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Real-Time Vehicle Accident Alert System Based on Arduino with SMS Notification

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Abstract *– Since the development of automobile as a mode of transportation has increased, it has been an important part of our daily lives. However, vehicle-related road accidents worldwide have also increased. Even with the efforts of government and non-government institutions to at least solve these problems, accident may happen no matter what. Lives could have been saved if the information related to the accident is reported on time. Literature review shows that there has not been a published research and patented device in Asian countries that automatically notifies the police and rescue team if there is an accident. This research study developed a device that automatically notifies the Philippine National Police (PNP) office if there is an accident occurred. The device is comprised of different sensors such as ultrasonic and vibration, and modules such as Global System for Mobile communication (GSM) and Global Positioning System(GPS). The sensors detect objects and vibration and will evaluate the gathered data using decision matrix if it is an accident or not. If the device detects an accident, it will automatically get the GPS location of the vehicle using the GPS module and sends a notification message to the nearby PNP office via SMS using the GSM module. This study followed the Agile methodology with ISO 9126 - based questionnaire and interview as a mode to gather data. A pilot of 45 respondents were used in this study, divided into two categories, 1) Police Officers and 2) Motorcycle Riders. Overall, the respondents evaluated the device as acceptable in terms of its functionality, usability, efficiency, maintainability and portability. For future works, further improvement and implementation of the device is highly recommended.*

Keywords *– Accident Alert System, Ultrasonic, GPS, GSM, SMS Notification*.

INTRODUCTION

Accidents may happen anytime. As a matter of fact, it probably happened even during caveman age (Hollnagel, 2016). Since the development of automobile as a mode of transportation has increased over the past decades, it has been an important part of our daily lives. However, it also brought disaster to many families (Amin et al., 2012).

The World Health Organization (WHO) reported that there are about 1.24 million casualties and 50 million injuries related to automobiles accidents. In 2010, traffic accident ranked 8th as cause of death worldwide (Aldegheishem et al., 2018) but just after 2 years, it ranked 5th which makes it a bothersome problem worldwide (Ganeshkumar & Gokulakrishnan, 2015) and it is estimated that the death toll will grow further by 2020 (Aldegheishem et al., 2018; Lee & WOlfensohn, 2004)

Road traffic death rate is highest in Africa with a ratio of 26.6 deaths per 100,000 population, followed by South East Asia with a ratio of 20.7 deaths in every 100,000 population (World Health Organization, 2018). According to an article from ABS-CBN News, more than 10,000 die annually in Philippines alone due to road crashes of which the affected age group is teenagers, ranges from 20-24 (Reformina, 2018). With these alarming vehicle-related death cases, it is important to have an effective emergency protocol to rescue victims. Automobile manufacturers have taken the initiative to develop both active and passive systems that are embedded to the manufactured vehicles to reduce road accidents (Fogue et al., 2012). Even with the efforts of government and non-government institutions to somewhat solve these problems, accident may happen no matter what. But lives could have been saved if the information related to the accident is reported on time (Amin et al., 2012).

Assisting those who are injured in an accident is vital, because it can either cause further damage to their health or it can save their lives. As a matter of fact, poor implementation of rescue teams during these kinds of emergency can increase high number of traffic fatalities and even death (Wei & Hanbo, 2011). Rescue operation

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must be fast and efficient to increase the survival rate of those involved in the accident (Fogue et al., 2012). Sadly, there are only 109 countries around the world who have an accessible telephone numbers intended for these service (World Health Organization, 2018).

Literature review revealed that as of the writing of this research, there is no published paper nor developed device in Asian Countries that automatically notifies the police and emergency response team once an accident occurred. The main purpose of this paper is to provide a solution to the mentioned problem by developing a device that will automatically notify the police office once an accident occurred. The device will use two sensors (ultrasonic and vibration) and two modules (GSM and GPS).

OBJECTIVES OF THE STUDY

The study aimed to design and develop a Real-time Vehicle Accident Alert System Based on Arduino with SMS notification to help the police to respond faster when an accident happened. Moreover, it also assessed the level of acceptability of the developed device as to Functionality; Usability; Efficiency; Maintainability; and Portability.

MATERIALS AND METHODS

This study made use of Arduino IDE version 1.8.5 with C++ as a programming language for the coding of the device. Arduino Mega board, sensors (ultrasonic and vibration) modules (GSM & GPS), cable wires, 12 volts with 2 amperes battery and remote controlled car were the materials used in the development of the device (Balcita et al., 2019; Jeff G Pereyras, 2019; Jeff Galapon Pereyras, 2019) . To test the device, a prototype was developed. The different parts were strategically positioned in a remote controlled car and was tested for vibration and impact.

This study also followed the different phases of the Agile Methodology with interview and questionnaire based on ISO 9126 as mode to gather data. The pilot area for this study was in the College of Information Systems in DMMMSU-NLUC with the Bacnotan – PNP as the response and rescue team. A total of 45 respondents, divided into Police officers and Motorcycle Riders, were used in this research. Two sets of questionnaire were distributed, one set for police officers and 1 set for riders.

RESULTS AND DISCUSSION

The prototype of this paper is shown in fig. 1. As displayed in the figure there are 8 parts such as 1) Antenna, 2) GPS Receiver, 3) Vibration Sensor, 4) Front Ultrasonic Sensor, 5) Arduino Mega 2560 board, 6) GSM Module, 7) Neo – 6M GPS Module and 8) Rear Ultrasonic Sensor. The sensors (part 3, 4, 8) are responsible for detecting any vibration or obstacles near the vehicle. If the sensors detected the maximum vibration and impact, the GPS module (part 7) will get the location through the receiver (part 2). The GSM module (part 1 & 6) will send a notification message to the police station that an accident occurred in a certain location. The text message that encloses the GPS location link (see fig. 2) will be sent to the Police office. The link can be opened using google maps.

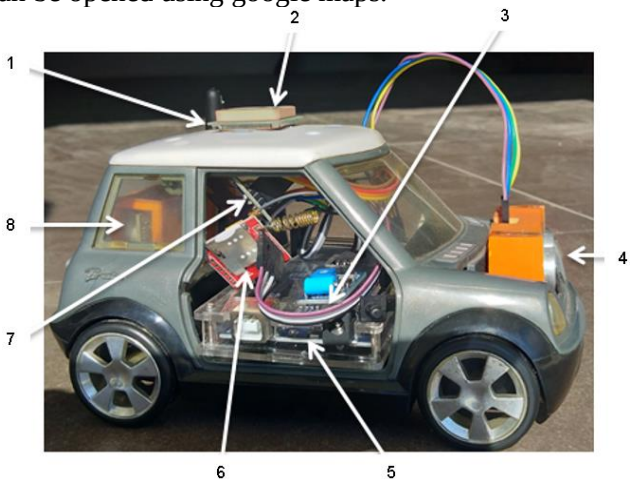

Fig. 1. Prototype of the Device

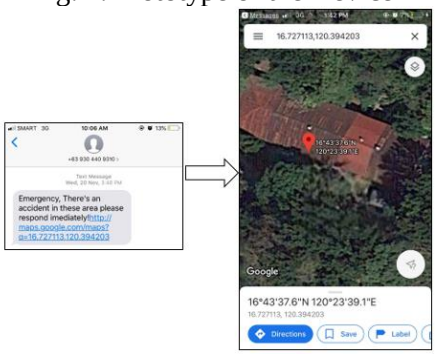

Fig. 2. Sample SMS Notification

The summary of evaluation of the police officers is shown in table 1. As perceived in the table, the respondents believed that the device is acceptable in all categories of the questionnaire with its Usability as rated highest. This means that the police officers find the device usable and helpful to their unit to respond to road-related accidents. The result of this study on usability strengthens the reason why developers evaluates this criteria of a system or a product, as it affects its final quality (Fernandez et al., 2011).

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Table 1. Evaluation Summary of Police Officers

Item	Mean	Descriptive Rating
Functionality	3.33	Acceptable
Usability	3.60	Acceptable
Efficiency	3.30	Acceptable
Maintainability	3.27	Acceptable
Portability	3.30	Acceptable

The summary of evaluation of motorcycle riders is shown in table 2. As perceived in the table, the respondents believed that the device is also acceptable in all categories of the questionnaire with its Usability and Efficiency as rated highest. This means that the motorcycle riders find the device useful and efficient as it helps in reporting an accident real-time and can be responded as quickly as possible by the emergency response team. This could potentially save their lives (Amin et al., 2012).

Table 2. Evaluation Summary of Riders

Item	Mean	Descriptive Rating
Functionality	4.53	Acceptable
Usability	4.65	Acceptable
Efficiency	4.65	Acceptable

CONCLUSION AND RECOMMENDATION

Results above show that the device is acceptable and can help both police officers and motorcycle riders. This means that the device can potentially save lives and limit any casualty when an accident occurs even if it happened in a remote area.

Future works can include the improvement of the device by incorporating the recommendations of the respondents. Implementation of the device in a national scenario is also highly recommended.

REFERENCES

Aldegheishem, A., Yasmeen, H., Maryam, H., Shah, M. A., Mehmood, A., Alrajeh, N., & Song, H. (2018). Smart Road Traffic Accidents Reduction Strategy Based on Intelligent Transportation Systems (TARS). *Sensors*, *18*. https://doi.org/10.3390/s18071983

Amin, S., Jalil, J., & Reaz, M. B. I. (2012). Accident Detection and Reporting System using GPS , GPRS and GSM Technology. *International Conference on Informatics, Electronis & Vision*, 640–643.

Balcita, A., Ventayen, R. J., & Palaoag, T. (2019). Usability of KITIKIT: A mobile-based app for implementing customizable online product ordering. *IOP Conference Series: Materials Science and Engineering*. https://doi.org/10.1088/1757-899X/482/1/012020

Fernandez, A., Insfran, E., & Abrahão, S. (2011). Usability evaluation methods for the web : A systematic mapping study q. *Information and Software Technology*, *53*(8), 789–817. https://doi.org/10.1016/j.infsof.2011.02.007

Fogue, M., Garrido, P., Martinez, F. J., Cano, J., & Calafate, C. T. (2012). Assistance Through Communication Technologies and Vehicles. *IEEE Vehicular Technology Magazine*, *September*, 90–100.

Ganeshkumar, P., & Gokulakrishnan, P. (2015). Emergency Situation Prediction Mechanism : A Novel Approach for Intelligent Transportation System Using Vehicular Ad Hoc Networks. *The Scientific World Journal*, *2015*. https://doi.org/http://dx.doi.org/10.1155/2015/218379

Hollnagel, E. (2016). *Barriers and Accident Prevention*. Taylor & Francis Group.

Lee, J., & WOlfensohn, J. (2004). World report on road traffic injury prevention: summary. In *Wo*.

Pereyras, Jeff G. (2019). Development of a Basic Electro-pneumatic Control Trainer. *Asian Journal of Multidisciplinary Studies*, *2*(2).

Pereyras, Jeff Galapon. (2019). A Computerized Touchscreen Student Voting System for the Universities and Colleges. *Asian Journal of Business and Technology Studies*, *2*(1).

Reformina, I. (2018). *10,000 die annually from road crashes in PH*. ABS-CBN News.

Wei, W., & Hanbo, F. (2011). Traffic Accident Automatic Detection And Remote Alarm Device. *IEEE International Conference on Electric Information and Control Engineering*, 1–4. https://doi.org/10.1109/ICEICE.2011.5777923

World Health Organization. (2018). *GLOBAL STATUS REPORT ON ROAD*.