut off the detection process in low speed condition and will not be able to detect the accident at that speed.

In [3], the Electronic call system is used to develop an automatic crash detection and notification service for handy devices like smartphones. This system uses the mobile network to communicate between the device and the Server.
The major concern with this system is that it uses the accelerometer sensor inbuilt in the smartphone as a crash sensor, and thus the electronic call system is exposed to high rates of false positives even when the user is outside the vehicle.

In [4], K.H. Patel has developed an application that senses the accident using the accelerometer sensors in the Smartphone.
Once the accident is sensed, the application automatically generates the geographical information by GPS and sends location information using a voice message which was recorded earlier to 108 ambulance emergency response service which runs in India. The most important requirement of this application is that the smartphone should not be kept near the person who is driving the vehicle; it must be kept inside the vehicle and the testing of the accelerometer is performed by moving the mobile left or right or free fall motion. The major issue with system is the smartphone inside the vehicle can fall accidently with a real accident and thus, the chances of false positive will be increased.

In [5], Z. Jorge et al develop a car accident detection and notification system that combines smartphones with cars through a second generation of On-Board-Unit (OBD-II) interface to get smart cars modeling, offering new emergency services. An Android application is developed that sends an SMS to an address which is defined earlier with required data about the accident and also an alert call is automatically made to the emergency services. The only requirement is that the car must support the OBD-II standard. The OBD-II standard is mandatory since 2001 in U.S and there is a similar standard in Europe, thus this solution is valid for all vehicles in U.S and European countries.

IV. METHODOLOGY

In this section the methodology used to develop the proposed system is discussed in detail. The methodology used in the first and the second phase is separately discussed in this section.

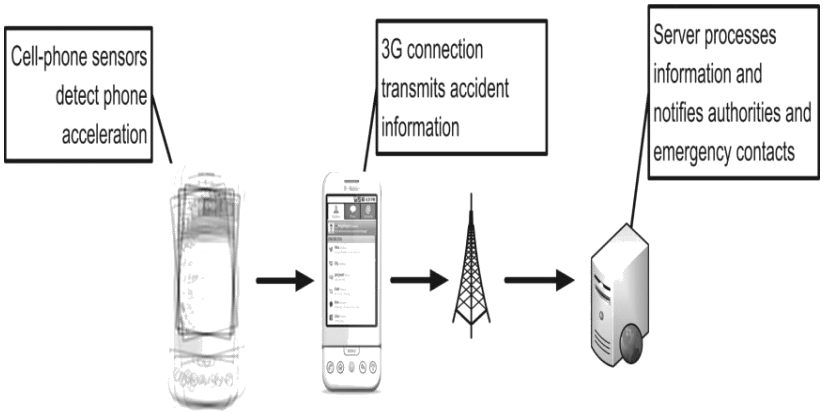

Figure 1. System Model

The first phase is the hardware phase in which the circuit designing, and mathematical calculations are done to detect the collision.The second phase is developing the android application and sending the text message to the desired phone number including the location of the accident.

A. First Phase

For the circuit part, accelerometer and Bluetooth on the aurdino are used.The aurdino processes the input from the accelerometer and detects if there is a collision based on the three axis(ax, ay, az) .Accelerometer provides thousands of data at a single moment and not all data is a signal for collision. To check the maximum value the accelerometer hits, three variables in different dimensions are used. Also, to get the time duration in which these parameters hit the maximum value, time variables are needed too. If there is a collision, aurdino sends the data to the mobile phone through the Bluetooth. Audino has two methods setup method which is the initialization method and the second is the loop method which includes the part which needs to be done again and again.

The Setup method does the following:

- Determines the speed at which the code is supposed to run
- Initializes the accelerometer
- starts the wire port (connected to accelerometer)
- starts the serial port(connected to bluetooth)

The Loop method does the following:

- reads the values of accelerometer
- finds the maximum value

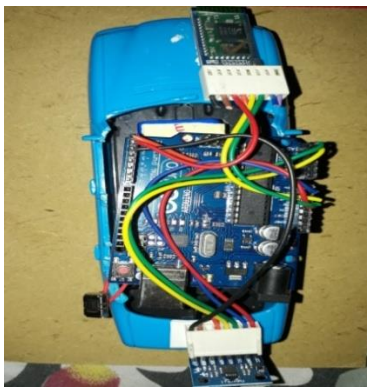

Figure 2. Prototype of the system

The above figure shows the dummy model of the proposed system. A similar system can be deployed on the real car and collision can be detected and notification be sent using the same circuitry.

B. Second Phase

The second phase involves the development of the android application, which acts as a user interface to feed the following data

- Phone number of the receiver
- Alert text message
- Name of the sender(The person who meets with accident/the smartphone of the person using the application)

The android application also acts as an interface to allow Bluetooth pairing. When the data is received using Bluetooth and collision is detected the android application uses Google maps to get the location of the accident and append it to the text message and send it to the desired number. The main logic behind detecting collision is that whenever the acceleration of the moving vehicles becomes negative i.e. it changes its direction in a very small amount of time(2 seconds), then there is said to be a collision. This is based on the laws of Physics, which says that according to Newton's Third Law of Motion, for every action there is a equal and opposite reaction. And hence, when the moving vehicle hits any other object it is will definitely receive a reaction in opposite direction in a very small amount of time.

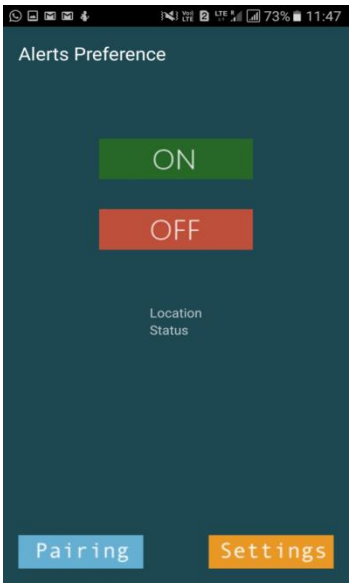

Figure 3. Home Screen

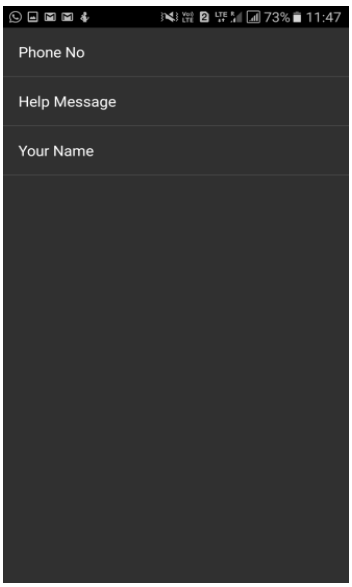

Figure 4. Settings

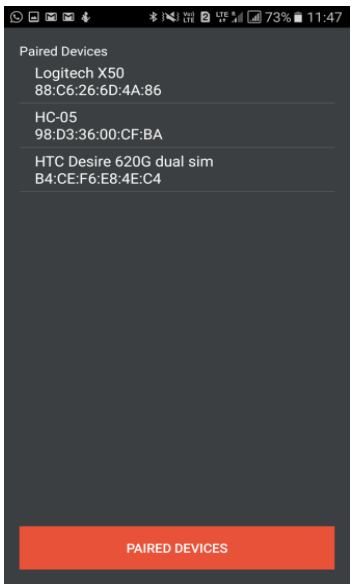

Figure 5. Paired Device

The above figures represent 3 different snippets of the android application

V. RESULTS

In this section the results of the implemented system have been analyzed.
The result obtained based on the trials performed is the text message on the desired smartphone which has 3 components

- Alert Message text
- Name of the sender
- Accident Location link of google maps

The following two table shows the time duration in which message is received and the distance between the actual accident and the location shown on the link.

Table 2. Time Gap

Trial Number	Distance gap (in km)
1.	0.3
2.	1.2
3.	0.3
4.	0.6
5.	1.1
6.	0.7
7.	0.9
8.	1.3
9.	1.2
10.	0.4

The above table displays the distance in kilometers between the actual accident location and the location detected by the GPS on smart phone. This helps in understanding the accuracy in terms of the precise location provided in the alert message to hospitals/police station/relatives.

Table 2. Time Gap

The

Trial Number	Time of accident(24 hrs)	Time when message is received(24 hrs)	Time duration in which message is received (in minutes)
1.	10:04	10:05	1
2.	11:23	11:24	1
3.	12:09	12:11	2
4.	13:46	13:48	2
5.	14:12	14:13	1
6.	15:33	15:34	1
7.	16:55	16:56	1
8.	17:27	17:31	1
9.	18:38	18:39	1
10.	19:31	19:33	2

above table displays the time of accident, the time when alert message is received and calculates the time gap (in minutes) between them. This helps to analyze the performance of the system by understanding how immediately the message is received so as to reduce the response time of the ambulance reaching the accident spot.

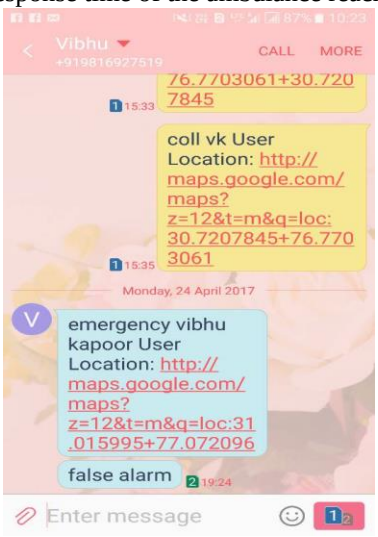

Figure 6. Text message received on smartphone

The following picture shows the text message received on the desired mobile phone
Here the alert text message is “emergency”, the user who met with accident is “Vibhu Kapoor” and the accident link is attached too. The second message which is “false alarm” is received when there was a false alert sent earlier.

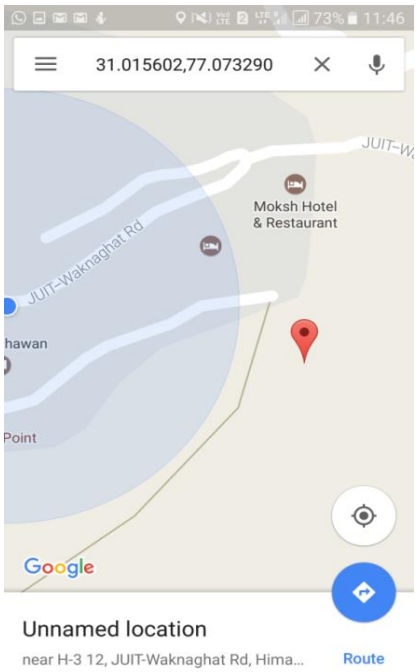

Figure 7. Accident location detected by GPS

The following image shows the link when opened, the accident took place in the JUIT Campus and the map clearly predicts the correct location.

VI. DISCUSSION OF RESULT

The results obtained in the above two tables are justified. The trials resulted in an immediate response which will further contribute in reducing the response time of the system. The average time gap based on these 10 trials comes

out to be 1.3 minutes, which can further be reduced if the connectivity is increased. The average distance gap based on these 10 trials comes out to be 0.8 kms.

VII. FUTURE SCOPE

It has been seen that the road accident detection system based on smartphone is not easy to handle. It has some challenges that prevent it from achieving 100% accurate detection. One of the few obstacles is avoiding false alerts. A future work can be tried to improve the accuracy of detection and to reduce the probability of false positive signs that are generated from the user when the vehicle is travelling at a low speed. Another challenge is that the system requires good connectivity to the internet as it needs the location coordinates. The scope of the system can be improved by sending pictures of the accident along with the text message. The immediate response system in case of road accidents is ideal for smart cities where the connectivity even on the distant areas like highways is not an issue.

REFERENCES

[1] morth.nic.in/showfile.asp?lid=2143
[2] www1.cse.wustl.edu/~schmidt/PDF/wreckwatch.pdf
C. Thompson, J. White, B. Dougherty, A. Albright, and D. C. Schmidt
[3] R.S. Sneha and A. D. Gawande "Crash Notification System for Portable Devices", International Journal of Advanced Computer Technology (IJACT), Vol.2, No-3, PP.33-38, June 2013.
[4] K.H. 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, Issue 9, PP 1340-1342, September – 2013.
[5] Z. Jorge, T. Carlos , C. Juan and M. Pietro, "Providing Accident Detection in Vehicular Networks through OBD-II Devices and Android-based Smartphones", Proceedings of the IEEE 36th Conference on Local Computer Networks, Washington, DC, USA, PP. 813-819, 2011.
[6] Sweety Jain, Sudeep Tanwar, Pradeep Kumar Singh, "*Energy Optimization in Smart Grid using Tensor Decomposition*", International Journal of Computer Sciences and Engineering, Vol.5, Issue.11, pp.178-182, 2017.
[7] Jitendra Oza, Zunnun Narmawala, Sudeep Tanwar, Pradeep Kr Singh, "*Public Transport Tracking and its Issues*", International Journal of Computer Sciences and Engineering, Vol.5, Issue.11, pp.192-196, 2017.
[8] Aditi Zear, Pradeep Kumar Singh and Yashwant Singh (2016). Intelligent Transport System: A Progressive Review, Indian Journal of Science and Technology, Vol 9(32), pp.1-8. DOI: 10.17485/ijst/2016/v9i32/100713, August 2016, ISSN: 0974-5645.
[9] P. Khurana, A. Sharma and Pradeep Kumar Singh (2016). A Systematic Analysis on Mobile Application Software Vulnerabilities: Issues and Challenges, Indian Journal of Science and Technology, Vol 9(32), pp.1-6. DOI: 10.17485/ijst/2016/v9i32/100190, ISSN: 0974-5645.
[10] Soham Banerjee, Pradeep Kumar Singh , Jaya Bajpai (2018). A Comparative Study on Decision-Making Capability Between Human and Artificial Intelligence. In , Nature Inspired Computing (pp. 203-210). Singapore: AISC, Springer. [ISBN : 978-981-10-6746-4].