An IoT based Automatic Vehicle accident detection and Ambulance Rescue System

Ms. Pooja Kadam[1], Ms. Yugashree Bhadane[2]
Department of Information Technology[1,2], University of Pune[1,2]
Email: lokarepooja31@gmail.com[1] ,yugadpcoe@gmail.com[2]

Abstract- In highly populated Countries like India, everyday people lose their lives because of accidents and poor emergency facilities. Some of the rescue teams face difficulty in reaching the injured people to due late alerts and insufficient information of the specific accident location. The advent of the mobile phone and Internet of Things (IoT) industries reshaped the way people communicate and brought a paradigm shift to public and private services. This ever-evolving technology marked the beginning of new era affecting the lives of people and various businesses. This paper express to provide a solution for such a problem we are going to proposed an IoT system which instantly notifies the Public Safety Organization (PSO) headquarter whenever an accident takes place and pinpoints its geographic coordinates on the map. When an accident takes place, a vibration sensor detects it. Then, an algorithm is applied to process the sensor signal and send the geographic location along with some medical information of passengers to the server, indicating accident occurrence. Server will forwards the details to nearest rescue teams.

Index Terms- IoT, accident detection, ambulance management, health care center, vibration sensor, fingerprint scanner.

1. INTRODUCTION

Smartphone-based accident detection applications have both advantages and disadvantages relative to conventional in-vehicle accident detection systems, e.g., they are vehicle-independent, increasingly pervasive, and provide rich data for accident analysis, including pictures and videos. Building a Smartphone-based accident detection system is hard, however, because phones can be dropped (and generate false positives) and the phone is not directly connected to the vehicle. In contrast, conventional in-vehicle accident detection systems rarely incur false positives because they rely on sensors, such as accelerometers and airbag sensors, that directly detect damage to the vehicle[5]. The time interval between the occurrence of an accident and the arrival of an ambulance is critical in reducing the mortality rate. The victims of the accident may be in an unconscious state, and cannot be expected to place a call to the emergency services control room, when an accident happens. Hence, an in-vehicle accident detection module can be used[3]. Further, in a country like India, where the witnesses are expected to inform the emergency services control room when an accident occurs, a lot of delay can happen[4].

In India, it takes 30 seconds on an average for the Communications Officer to collect relevant information, and three minutes for the Dispatchment Officer to dispatch an ambulance to the location. Further, the ambulance driver needs to identify the accident location based on cues provided by the officer and sail through the heavy traffic. It takes another 48 hours after the accident to conduct a follow-up to check the impact of the care[6]. A lot of delay arises in each and every stage due to the human element involved. In this paper, we propose a system that can intelligently detect accidents, and dispatch and guide the nearest ambulance to the accident location with minimal delay involved. Before moving into the details of the proposed method we briefly review the related literature.

2. RELATED WORK

- **An IOT Approach to Vehicle Accident Detection , Reporting and Navigation[20]**

One particular concern that Public Safety Organizations (PSO) must account for whilst engaging in many activities is decreasing the effect of vehicle accidents, aiding as many injured people as possible and providing 24/7 on the spot rescue. The Red Cross humanitarian organization is one of the most known PSOs to be present on-site whenever an accident or a disaster takes place. However, some of the rescue teams face difficulty in reaching the injured people to due late alerts and insufficient information of the specific accident location. The advent of the mobile phone and Internet of Things (IoT) industries reshaped the way people communicate and brought a paradigm shift to public and private services. This technology marked the beginning of new era affecting the lives of people and various businesses. This paper conveys a smart and reliable IoT system solution which instantly notifies the PSO headquarter whenever an accident takes place and pinpoints its geographic coordinates

International Journal of Research in Advent Technology, Vol.6, No.5, May 2018
E-ISSN: 2321-9637
Available online at www.ijrat.org

on the map. When an accident takes place, a shock sensor detects it. Then, an algorithm is applied to process the sensor signal and send the geographic location along with some ancillary information to the PSO headquarter, indicating accident occurrence. This is a promising system expected to aid in the tedious rescuing process by reporting in a matter of seconds the location of an accident, the passengers injured, blood types, thus lowering death's rates. The geographical data collected from this system could be relied upon as admissible evidence or indicator of the road state and conditions.

- **Accident Detection and Reporting System using GPS , GPRS and GSM Technology[2]**

Speed is one of the basic reasons for vehicle accident. Many lives could have been saved if emergency service could get accident information and reach in time. Nowadays, GPS has become an integral part of a vehicle system. This paper proposes to utilize the

Fig 1. Block Diagram of Proposed system

capability of a GPS receiver to monitor speed of a vehicle and detect accident basing on monitored speed and send accident location to an Alert Service Center. The GPS will monitor speed of a vehicle and compare with the previous speed in every second through a Microcontroller Unit. Whenever the speed will be below the specified speed, it will assume that an accident has occurred[14]. The system will then send the accident location acquired from the GPS along with the time and the speed by utilizing the GSM network. This will help to reach the rescue service in time and save the valuable human life.

- **A Comprehensive Solution To Road Traffic Accident Detection and Ambulance Management[21]**

Delay in providing Emergency Medical Services (EMS) is the cause of the high mortality rate in road traffic accidents in countries like India. There is delay involved in each and every stage of the process, right from reporting an accident to dispatching an ambulance, till the patient is safely handed over to the casualty. Minimizing this delay can help save lives. We propose a comprehensive solution to both accident detection and ambulance management. When the in–vehicle accident detection module reports an accident, the main server automatically dispatches the nearest ambulance to the accident spot. The android application used by the ambulance driver assists the driver to reach the location quickly and safely. Automation of accident detection and ambulance dispatch, along with providing guidance to the ambulance driver, is achieved here. This can save precious time and help standardize the whole process.

- **Accident Reporting and Guidance System with Automatic Detection of the Accident[8]**

Mobile phones have been present in our lives for over 20 years during which they have become indispensable. Due to the hardware and software characteristics of the smartphones, these devices are suitable to work as terminals for accident guidance and reporting system[15]. The goal of the paper is to present the design and implementation of such a system, able to give a set of information from the user, information that is associated with a location using a GPS Tracking system and creates an accident report. The system sends the GPS coordinates of the person, display the coordinates on a map and computes the shortest route to the accident site. Also, the system is able to automatic detect an accident when occurs. The paper focuses on the mobile part of the system.

3. THE PROPOSED SYSTEM

According to the Association for Safe International Road Travel (ASIRT), nearly 1.3 million people die in road crashes each year, 20-50 million are injured or disabled[12]. The challenges imposed to local PSOs in saving human lives resulting from vehicles accidents have become a crucial concern. To provide a solution for such a problem we are going to propose an IoT system which instantly notifies the Public Safety Organization (PSO) headquarter whenever an accident takes place and pinpoints its geographic coordinates on the map[23]. When an accident takes place, a vibration sensor detects it. Then, an algorithm is applied to process the sensor signal and send the geographic location along with some medical information of passengers to the server, indicating accident occurrence. Server will forwards the details to nearest rescue teams.

3.1. SYSTEM ARCHITECTURE

- To notify information of the accident to the nearest ambulance.
- Detect accidents in significantly less time and sends the basic information to the ambulance within a few seconds covering geographical coordinates.
- To make a system which will provide the detailed information of accident within short period of time.

4. IMPLEMENTATION DETAILS

The Android user can be ambulance driver or any member of hospital's rescue team. When an accident occurs server will notify the android user (rescue team). If user responds to the request the

server starts to track the user until he reach to the destination.

Fig 2. Raspberry-pi sensor Interface

When an individual riding his/her vehicle, meets with an accident, there is a chance that the individual may suffer from a serious injury or expire instantaneously and there is no one around to help him. Well this system is a solution to the problem[11]. The system acts as an accident identification system that gathers and sends this vehicle information that met with an accident, and conveys it to the nearest control room. For this the user vehicle is fixed with an RF transmitter circuit that has a vibration sensor along with raspberry pi, RF encoder and also fitted with an RF transmitter. Whenever a user vehicle meets with any accident, the vibration sensor detects and gives its output. This output is then detected by the microcontroller. Now the microcontroller sends this change detection signal to an RF transmitter. The RF transmitter now intern begins transmitting this accident data.

Raspberry-pi interface with vibration sensor:
The Raspberry Pi is a series of small single-board computers developed in the United Kingdom details of the board, so that the Raspberry Pi's OS is informed of the HAT, and the technical details of it, relevant to the OS using the HAT.CPU: 1.2 GHz 64/32-bit quad-core ARM Corte System-on-chip used: Broadcom BCM2837Memory: 1 GB LPDDR2 RAM at 900 MHz. Vibration sensor is used to sense the occurrence of accident. Sensor is connected to raspberry-pi through GPIO pins. The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside of its target market for uses such as robotics. Peripherals (including keyboards, mice and cases) are not included with the Raspberry Pi. Some accessories however have been included in several official and unofficial bundles. Raspbian is full Linux, a rich, powerful, and comprehensive development environment. As noted previously the common languages, debuggers, profilers, editors and other support tools are included within Raspbian (even the cut down "Lite" version has C/C++ and python). Countless other languages and tools are available for

free with a simple "sudo apt install xxx". (The base Debian repository has some 84,000 software packages, all free. Though Raspbian will have less because its ARM based).

5. CONCLUSION

We proposed and implemented an IoT system which may help the community decreasing the death rates resulting from vehicles accidents. This solution provided many advantages compared to traditional systems, namely, minimizing injured passengers interaction, providing basic medical information to rescue teams, recognizing exact and accurate accidents locations, and facilitating the routing process. Reliability test showed that the system is robust, that is, available and serviceable specially when the IoT device keeps sending continuous notification of crash occurrence until it makes sure its reception by the headquarter (server) The presence of a server with secured log– in for administration staff, lets us keep an eye on ambulance dispatch services for multiple accidents at the same time. It is easy to monitor the performance of ambulance drivers too. With the android application, navigating through the heavy traffic becomes easy for the ambulance driver, as routes with less traffic are automatically suggested. The main purpose of the system is to find the nearest medical unit from the accident location. This was achieved by using some features that the GPS receiver and Google Maps are providing[10]. The server application together with the mobile one and the database compose the strongly connected client-server applications system and there is no sense of using one part without the other one.

REFERENCES

[1] 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, vol. 16, no. 3, pp. 285–303, 2011.

[2] M. S. Amin, J. Jalil, and M. Reaz, "Accident detection and reporting system using GPS, GPRS and GSM technology," in Proc. IEEE International Conference on Informatics, Electronics & Vision (ICIEV), pp. 640–643, 2012.

[3] S. Kamijo, Y. Matsushita, K. Ikeuchi, and M. Sakauchi, "Traffic monitoring and accident detection at intersections," IEEE Trans. on Intelligent Transportation Systems, vol. 1, no. 2, pp. 108–118, 2000.

[4] Y.-K. Ki and D.-Y. Lee, "A traffic accident recording and reporting model at intersections,"

IEEE Trans. on Intelligent Transportation Systems, vol. 8, no. 2, pp. 188–194, 2007.

[5] Chris Thompson, Jules White, Brian Dougherty, Adam Albright, and Douglas C. SchmidtUsing Smartphones to Detect Car Accidents and Provide Situational Awareness to Emergency Responders, @c Institute for Computer Sciences, Social Informatics and Telecommunications Engineering 2010.

[6] Harrald J, Jefferson T (2007) Shared situational awareness in emergency management mitigation and response. In: 40th annual Hawaii international conference on system sciences, 2007. HICSS 2007. IEEE, p 23.

[7] W. Wei and F. Hanbo, "Traffic accident automatic detection and remote alarm device," in Proc. of International Conferenc of Electric Information and Control Engineering (ICEICE), pp. 910–913, 2011.

[8] M. Fogue, P. Garrido, F. J. Martinez, J.-C. Cano, C. T. Calafate, and P. Manzoni, "Automatic accident detection: Assistance through communication technologies and vehicles," IEEE Vehicular Technology Magazine, vol. 7, no. 3, pp. 90–100, 2012.

[9] T. Andersson and P. V¨arbrand, "Decision support tools for ambulance dispatch and relocation," Journal of the Operational Research Society, vol. 58, no. 2, pp. 195– 201, 2007.

[10] L. Brotcorne, G. Laporte, and F. Semet, "Ambulance location and relocation models," European Journal of Operational Research, vol. 147, no. 3, pp. 451–463, 2003.

[11] O. Vermesan, Internet of Things: Converging Technologies for Smart Environments. River Publishers, 2013.

[12] "Road Crash Statistics", Asirt.org, 2016. [Online]. Available: http://asirt.org/initiatives/informing-road-users/road-safety-facts/roadcrash- statistics.

[13] A. App and P. LLC, "Auto Accident App dans l'App Store", App Store, 2016. [Online]. Available: https://itunes.apple.com/ca/app/auto-accident-app/id515255099?l=fr.

[14] "Auto Accident App - Murphy Battista LLP", Murphy Battista LLP, 2016. [Online]. Available: http://www.murphybattista.com/autoaccident-app.

[15] "Accident Report for Android", Appsgalery.com, 2016. [Online]. Available: http://www.appsgalery.com/apps/accident-report-34136.

[16] Alexandra Fanca and Honoriu valean, Accident Reporting and Guidance System with automatic detection of the accident, 20th International Conference on System Theory, Control and Computing (ICSTCC), October 13-15, Sinaia, Romania IEEE, 2016.

[17] M. Bhokare, S. Kaulkar, A. Khinvasara, A. Agrawal, Y. K. Sharma. An Algorithmic Approach for Detecting Car Accidents using Smartphone. International Journal of Research in Advent Technology, Vol.2, No.4, April 2014, pp. 151-154, E-ISSN: 2321-9637

[18] A. Puşcaşiu, A. Fanca, H. Vălean. Tracking and Localization System using Android Mobile Phones. Proc. of 2016 IEEE International Conference on Automation, Quality and Testing, Robotics THETA 20th edition, ISBN: 978-1-4673-8691-3, IEEE Catalog Number: CFP16AQTUSB.

[19] Elie Nasr, Elie Kfoury and David Khoury, "An IoT approach to vehicle accident detection, reporting and navigation", International multidisciplinary conference on Engineering Technology (IMCET), IEEE 2016.

[20] Hari Sankar S, Jayadev K, Suraj B and Aparna P, A Comprehensive solution to road traffic accident detection and ambulance management, International conference on advances in Electrical, Electronic and system Engineering, IEEE, Nov 2016.

[21] A Zanella, N Bui, A Castellani, Internet of things for smart cities, IEEE INTERNET OF THINGS JOURNAL, VOL. 1, NO. 1, FEBRUARY 2014.