DEVELOPING A GEO-APP FOR ROAD ACCIDENT EMERGENCY RESPONSE: SUPPORTING THE UN SDG 3

Adebisi Naheem Idowu(1) and Abdul-Lateef Balogun(1)

(1) Geospatial Analysis and Modelling (GAM) Research group, Department of Civil and Environmental Engineering, Universiti Teknologi PETRONAS (UTP), 32610 Seri Iskandar, Perak, Malaysia
Email: adebisi.naheem@gmail.com; alateef.babatunde@utp.edu.my

KEY WORDS: Traffic accident, GIS, Disaster management

ABSTRACT: Globally, road accidents remain the most frequent and leading cause of death of children and young adults between the ages of 5 and 29 (World Health Organization, 2018).This is in spite of the various researches and efforts being undertaken to address road hazards. Africa and Southeast Asia record the highest road traffic death rates at 26.6 and 20.7 deaths per 100,000 persons respectively (World Health Organization, 2018). Many reports attribute these avoidable deaths to delays in detecting and providing care to victims of road accidents. Unfortunately, prompt and reliable early detection methods to reduce the risks of road accident induced deaths do not receive as much attention as it requires in several regions, including the highly vulnerable African and Asian continents. Many of the existing solutions are expensive, ambiguous and unaffordable for many road users and stakeholders. There is thus apparent need for a smart and cost-effective approach to tackle this societal challenge. This research adopts a geospatial technology-based approach in meeting this need by developing a low-cost Geographic Application (Geo-App) to facilitate road accident rescue mission through smart reporting, rapid response and data-driven decision making. The free online GIS software application platform, ArcGIS online, which creates and maintains mobile and desktop applications that are easy to use and secure, will be utilized in this research. The proposed Geo-App will be a system of two inter-working units. The user unit will offer functionalities such as enabling the public to report accident events, listing of nearby hospitals to the accident scene and providing optimal routes and direction to the hospitals (considering distance, traffic and other variables).The dashboard unit will provide pertinent real-time information on accidents to government agencies, local authorities, first responders and other stakeholders thereby facilitating faster rescue and effective decision making. Considering the efficacy and affordability of the proposed solution, this study will support the actualization of the agenda of the United Nations Sustainable Development Goals to halve the global number of deaths and injuries from road traffic injuries by 2020.

1.0 INTRODUCTION

Globally, road accidents remain the most frequent and leading cause of death of children and young adults between the ages of 5 and 29 (World Health Organization, 2018) . The reasons for road traffic accidents are multiple and include rapid urbanization, poor safety standards, lack of enforcement, people driving distracted or fatigued, influence of psychoactive drugs and alcohol, speeding, and failure to wear seat belts or helmets (World Health Organization, 2018). According to the UN global status report on road safety, Road accident induced death has increased to 1.3 million a year, translating to nearly 3700 people dying on the world's road every day, and with about tens of millions disabled or injured every year . Road traffic injuries cause considerable socio-economic losses to individuals, their families, and to nations as a whole. Road traffic crashes cost most countries 3% of their gross domestic product (World Health Organization, 2018). Africa and Southeast Asia record the highest road traffic death rates at 26.6 and 20.7 deaths per 100,000 persons respectively (World Health Organization, 2018). Years after years, Malaysia has been recording a steady increase in road accident at a rate of 5% (Radzuan et al., 2020) and presently has the third highest fatality rate from road traffic accidents in Asia and Asean, behind Thailand and Vietnam (The Star Online, 2019). Transport accidents (5.4%) were the fourth most common cause of death in Malaysia in 2016, behind ischaemic heart disease (13.2%), pneumonia (12.5%) and cerebrovascular disease (6.9%) according to the Department of Statistics (The Star Online, 2019). The Global Status Report on Road Safety published by the World Health Organization (WHO) and the World Bank in December 2018 reported that Malaysia had 7,152 deaths in 2016, of which 87% were males and 13% females (World Health Organization, 2018).

So many legislations and laws, like speed limits, drink-driving ban, compulsory use of helmets and seat belt, child driving ban etc, have been made in most countries of the world and yet, very little progress has been made. This is even in spite of the various researches being undertaken to address road hazards. Regardless of the policies and measures, road accidents can only be reduced but not eliminated. Many reports attribute these avoidable deaths to delays in detecting and providing care to victims of road accidents (World Health Organization, 2018). When accident occurs, seconds and minutes can be the difference between life and death. So, there is a need of a system for the effective management of road post-crash issues. A system that supports easy reporting, rapid response and data-driven decision making.

Although, some systems have been developed in recent years for emergency management, most of them do not meet the special requirements of road accident response operation. ELERT App is an application developed for emergency reporting all over America. The mobile version allows taking photos of emergency situation, sharing the emergency with the public who have

the application on their phone and getting help through rescue tips from public or emergency officer (ELERTS Corp, 2019). The app also incorporates Google Map and geo location to locate emergency places and advice others on the issue at that location. HelpMe works in a similar way as ELERT. In addition to ELERT features, it employs WIFI signal to build ad-hoc network to enable smart phones communicate during disaster time (Komwit, Supasit, Kasikrit, Watanyoo, & Aninnuch, 2013; Mokryn, Karmi, Elkayam, & Teller, 2012). GreatCall is a relatively easy to use mobile application similar to phone call application but with a user friendly button for person in emergency to talk to emergency team for help (Komwit et al., 2013). These applications, besides being general emergency systems, only address the reporting aspect of emergency rescue operation. They provide faster notification and communication of emergency to the public and emergency team. FIRST AID APPLICATION on mobile device FAD employs Google Maps API to provide routing to nearby hospitals (Great Call, 2019). The main objective here is to serve as the navigation aid only to nearest hospitals during accident crises. Rajput, Deshmukh, and Kale (2015) created a Smartphone emergency reporting application with core functionalities for reporting, response and data crowd sourcing. This application just like others is suitable for general emergencies like fire, robbery, hazards, and criminality but road accidents.

Most of these applications have been a trade off of some of the functionalities of an effective road accident management system; smart reporting, rapid response, aid Navigation, Crowd sourcing for data driven decision making. In addition, many of the existing solutions are poorly designed, difficult to use, expensive and unaffordable for many road users and stakeholders. There is thus apparent need, especially in the highly vulnerable African and Asian continents for a smart and cost-effective approach to tackle this societal challenge. This research adopts a geospatial technology-based approach in mitigating the problem by developing a low-cost Geographic Application (Geo-App) to facilitate road accident rescue mission through smart reporting, prompt response and data-driven decision making. Because of its significance as one of the highly vulnerable countries to road traffic accident, Malaysia is used as the study area for this research.

2.0 UN SDG 3:

World Leaders in 2015 converge to set new 17 Sustainable Development goals and 169 targets for the world. Goal 3 seeks to promote physical and mental health and to extend life expectancy for all. This goal has 9 targets and target 3.6 sets to halve the number of global death and injuries from road accidents by 2020. But four years on, little progress has been made to achieve this goal. According to the UN progress report on goal 3, the number of road traffic deaths climbed from 1.31 million in 2013 to 1.35 million in 2016 (United Nation, 2018). Many reports attribute these avoidable deaths to delays in detecting and providing care to victims of road

accidents. To achieve this target, UN highlighted 'improving post-crash care for victims of road crashes' as one of the necessary interventions. Developing an easy to use and user-friendly Geo-App to facilitate road accident rescue mission through smart reporting, prompt response and data-driven decision making will be a fast drive to achieve this target.

3.0 METHODOLOGY

The free online GIS software application platform, ArcGIS online, which creates and maintains mobile and desktop applications that are easy to use and secure, was utilized in this research. Web data collection form was created with Survey123 for ArcGIS for public to report accident cases. Survey123 for ArcGIS allows users to enter data to a form which adds the location and information to a hosted feature layer. Figure 1 below shows the accident e-reporting form is user friendly and simple to use in distress situations. Click for a demo https://arcg.is/mL05y

Fig 1: Accident e-report Form Interface

A viewer App was also developed using Operations Dashboard to display the locations of reported accident events in real time. This enables the concerned agencies to see the report from the public immediately an accident occurs and this makes them see the kind of medical attention that is needed in order to save the victims lives. This will facilitate quick response by the agencies. The process of development involves adding the hosted feature layer of the reported accident cases to WebMap and using the Operation Dashboard to create a Viewer App. https://arcg.is/jCmO1

Layer of some healthcare facilities in Malaysia is created in ArcGIS online and added to WebMap and routing functionality integrated to create another WebApp that enables the public find nearby hospitals to the accident scene and gets direction to them.
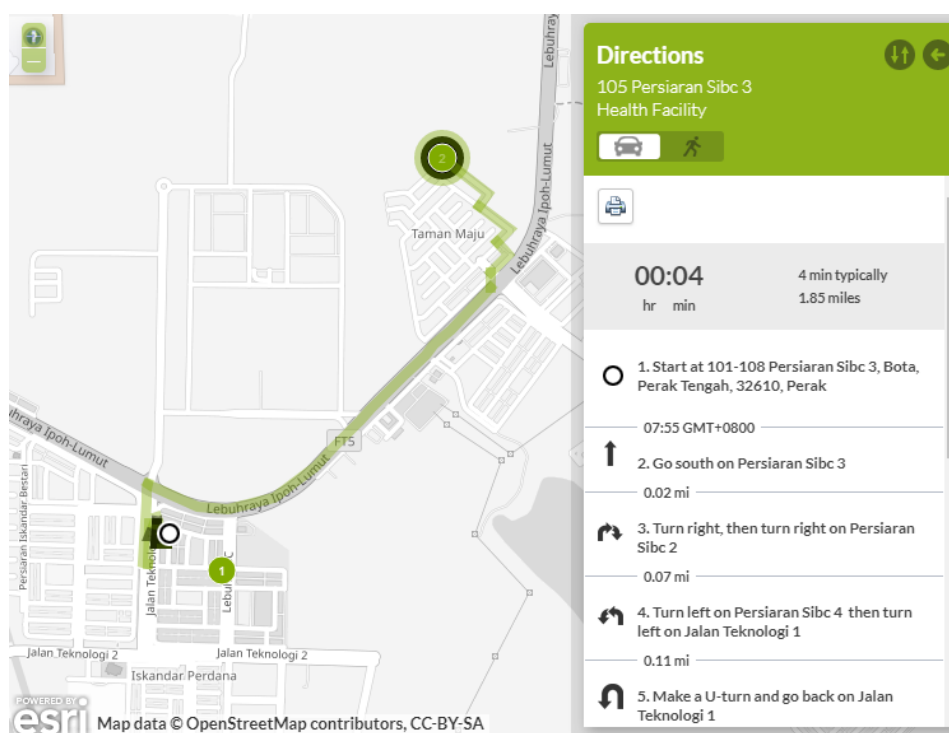

Fig. 2: Routing functionality to the nearby hospitals

4.0 RESULTS AND DISCUSSION

The Geo-App is a system of two inter-working units. The user unit will offer functionalities such as:

1. Enabling the public to report accident events. The reporting can be done with a Web Browser or Mobile Device with the Survey123 App through URL or barcode scan. For each user who uses the Survey123 App to report accident cases, the feature layer created will have one more point added. The barcode option makes it easy to report accident from mobile without any installation.

2. Listing of nearby hospitals to the accident scene.
3. Providing optimal routes and direction to the hospitals (considering distance, traffic and other variables).

The dashboard unit will provide pertinent real-time information on accidents to government agencies, local authorities, first responders and other stakeholders thereby facilitating faster rescue and effective decision making. See the result of the crowd sourced data here https://arcg.is/1HLvay

5.0 CONCLUSION

The latest status report by World Health Organization on road safety calls for a need of a smart and effective approach to the management of road traffic accident. This research adopts a geospatial technology-based approach in meeting this need by developing a low-cost Geographic Application (Geo-App) to facilitate road accident rescue mission through smart reporting, prompt response and data-driven decision making. The Geo-App is developed using GIS software application platform. The application can be used by the public, agencies and hospitals. Considering the efficacy and affordability of the proposed solution, this study will support the actualization of the agenda of the United Nations Sustainable Development Goals to halve the global number of deaths and injuries from road traffic injuries by 2020. Since the Survey123 automatically creates a Web layer of reported accidents that is incorporated to the viewer App, it will also support the data gathering process for future status report and analysis in countries where it is employed.

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