

# Location Based Evacuation Center Finder

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**Abstract**— The Philippines is fifth most vulnerable country in natural disasters around the world. The country needs to increase the awareness of many people on disaster management by providing up-to-date information on evacuation centers to minimize the casualties on any natural disaster happened in the country. This research developed a mobile application to provide the nearest evacuation center in android platform. The mobile application uses shortest path algorithms and identifies the location of the user using global positioning systems. The mobile application uses Google maps, places and application programming interfaces to provide evacuation center location maps in Manila city. The evacuation center data is stored in android devices that can be displayed and updated anytime through version. Overall, the mobile application has functioned properly. It is expected that this application helps in providing relevant nearest evacuation center and assists disaster response team to work efficiently and clearly as improving the local disaster response team evacuation strategy. This paper also recommends future research activities.

**Keywords**— shortest path, android mobile application, evacuation center finder.

## I. INTRODUCTION

THE Philippines is one the devastated countries in Southeast Asia by several typhoons in the past decades [1]. In the past decade, over a hundred natural calamities resulted in 3 million affected people and agricultural investments. In particular, Manila city has been affected by the natural disasters including floods and earthquakes in the past. It is brought by changing climate and weather conditions [1]. Thus, it is essentially needed to provide real time support for affected people affected by these disasters. At this point, the project aims to design a mobile application that assists people in finding a nearest evacuation centers during natural disasters. The application is fully developed in an open source mobile platform.

## II. RELATED WORKS

In this section, an overview of natural disasters and current state in the Philippines is presented. Disaster technologies and open source platform is explored and briefly discussed in the succeeding parts of this section.

The Philippines is one the Southeast Asian countries with higher incidents of natural disaster around the world. Based on UNISDR (The United Nations Office for Disaster Risk Reduction), Philippines ranks 5<sup>th</sup> among 76 countries with

risk of tsunami, 7<sup>th</sup> among 162 countries for nation with high risk of flood, and 10<sup>th</sup> among nations with risk of earthquake [1]. From 1995 to 2015, a total of 274 disasters were recorded. In addition, the Philippines is considered the 5<sup>th</sup> most vulnerable country in regards of disaster risks implications for development capacity. Therefore, the Philippines need an effective and efficient natural disaster's strategy, recovery, and technology systems.

One of the approaches that are commonly used to increase awareness of people, evacuees and victims in natural disaster is massive evacuation information dissemination [2]. Evacuation information campaign may involve traditional orientation through media outlets such as television, radio, and actual evacuation drills and exercises and or by using new technologies such as mobile application or messaging service [3]. For special case such as natural disaster, providing evacuation centers through location based approach assist citizens to increase awareness and readiness during natural disaster [4]. This type of approach is used save many people as possible with the available resource [5]. Previous studies suggest the use massive information dissemination, sensor based disaster data management [6, 7], messaging service [8], emergency and evacuation support system [9], and rescue team tracking systems [10]. In addition, crowd-sourcing is one of key implementations of disaster notification and information dissemination [11]. Also, mobile based disaster management increase results of rescue operations and assists in decreasing related incidents [12].

Android application systems is based from Linux operating systems for mobile devices designed by Google and Open Handset Alliance covering an operating system, middleware, and set of applications [13]. Android is considerably as of the complete developed open and free mobile platform [14]. Android mobile applications are widely used for data gathering and dissemination of personalized contents for specific types of users covering social media, weather, entertainment, and disaster and emergency among others [15]. Thus, mobile applications are used as an effective platform to increase information visibility among people involved in such situations. However, there are very few studies attempting to explore the usage of open source maps, third party technologies, and algorithms in designing an evacuation finder by considering actual locations of the people during natural disaster. Hence, this study explores the application of open-source maps and platform to deliver a nearest evacuation centers local barangays and zonal centers

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### III. METHODOLOGY

The study is based on quantitative and development research method. This research intends to develop a mobile based application for finding the nearest evacuation center within the vicinity of the users. Agile software development methodology is used to cover the important aspects of the user requirements, development, and outcomes. This project used Java programming language in Android platform and third party technologies such as Google Maps and relevant application programming interfaces. Furthermore, the study used proven shortest path algorithms used available in Google Maps API to identify the nearest evacuation centers across the barangays and zonal centers in Manila city. A group of users including local emergency response team in 10 barangays and coordinating agencies represented by local disaster coordinating council members were consulted in the entire study. This research used a software evaluation following ISO9126 criteria and distributed to the users during the testing stage. The Likert's scale with interpretation of Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree were used to specify the users' level of agreement or disagreement on the software evaluation items. The results of software evaluation are presented in the succeeding sections of this paper.

### IV. RESULTS AND DISCUSSION

In this section, the results of study are presented.

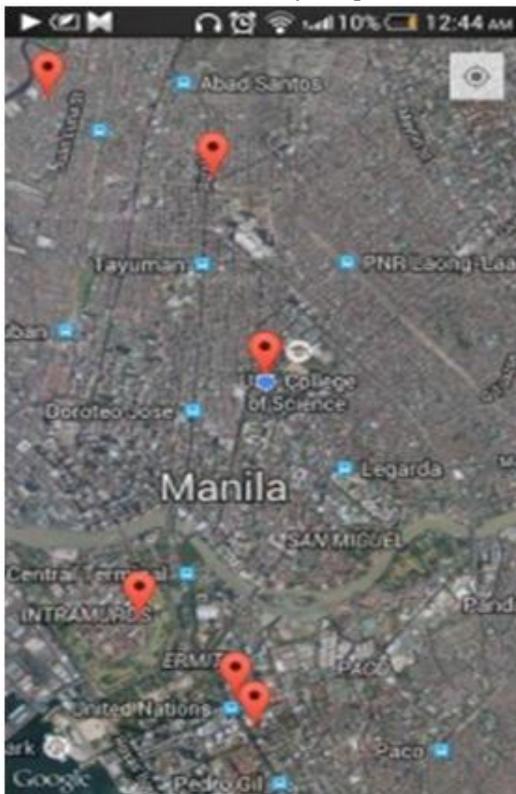


Fig. 1 Google Maps

Global Positioning System (GPS) and the Google API's covering Google maps and Google places are utilized within the mobile application. These third-party technologies are useful in tracking users location and presenting the zonal centers barangays and zonal centers in Manila. The maps also present a live view of the specific locations of the evacuation centers nearby public schools and hospitals based from the detected location of the GPS module in the mobile application.

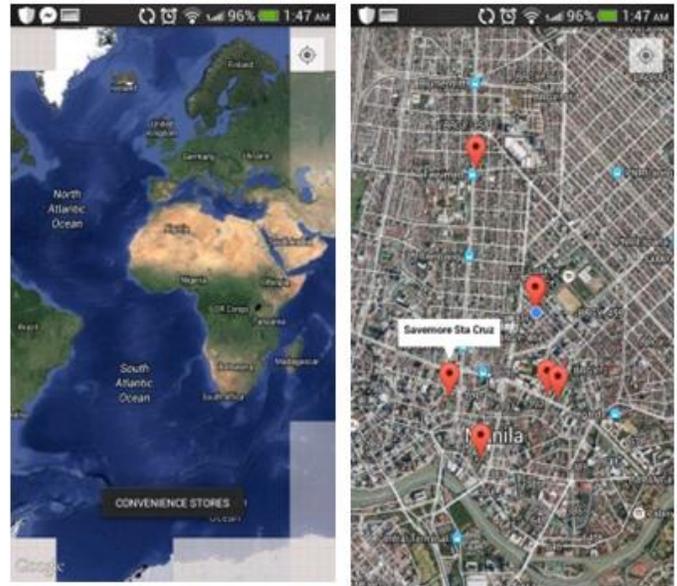


Fig. 2 Google Places

The Google maps API is the main reference utilizing the maps features integrated in the mobile application. The Google places serve as a reference for showing the specific places needed to update the users on the live tracking of nearby evacuation centers, public schools and hospitals.

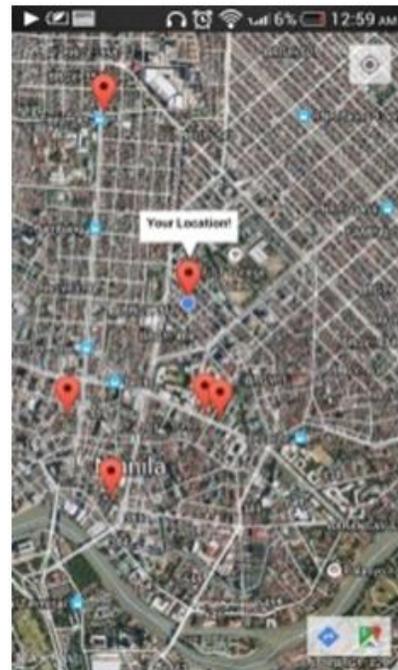


Fig. 3 Global Positioning Systems Integrated in Mobile Application

Figure 2.0 allows the users to search for specific locations with their evacuation centers. The Google places API is used to provide a range of information about specific locations and relevant information covering places, nearby stores, banks, hospitals, and public place markers. These tools allow users to become aware of location information, search and retrieve information of local business establishments and specific points of interests for mobile application users. Hence, the integrated Google places API in the mobile application serves as main mapping technology to increase awareness on the nearby and distant location information.

In this study, the dedicated evacuation centers and emergency response team information in barangays and zonal centers were saved in a database to update the mobile application users every time there is a search for nearest evacuation centers and emergency situations. The mobile application has a module for allowing local emergency response team to constantly update the evacuation centers zonal mapping complemented by Google places providing rich information on public and private establishments within the specific location of the mobile application user. Thus, it provides convenience for the users to update themselves on the latest bulletin on finding the nearest evacuation centers and related information.

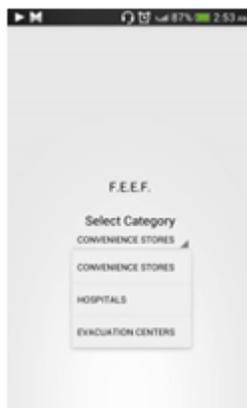


Fig. 4 Search Feature for Evacuation Centers

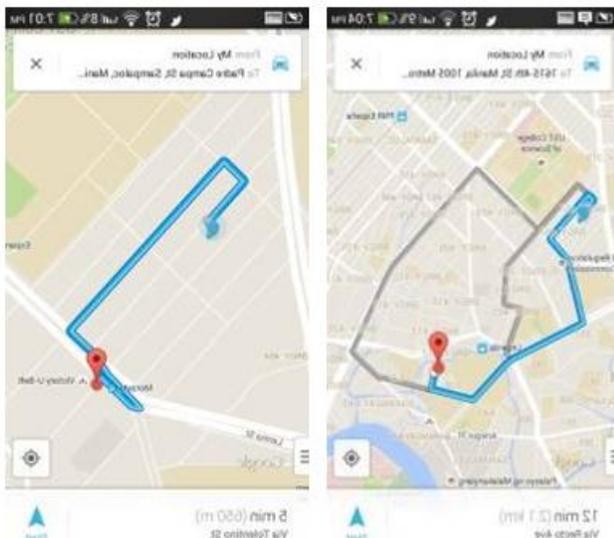


Fig. 5 Shortest Path to an Evacuation Center

Figure 4.0 provides a search feature for users to locate nearby evacuation centers, hospitals, schools and nearby barangay and zonal centers dedicated to cater evacuees and refer them to the nearest local disaster and emergency response team assigned in the evacuation center during disaster and emergency situations. Figure 5.0 presents shortest path as waypoints to proceed directly to the nearest evacuation centers. The GPS module detects the specific location of the users and suggests waypoints to proceed in a nearest evacuation center. The application also suggests a medium to transfer from the current location to the specific point where the evacuation center is located (e.g. walking, bicycling, vehicle). The waypoints feature also tracks the distance of the mobile application user.

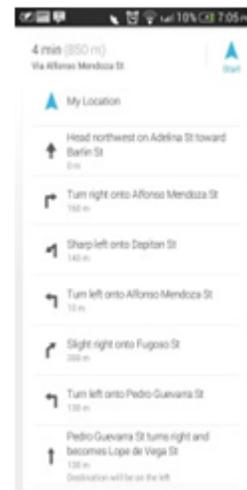


Fig. 6 User Location Tracking and Waypoints

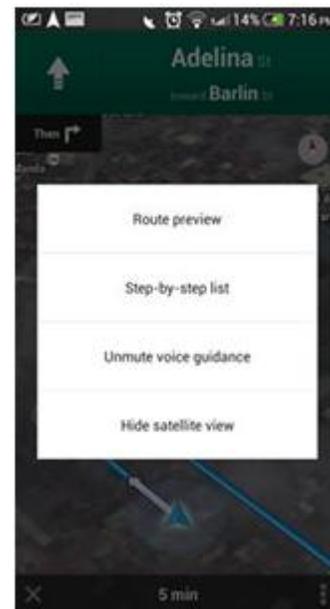


Fig. 7 Instructions of Waypoints

The instruction points are sub-feature of the waypoints to present the users destination, route view and procedure list to arrive in the destination. It also provides voice guidance and

satellite view options to easily locate the evacuation center.

TABLE I: Summary of Software Evaluation Results

Criteria	Mean	Interpretation
Functionality	4.49	Highly Acceptable
Reliability	4.40	Highly Acceptable
Usability	4.43	Acceptable
Efficiency	4.60	Acceptable
Maintainability	4.51	Acceptable
Portability	4.63	Acceptable
Overall	4.51	Acceptable
Weighted Mean		

In summary, the software evaluation indicates strong perception among the respondents that the mobile application is highly functional (4.49), reliable (4.40), usable (4.43), efficient (4.60), maintainable (4.51), and portable (4.63). Hence, the software evaluation receives an overall rating of 4.51 with an interpretation of acceptable.

## V. CONCLUSION

This research aims to develop a mobile application for finding the nearest evacuation center by using a shortest path algorithm. First, the study used Google Maps and Google Places API to easily launch a map of Manila City covering its barangays and zonal centers. The map presents distribution of the evacuation centers. Also, GPS module is used to track the current location of the user. The study also created a database to constantly update the evacuation centers across the barangays and zonal centers in Manila city through the assistance of the local disaster coordinating council and emergency response unit. Second, the mobile application provides the shortest path through waypoints to locate the nearest evacuation centers. Thus, it provides clear direction to the mobile application users on an updated database of emergency response team positioned during disasters and or emergency situations. The results of the software evaluation among the respondents also indicate strong agreement that the mobile application achieves its objectives of providing a useful tool to locate nearest evacuation centers during disasters and emergency situations.

In this research, it is recommended to conduct future research covering the following: (a) improving the features of the mobile application by covering history tracking of disasters and emergency situations happened in the past, (b) provide a practical guidelines or procedures to users during emergency situations, (c) develop an offline version of the evacuation finder to allow users to manipulate the functions while there is no internet connectivity, (d) develop a feature to alarm relatives and or family members about a evacuees condition during emergency situation and (e) track the number of mobile application users during emergency situation that can be used for disaster response and future decision-making activities.

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