CALAMITIPS: AN ANDROID MOBILE APPLICATION USING KALMAN FILTER ALGORITHM

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ABSTRACT

The study is an Android mobile application which promotes and implements risk reduction awareness and preparedness to the community. It connects Virtual Reality in terms of giving interactive user experience, in a way of educating users about the importance of participating in risk reduction seminars, and drills or activities. CalamiTips provides two main features for the user. First is the VR mode, where the user experience being in a situation before, during, and after the disaster / calamity. Second is the screen mode, where the user can still visualize the scenario, even without the use of VR box or VR equipment. The application also provides reader's mode where all the gathered information is in text form, including guidelines on disaster / calamity and emergency hotlines. The study used Kalman Filters as an algorithm in developing the mobile application. Predictive tracking is used in VR to forecast position of an object and its trajectory. This makes Kalman Filters a common choice in this kind of application. The proponents will use the V-Model since it strictly follows important phases on the development of the system, and it also does verification and validation in the phase of testing. To be able to install the mobile application, the target device should be running the Android Operation System. The minimum Android Version supported is Android 4.4 'Kit Kat' (API level 19) or higher.

KEYWORDS: Android Application, Calamity Mobile Application, Kalman Filter Algorithm, Virtual Reality

INTRODUCTION

Natural disasters are unpredictable and can be of many different kinds. Natural disasters can be quite powerful and cause severe damage to the environment. Over the past two decades, the Philippines endured a total of 274 natural calamities, making it the fourth most disaster-prone country in the world (CNN Philippines 2016). Prior to this, the natural disasters prompted the government to influence the "Philippine Disaster Risk Reduction and Management Act of 2010," in Section 3 of Republic Act 10121.

In recent years, mobile technology has expanded around the world. There are many ways on how it will assist on the creation of warning systems, aids in emergency coordination, and implementation on risk reduction awareness. As part of expanding the implementation of mobile technology, the proponents of this study make better use of it and promote future advances, such as implementing disaster risk reduction awareness and management with Virtual Reality (VR).

Through data coverage and capability of mobile technology, it is possible to utilize the everyday technology, such as mobile applications, in a disaster risk reduction context. The said context includes basic information for the users, concerning disaster awareness and preparedness. As part of awareness and preparedness, drills, emergency hotlines and basic first aid are also included.

One of the best contributions of the mobile technology, together with Virtual Reality, is to allow users to see, hear, and somehow feel the situation of a natural disaster. Also, VR has opened many opportunities for educational and training purposes. Together with the risk reduction context, it aims to lower the risk of personal injury and priority the safety of the people. This also aims to provide an interactive user experience, letting the user experience certain scenarios, and teaching them different ways on how to respond before, during, and after the disaster.

LITERATURE REVIEW

Virtual Reality: The Learning Aid of the 21st Century

Sol Rogers is the CEO and Founder of REWIND, an Emmy nominated immersive content studio that fuses bleeding-edge technology with award-winning creative storytelling. According to him, "VR is not only a great medium to enhance recall, but it can also build empathy which helps users understand situations, people, and events that they would otherwise never have contact with." In the 21st century, Virtual Reality, as expected, is being adopted by educators and organizations to implement all over the world [1]. Also stated by Sol Rogers, VR is facilitating learning and understanding through unique properties every day. One of the examples, as he mentioned, is using VR as a tool to help children develop empathy with victims of natural disasters. This helps children with limited life experience imagine what it is like for people who have experienced a natural catastrophe. With the use of VR equipment, children can explore the aftermath of a real disaster. This is where CalamiTips come in with the idea of providing a better understanding of natural disasters to the youth.

St John WA Offers Virtual Reality for Emergency Training

St John Ambulance WA provides high quality ambulance and first aid services for the welfare of the Western Australian community. In the recent year they are using mobile and virtual reality in its first aid training, allowing people to use VR to learn how to respond to an emergency, improve lifesaving skills and implement make first aid. The non-profit is pioneering a technology called First Aid Skills to guide users through three training simulations – CPR, defibrillation and the DRSABCD action plan using a Medical Information Assistant (MIA) that offers step-by-step instructions throughout the training. Additionally, sensors are linked to a resuscitation manikin to provide feedback on correcting rate of compression during CPR and breathing frequency. St John CEO Tony Ahern said the mobile and virtual reality technology is "a breakthrough" in helping introduce more people to first aid [2]. "Short, cost-effective training will allow us to conduct training all over WA. Think remote regional towns, while you are waiting for a plane at the airport, anywhere." As stated by Tony Ahern, CalamiTips also aims to provide an effective basic first aid training conveniently. With the help of technology, virtual reality in specific, it will be easier for the users to visualize the proper way of handling a victim. It is important to know basic first aid to save a life whenever a natural disaster hit.

Oculus Rift VR

The VR simulation is powered by the Facebook-backed Oculus Rift headset and puts the user behind the wheel of a car in a city that's just been ravaged by a tsunami. To make an authentic replication of a disaster situation, the program's creators analyzed video footage taken from retrieved car-mounted cameras during the 2011 calamity and interviewed surviving victims [3]. Wave movements and collision predictions were programmed into the VR experience, which takes place in three different locations: Tokyo's Asakusa district, Minami ward in Nagoya and Kokura-Kita ward in Kita-Kyushu. CalamiTips, same with Oculus Rift VR, also provides different locations and different disasters or calamities. This will make the user experience being in different situations, where they can earn knowledge on risk reduction and survival. It will also show the users different ways on responding to natural disaster.

Save the Day

With the onslaught of typhoons "Yolanda" in 2013 and "Ruby" in 2014, the need for disaster preparedness in the country has become more pressing than ever [4]. A group of students has seen this as an opportunity to address the issue in a unique yet engaging way. The Save the Day mobile application introduces the concept of disaster preparedness in a fun way through games featuring cute animated characters that allow the user to cope with emergencies or disaster situations. Drawing from the creators own personal disaster experiences, they mentioned that they want to provide innovative solutions to social concerns, such as mitigating the effects of calamities. This brought CalamiTips to create an application with the help of Virtual Reality (VR), to make the users visualize and somehow experience calamity. This will lead people to participate seriously during the drills and trainings as they visualize the hazards of natural disaster.

VR Fire Escape

VR Fire Escape is an immersive virtual reality adventure game where the player must rescue his pet guinea pigs from a burning house. The user will experience a real video footage from an actual house burning down. Everything catches fire exactly as it would in a real situation. The 360˚ cameras set up to capture the fire had to be proofed to withstand extreme heats, between 300-600 degrees Celsius, which has never been done before. House fires become un-survivable in less than five minutes, so people need to know how to get out fast. This game uses spatial audio and is best enjoyed using headphones [5]. The reliability of information in VR Fire Escape, is one of its best features, giving the user an interactive experience. Creating an informative application, like this, must provide reliable information, especially when creating an application concerning calamity or disaster preparedness and response, which CalamiTips will also apply to its feature.

METHODOLOGY

The V-Model is a unique, linear development methodology used in developing a system. The V-Model focuses on a typical waterfall-sequel method that follows strictly the step-by-step stages, which also shows how the testing activities are related to analysis and design. Coding is in the center of the model, where the main action happens. The proponents will use this model for the system because V-model strictly follows important phases on the development of the system, and it also does verification and validation in the phase of testing. In case problems were detected, the analysis and design phase will be executed again to fix it, before proceeding. The V-model focus on the process itself and improvements, which makes the model highly appropriate for the development of the system.

Table 1. Summary of Results

EVALUATION CRITERIA	MEAN SCORE	
Functionality	4.63	
Reliability	4.2	
Usability	4.52	
Efficiency	4.66	
Maintainability	4.59	
Portability	4.65	
		INTERPRETATION
General Mean Score	**4.54**	**Outstanding**

As part of the methodology, the proponents conducted a survey to test CalamiTips' effectiveness to the users. The total respondents of the study are 100 respondents. There are 50 respondents for end users which includes the calamity victims and 50 respondents from safety professionals that includes CDRRMO, PHILVOCS and Philippine Red Cross.
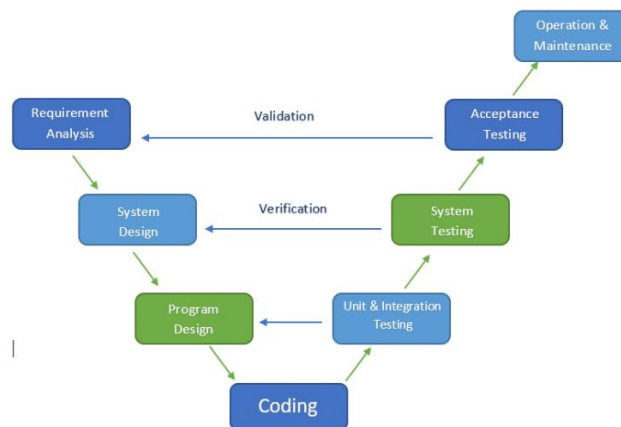

Figure 1. V-Model

The formula used in the study aims to get the arithmetic mean to interpret the data gathered from the respondents.

$$A = \frac{1}{n} * \sum_{i=1}^{n} x_i$$

RESULTS

Based from the summary of results shown in table 1, the system is considered effective to the respondents. The general mean score of 4.54 is interpreted to have an outstanding result, which means that the goal of the study was highly-achieved. The questionnaire comprises six criteria that clearly explains how the system meet the standard of the respondents. Each criterion reached a mean score of 4.2 as the lowest and 4.66 as the highest. The criteria for reliability have the lowest mean score, yet the efficiency with the highest mean score made it possible to sustain an outstanding result.

DISCUSSION

The outstanding results from the survey conducted by the proponents of this study leads to success. As shown in the summary of results in table 1, the functionality of the mobile application is outstanding meeting the tasks required, expected results, and high security. In the other hand, the reliability is lack of handling errors, but it is good to see that respondents are still satisfied on how it works. When it comes to usability, the respondents considered the mobile application to have a user-friendly interface. The mobile application based from the respondents' feedback, is said to be efficient providing information; also, easy to maintain and portable.

CONCLUSIONS AND RECOMMENDATIONS

Implementing Disaster Risk Reduction and Management to the youth is the main objective of CalamiTips. Youth in this generation are already dependent to the modern technology until they forgot about reality. Taking advantage of this negative effect of technology brought this study to create a mobile application with virtual reality to educate. Therefore, CalamiTips concludes that the use of virtual reality is not just about escaping reality but bringing real-life scenarios to people anytime and anywhere. It is all about taking opportunity of turning the negative effects of technology into good ones.

The study recommends for the future researchers to create a system focusing on PWD's to prepare them for the upcoming natural disasters.

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