GPS BASED SAFE LOCATION GUIDING ANDROID SYSTEMS IN CASE OF TSUNAMI

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Abstract- Tsunami can be defined as giant waves caused by earthquakes or volcanic eruptions under the sea. Out in the depths of the ocean, tsunami waves do not dramatically increase in height. But as the waves travel inland, waves build up to higher and higher heights as the depth of the ocean decreases. It has been scientifically proved that the speed of tsunami waves depends on ocean depth rather than the distance from the gravity of the wave. This research is to establish a tsunami guidance system and to make the general public aware about such a disaster and to guide them to the nearest security sites. The major problem that has been identified in this research is the impossibility of arriving in a safe place and the lack of knowledge in case of tsunami. The probability of predicting a disaster is very unlikely, thus the resulting damage is immense. Once this scenario is taken in to consideration, this research has identified some problems. Among them, the lack of preparedness for potential tsunamis, the lack of resources and the exotic staff have no idea of reacting and getting warning signals. But one of the major issues of this research is the inability to track Tsunami alerts and arrive at a safe place in the easiest way.

Keywords- Tsunami, easiest way, distance, warning signals

I. INTRODUCTION

The purpose of this project is to alert people living in an uncertain area of the tsunami in southern Sri Lanka and guide them to safe places. According to the pre-survey of people living in the South, research has shown that people living in close proximity to the coastal zone are aware of the safe places that are pre-appointed by the government but those people lack knowledge about the actions to be undertaken. In case of a Tsunami warning, hence people are not aware of the immediate actions that need to be taken.

This project is an introduction to an Android application that must be installed on the smartphone and detects alert alarms sent by tsunami warning systems which have been installed along the coastline in Sri Lanka. What is more, this app shows the nearest security locations that have been named by the government in case of an emergency and the fastest way to access the designated security locations using Global Positioning System (GPS). The purpose of this project is to set up a tsunami warning system and to raise public awareness on this disaster and to guide them to the closest security sites by the fastest route. Ultimately, this can reduce the number of deaths caused by the tsunami and ensure that people are not affected and rest in safe places. (Olson et al., 2011).

II. LITERATURE REVIEW

It is noteworthy that actions and responses taken in the initial minutes of an emergency are critical. These life-threatening events may happen at any moment. Being always prepared and taking precautions can save lives. A call for help to public emergency services that provides full and accurate information by the general public who're affected will help the dispatcher to send the right responders and equipment.

It is worth recalling the research done by Jethro B. de Guzman, Ritz Carlo C. de Guzman, and Engr. Remedios G. Ado on Mobile Emergency Response Application Using

Geolocation for Command Centres (de Guzman et al., 2014). According to their research, this is a combination of a mobile application and a web application to respond to urgent ambulance, fire truck and police requests by people in a certain area or city. The mobile application would detect the user's current location via geolocation and send it to the deployed web application in a command centre with the name, age, mobile number and location of the user for easy dispatch of emergency units.

Mao Chongyuan and Fu Qiang have done a research about APPLICATION RESEARCH OF TSUNAMI MONITORING AND FORECASTING USING DATA MINING TECHNIQUES (Chongyuan and Qiang, n.d.). The following result is borne out by this research on the tsunami triggered by earthquakes, it is difficult to detect and of great danger. As the tsunami triggered by an earthquake on the high seas is spreading rapidly, it is difficult to effectively monitor and forecast in an effective and timely manner. However, the trajectory and impact of the tsunami follow certain rules that are not obvious.

Marco Romano, Teresa Onorati, Ignacio Aedo and Paloma Diaz have done an article regarding designing Mobile Applications for Emergency Response: Citizens Acting as Human Sensors (Romano et al., 2016). According to their article when an emergency occurs, citizens can be a useful support for the operation centres involved in intervention activities. As witnesses to a crisis, people can initially share up-to-date and detailed information about what's going on.

J. Wachter, A. Babeyko, J. Fleischer, R. Haner, M. Hammitzsch, A. Kloth have done a research about Development of tsunami early warning systems and future challenges (Wächter et al., 2012). According to their research Encouraged by and integrated in the general development of information and communication technologies (ICT), the evolution of the tsunami warning systems (TWS) shows a significant development of the architectures of seismic systems fluted to multisensory using additional sensors for tsunami detection in the ocean. Currently, the initial implementation of the regional tsunami warning infrastructure indicates a new phase in the development of TWS. The research underlined that a new generation of TWS should not only be able to perform multi-sensor monitoring for tsunami detection.

M. Di RisioG. has done a research regarding Algorithms for automatic, real-time tsunami detection in wind-wave measurements: using strategies and practical aspects (Di Risio and Beltrami, 2014). Based on the findings of research, the authors identification of the ability not only to detect, automatically and in real time, a tsunami propagating on a WWG site, but also to characterize its waveform are notable. With regard to this method, the tests show that it is capable of almost perfect characterization of the tsunami waveform, at least, in the case of, tsunamis generated by an earthquake.

Tan Juan has done a research regarding Risk Assessment of Computer Network Security in Banks (Juan, 2016). According to the research, in response to the media report of holes in the banking system and the credit crisis banks, the study highlighted the banks should improve the management of the security of its computer system and increase security levels. Priority should be given to assessing the risks associated with the security of the computer system, so as to ensure the normal operation of the bank's business.

III. METHODOLOGY

Android, GPS accompanied by GIS technology can be used to develop an Android system that works as a guide and directs people from the current location to a place of safety, useful for people traveling near the coastal area can be warned if such warning is published

The main result of this research is to develop an android solution to show the shortest way to reach the tsunami safety site. Depending on the user of the currently hosted place, the system will indicate the possible security locations identified by the government. Depending on the security locations, the user can choose the nearest security location. If people select the security location as much as possible, the system will guide people to the location.

To study the key issue, there is little action to be taken. The main objective of the survey was to understand the knowledge of the place of safety in case of tsunami of the community. Firstly, the research identified the problem. To identify the problem, the above research has already been done. After that, related research distributed an online survey to obtain data from the community. A questionnaire was prepared and distributed among people who live in the Southern Province and other provinces. According to the survey, several search results were found. After mentioning the results of the survey:

A. Lack of preparation for a potential Tsunami.

The author conducted an online survey so that the majority of survey participants represented the Southern province and the majority of them had experienced the tsunami disaster in 2004. Although he is already 12 years old, the author noticed some persistent issues that have improved the requirement for a sophisticated Android system to communicate tsunami warning alarms. According to the author, it was noted that the majority of them had not participate in the government-led tsunami training programs and that the majority of them do not seem too enthusiastic about this training as such training would divert their daily activities.

B. Inadequacy of Resources

Disaster warning alarm systems require high technological equipment, infrastructure, knowledgeable staff or expensive services. This research came across certain instances where the basics of such a sophisticated alarming system would cause high cost but ultimately the general public don't receive the message of a disaster communicated on time.

C. No idea of reacting and getting warning signals.

It was identified that the tourists or whoever visit down south as strangers had no idea of the warning alarm system as the pre-tsunami training was only given aiming a particular target group. It is observed that the need for an instant warning system for anyone who are close to the disaster area is seen as an urgent requirement.

According to above findings, this project tries to implement a new system for identifying tsunami warning alerts and show the easiest way to go to safety places which have been established by the government.

IV. ANALYSIS

This research expects to develop an application with a map which includes Navigations, GPS, GIS and other related components in order to capture the warning alarm signals from Disaster alarming towers which have been established along the coastal line (Sumanasinghe et al., 2016).

This technology can be used to develop an Android system that captures warning alarm signals from disaster alarm towers that have been established along the coastline. This project uses the map online and indicates the safest places and the fastest route to get there in seconds. The search can make this app available for free download and anyone who travels along the south can be notified if such a disaster warning is posted.

Once the emergency towers issue a warning on an upcoming tsunami, the Android device with this particular application captures the signals transmitted from such a system. Then, the navigation system and the GPS will be automatically activated. Thus, the map could guide the person to the nearest security location on the fastest route. As a consequence of the data analysis, the research revealed that this application should present some of the basic services. Namely;

1. By introducing such an application, it is expected to communicate to people of a probable disaster and thereby, promoting safety and less number of life losses.

2. It enhances to take precautionary measures against and minimize the effect of tsunami.

3. Quick actions can be taken and a wide range of individuals can be informed.

Study area

Figure 1. Sri Lanka Map with Southern

Sri Lanka is an island with an area of 65,000 km which is located between latitudes 5° and 10°N and longitudes 79° and 82°E. The maximum length and the width of

the island measured as 432 km and 224 km respectively. Current population of Sri Lanka is 20,900,516 as of Friday, October 27, 2017 based on latest United Nations estimates.

Basically, this project aims to implement this system for areas in Southern Province. The reason of implementing this project in down south is due to the huge impact Tsunami had on down South coastline in 2004.

A. Data analysis

According to survey which author has done, most of the people are aware of safety places if Tsunami happens again.27 out of 42 in the sample are aware of the safety places. After Tsunami happened in 2004, government implemented several projects featuring with government organizations and non-government organizations. As an example, Helping Hambantota with World Bank, Jaffna Tsunami recovery and rebuilding, Rebuilding Sri Lanka with United Nations etc. Government already established several safety locations in case of Tsunami around Sri Lanka.
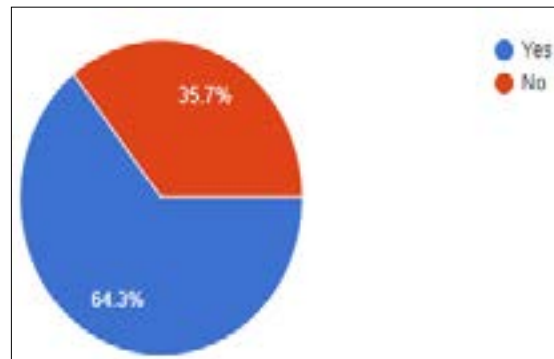

Figure 2. Awareness of safety location in case of Tsunami

The safety locations that have been identifies by this research are, Milidduwa, Unawatuna, Pitiduwa in Galle district, Diyagahagewatta, Hunnadeniya, Kambassawela in Matara district, Malpettawa, Hambantota, Tsunami Helping Hand Housing Project Tissa in Hambantota district.

And also, research has identified the people who contributed to online survey have not taken part in Tsunami pre-training programme.

After 2004 Tsunami, government ordered the Provincial Council to conduct a Tsunami pre-training sessions and government allocated enough financial and non-financial resources for the sessions. Somehow, 88.1% of people who contributed to online survey have not participated in Tsunami pre-training (Papageorgiou et al., 2015).
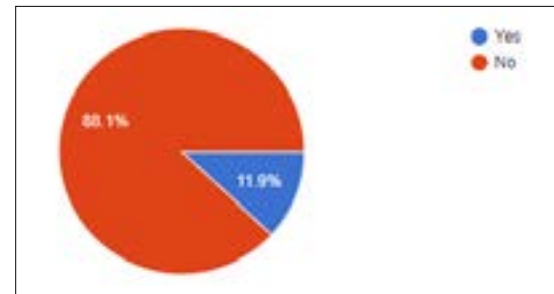

Figure 3. Participation for pre-tsunami training

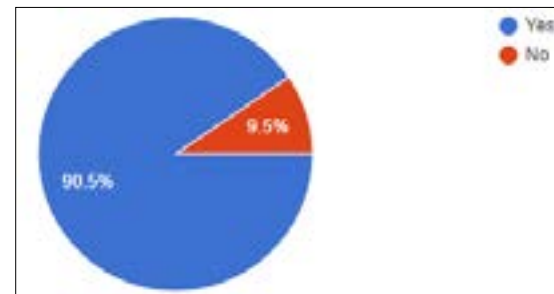How is this project related to Information Technology?

Figure 4. Acceptation of Mobile solution

Once recorded data is analysed, the research should present a solution for problem which arising from the online survey. The problem is, inability to identify obvious way to arrive to a Safety location in case of Tsunami. As a solution, the research suggests an Android application which tracks the Tsunami signals and shows the easiest path or easiest way go to safe location where government has established.

Before December 2004, there was no discussion about the sea disaster. Therefore, there had been no pre-preparation for that kind of situation. The proposed solution given by this research will help people who are living close to costal area and travellers.

V. RESULTS

From the stage of problem identification, information gathering and analysis, this research attempts to solve one of society's burning problems. The main problem that this research will solve is the impossibility of identifying an obvious way to arrive at a place of safety in case of tsunami.

The government has already established the security sites. But to identify a place of safety, a technique must be followed. As the basement of this research, he briefly shows how to perform a GIS analysis to find the safest place in case of tsunami.

In fact, when it comes to finding the safest place in the event of a tsunami, this GIS project has to go through a long process. First, he must create a google form to collect information from the community. Before collecting information, the research must take into account the research that the author intends to carry out. Based on the information collected, factors or parameters are to be collected and prioritize these factors based on the average values.

First, the author must draw a study area. This field returns the project boundaries. After drawing a study area, draw basic layers or basic parameters. According to this project, the parameters are the main roads, the railways, the streams, the streets and the coastal zones. These settings are the shape files of this project. As a beginner, it was difficult when drawing shapefiles for the first time. It takes time to become familiar with the software.

After that, multiple ring buffers should be created for these created shape files. In this too, it was a bit difficult task and after becoming familiar, it was very easy to do the project. After creating several annular buffers, before moving to the union, author had to give the values in the attribute table. There was nothing to think because there were only three attributes in the table. After the union, the layers with the study area, there was nothing but a complication on how to do it (Raju and Sokhi, 2008).

Then, the clipping function was taught. After clipping, by taking the study area as the clipping feature there was no any complication.

Figure 5. Finale map

When it comes to the last steps, author had to merge clipped maps together. In that case, the attribute table was so confusing because there were 30 to 40 attributes in the table. Initially it was felt that it was a hard nut to crack but after learning it was an easy task for author.

In making the final map, there was a confusion because author had 300 to 350 attributes in the table while others had 100 to 200 attributes. After following the steps, the GIS project produces most of the possible areas to locate most security sites in the event of a tsunami.

The final map of the GIS shows all the parameters that have been selected and what the possible areas are to implement the security location. By comparing with the parameters and the possible areas, it is possible to have an idea of what the government must take into consideration before choosing a place of safety. It should be a place that could be reached in the shortest possible time. It must be equipped with infrastructure and have possible means (roads, streets) to reach the security location. Therefore, before selecting the location, the search should consider the parameters and these parameters and the study area are to be totally similar to the basecoat data.

B. Selecting parameters

Selecting a proper land is identified as the number one factor that influences the ability of projecting the business to its full potential. A poor choice of selecting the location is sometimes impossible to re-correct. So that the government must have the ability to select the most suitable location for most safety in case of Tsunami. In selecting a location, many factors are to be considered.

1. Main Roads
2. Railway Roads
3. Brooks
4. Streets
5. Costal Area
6. Junctions
7. Buildings

Identifying each parameter

1. **Main Roads**

   According to this project, government is going to find out the safest location in case of Tsunami. Main roads are the key parameters of this project, due to the easiness to arrive to the safety location through main roads. The identified safety place should be near to main road. If a Tsunami occurs, people can arrive at the location in a quick manner.

2. **Railway Roads**

   Railway roads are another key point of this project. Railway roads are established close to the sea. That is the reason why government has considered the railway roads. The locations which government will be going to find must be far away from the Railway roads.

3. **Brooks**

   There are many brooks located near to study area. The reason why government consider brooks is mere because, brooks increase the impact of the Tsunami disaster. When selecting a safety place, it should be far away from the brooks.

4. **Streets**

   This parameter refers all the lanes and cross streets close to study area. According to this project, one of the main factors is streets. Government has identified these streets are connected to each other. It is like a

street network. When selecting a safety location, it should be close to those streets. In case if a Tsunami takes place, people can arrive at the location without wasting time.

5. **Coastal Area**

   According to this project, most interesting factor is coastal area. When selecting a safety location, in case of tsunami, the distance from the coastal should be identified by the government. The safety place should be located at least 1500 meters away from the coastal area.

6. **Junctions**

   Down South area is a kind of very busy area. Near a junction, the traffic is very high. So, the proposed location must be far away from the junction. This parameter is not considered because of low average importance.

7. **Buildings**

   Down South is one of the busiest and crowded areas in Sri Lanka. Therefore, government has a responsibility to find a safety location within this busy area. In this project, junctions are not considered because of low average importance. Buildings decrease power of Tsunami waves.

After having selected all the parameters, the priority of the key factors or parameters identified is in progress and checks whether all the parameters have an equal weight or not and then the search can be divided into two categories: Important and Less important (Ware et al., 2000).

After prioritizing the parameters, according to the google form, the data search can select the most important factors selected by the stakeholders via the google form. From these factors, it is necessary to select the most important factors according to the priority, which can be presented in Arc GIS presentation of the map. Author has selected the main factors according to the priority, shown as follows.

1. Main Roads
2. Railway Roads
3. Brooks
4. Streets
5. Costal Area

Figure 6. All the taken parameters

After identifying parameters, project has added Multiple ring buffer, union, clip types of techniques and generate final answer.
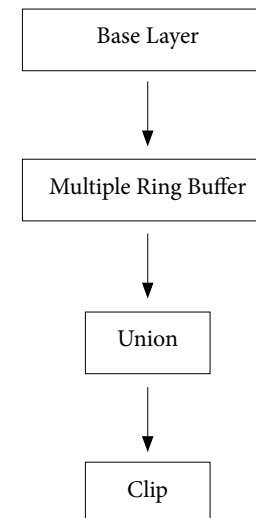
VI. DISCUSSION

As a consequence of the development of this research, it benefited people who suffered from the tsunami in 2004 and travellers and people living in coastal areas. The goal of creating this research is to save people's lives if a tsunami recurs. The final production of this research is to be developed as an Android app to track Tsunami alerts and show the most obvious or shortest path to get to the security location.

This research understands that there is no such application or such prevention has been developed previously. There are techniques to track tsunami warnings and also the changes that occur at sea. According to this research, the proposed system is an online application and it should have more specifications compared to other applications.

ACKNOWLEDGEMENT

VII. CONCLUSION

This research is based on guiding people to safe places in the event of a tsunami. Key solution for the problem identified is an Android application to show the most obvious or easiest way to arrive at a safe place and guide people. In accordance with an online survey that involved 53 people, only 64.3% were aware of security sites. The main thing in this research is that it has identified that 88.1% of people have never participated in pre-tsunami training. Therefore, this proposed application will be of immense help for people if Tsunami occurs again.

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