Design of a Real Time Situation Awareness and Crisis Management System Using Social Network platform

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ABSTRACT

Crisis Management and Situation Awareness are two increasingly important topics in today’s world. Nigeria, like the rest of the world, is exposed to a wide range of natural or human induced disasters. While some of these disasters are rapid, others are slow-onset, resulting in catastrophic situations leading to loss of lives, property and degradation of environment. Some of the disasters are drought, desertification, flooding, epidemics, coastal erosion, dam failure, building collapse, oil spillage, maritime collision or accident, bomb explosion, communal clash, fire, air crashes and boat mishap and many more. This paper presents the design of SITUWARE, a situation awareness application that takes advantage of the vast usage of mobile and portable electronic devices to provide handy, prompt, precise and instructional information about critical situations around people. PHP was used as a server side scripting language and MySQL as database platform for the system. We note however, the inability to guarantee the integrity and dependability of information retrieved from social medial as potential limitation of the work.

Keywords: Crisis Management, Situation Awareness, induced disasters, instructional information.

1. INTRODUCTION

Situation awareness involves being aware of what is happening in the vicinity, in order to understand how information, events and one’s actions will impact goals and objectives both immediately and in the nearest future. One with an adept sense of situation awareness generally has a high degree of knowledge with respect to inputs and outputs of a system, i.e. an innate “feel” for situation, people, and events that play out due to variables the subject can control. In contrast to risk management, which involves assessing potential threat and finding the best ways to avoid those threats, crisis management involves dealing with threats before, during and after they have occurred. It’s a discipline within the broader context of management consisting of skills and techniques required to identify, assess, understand and cope with serious situations especially from the moment they first occur to the point that recovery procedures start.
According to (USDS, 2011) National Disaster Management Framework (NDMF), in 2010 reported that Nigeria has a land area of approximately 356,700 square miles (923,800 square km), with varying climate and terrain like coastal swamps, tropical forests, woodlands, grasslands, and semi-desert. Nigeria is Africa’s most populous country with a population of about 152 million people. Nigeria like any other country is exposed to a wide range of social hazard which could be natural or man-made in which the lives of the citizens as well as infrastructures may be endangered or adversely affected. Such hazards could lead to great or sudden misfortune causing severe widespread disruption to normal patterns of life, injury, hardship and adverse effect on health. Furthermore, the event affects the social structure such as destruction or damage to governance, legal systems, buildings, communications and essential services. Disaster therefore means a serious disruption of the functioning of the society, causing widespread human, material or environmental losses, which exceed the capability of the affected society to cope with using only its own resources.

The vulnerability of Nigerians to hazards is a function of several factors. These include the level of poverty; population growth and distribution; and the condition of human settlements and their infrastructure. Other causative factors include the level of environmental degradation, level of public awareness, the dynamics of public policy and environment on disaster management. In 2012, many people lost their life as a result of flood that swept through the confluence city of Lokoja (NEMA, 2012). Their deaths might have been averted if there was a quick alert system about the impending disaster.

In Nigeria Emergency management and crisis management is still in its infancy. Although organized responses to disasters date back to the early 1900s but still face innumerable challenges, including poverty, lack of funding for emergency management programs, and marginalization, among many others (Abdul-Akeem, 2013). For this work however, we are more concerned with problems related to poor or complete lack of information to those directly in the path of avoidable disaster. Lack of information as at when needed, especially in the event of an impending disaster or crisis has caused immeasurable loss of life and property in Nigeria. This is because the biggest source of information for the vast majority of Nigerians is the mass media. This paper presents design of Situation Awareness (SITUWARE) using PHP, CSS and MySQL with the following major contributions:

- Create a situation awareness system that exhibit functional properties like mobility and portability, accuracy in information, adaptability, multi access and persistence in operation.
- Create a situation awareness application that takes advantage of the vast usage of mobile and portable electronic devices to provide handy, prompt, precise and instructional information on the go about critical situations around users.

The rest of the paper is organised as follows: Situation awareness and management is discussed in section 2.1 Section 2.2 discusses existing systems, 2.3 discusses limitations of the existing systems while 2.4 is on features of the proposed system. Section 3.1 focuses on system design and implementation, 3.2 discusses the client application, and section 4.1 is on discussion of results. Section 5.1 concludes the work. Recommendation and future work are discussed in section 6.1 and 7.1 respectively.
2. SITUATION AWARENESS AND MANAGEMENT

Environmental disasters are events that do not give notice to its occurrence but are tackled through careful planning and execution of contingency measures. The flood disaster of 2012 in Nigeria has revealed several challenges regarding the nation’s disaster preparedness, the need to strengthen Nigeria’s Disaster Risk Reduction (DRR) mechanism is therefore particularly timely. (Al-Amin, 2013). Al-Amin found out that this administrative setback is hampering Nigeria from being fully prepared for eventualities of extreme environmental events; especially as occasioned by climate change. Many recommendations according to Al-Amin, (2013) were made for institutional, policy and attitudinal adjustments to forestall calamities and quantum destructions resulting from environmental disasters. Though Al-Amin, (2013) recognised the importance and the contribution of technology to an improved state of situation awareness, he has ignored the significance or the possibility of a much more compact, mobile solution to the problem. Countries have long been concerned about the huge impacts that natural disasters have on society in developed and especially in developing countries. Unfortunately, societies in Nigeria have not adapted their frameworks of development to the natural environment surrounding them and the losses and costs associated with disasters of natural origin (Entwicklung & Ländlicher, 2006).

Another study by Nasiru (2012) described disasters as “complex events with multifaceted causes” and hence disaster management needs comprehensive, multidisciplinary training to deal with both complexity and change. Though several studies, have conducted interesting and productive research into the issue of situation awareness and the corresponding crisis management with most of them referring to some sort of community effort or technological tool as the solution to the problem of crisis management, hardly has any referred to the possibility of a synergy between community awareness and mobile technology implementation as a viable solution. This is strange especially with the high rate of increase in the number of mobile phones and other compact hand held devices. Interestingly, Nasiru, (2012) in a study titled “Disaster Management in Nigeria” says “Recently thinking in the areas of disaster management is indicative of the need for a new paradigm that focuses on reducing the risk of disaster with the involvement and participation of communities (probably with the help of some mobile personal technological instrument or guide) in the management of disaster effects”. From the issues regarding situation awareness itself, another important consideration would have to be the use of mobile phones and other portable hand held devices among Nigerians. To foretell the possible success of an application for situation awareness, there has to be a thorough understanding of the attitude of the prospective users (for whom the application is designed) towards mobile applications as a solution to serious social and environmental issues (Pyramid, 2010).

2.1 Existing Systems
According to Blandford and Wong, (2004) Situational Awareness in emergencies is paramount to deliver a timely and effective response. In other to achieve effective Situational Awareness, emergency services must collate information from multiple sources and use it to build an understanding of the current situation and how this may evolve over time (Endsley, 1995).
Data from citizens may be used to build a form of collective intelligence (Solachidis et al., 2010), during emergencies or for security purposes. Suvodeep, et. al (2014) developed a system, TUI (Tracking User Intelligence) that exploits various visualisations and employs different interaction paradigms and approaches to help users improve their Situation Awareness by exploring various facets of Social Media (Lanfranchi, 2011). Though there are hundreds of mobile applications that exist for countering disasters through early warning and awareness to their users, the one available in Nigeria is the Mobile Authentication Service (MAS) by NAFDAC (Abubakar, 2014). Most of the applications for situation awareness and crisis management are programmed to detect and warn against natural and environmental disasters like typhoons, hurricanes, and tsunamis, most of which are not experienced in Nigeria. There is however one application developed by ubAlert and named ubAlert-Disaster Alert that was built with the same idea as the one used in this research work.

2.2. ubAlert-Disaster Alert
This application was created by social network website ubAlert, which gathers verified accounts of the people who were present at ground zero and witnessed the natural disaster before any media organization reported it (Fig.1). Once the person informs a calamity in his/her area, the network will authenticate the news with multiple sources so that there is no scope for false panic (www.ubalert.com).

Fig. 1: Screenshots from ubAlert (Source https://www.ubalert.com/)
People can upload pictures and videos of the event from the app to social networks like Facebook and Twitter and alert. ubAlert sources information from eyewitnesses and allows users to post. Allowing users to post information on any news or disaster warning system allows for a bigger margin for error, false information and quicker spread of rumors.

To address the impact of disasters which normally happens with or without prior notice and often with un-quantified loss to lives, property and the destruction to our cherished environment, it is necessary to put in place Institutions, Policies and Plans. The main purpose of these institutions and Plans is to address the challenges that are often posed by the hazards of disasters in a timely, effective and efficient manner in order to minimize its impact on the vulnerable community. The proposed system application in this project is one of such plans to address the impact of disasters which normally happen by employing situation awareness in a mobile, compact package suitable for users at all levels.

2.3 Limitations of the existing systems
Most other news and situation awareness applications take the easier way out by allowing users to input information and then going through the avoidable task of warning users that information entered is not provided by them (the developers) and that they will not be liable for errors or misinformation. Some of the common problems associated with situation awareness applications include:

a) They are not easily accessible and not mobile
b) Lateness to report news
c) Even where news is reported early, they lack the corresponding crisis management ability.

2.4 Features of the Proposed System
SITUWARE is a mobile situation awareness application that retrieves data from the internet through the social media platform; Twitter, in the form of trends and translates relevant data into useful information regarding situation awareness and crisis management to be fed to the users in human readable format. The application (which will be called SITUWARE) is in two parts, the administrator side and the client side.

3. SYSTEM DESIGN AND IMPLEMENTATION
The idea for this project is to create an online social network-based application that will provide prompt information regarding situation awareness and crisis management to its users. The data to be used by the application is to be provided by the users themselves through the internet over a large coverage area.

The SITUWARE application works on mobile application platforms with Android enabled devices. Android is a mobile operating system (OS) (based on the Linux kernel and currently developed by Google) with a user interface based on direct manipulation. The application (SITUWARE) is in two parts, the administrator side and the client side.
3.1 The administrator side
The administrator side of SITUWARE is the part responsible for accessing, fetching and presenting the twitter trends to the administrator. This application features contents like the home page, the fetched trends, and two pages that display the home pages of two of the most popular Nigerian newspaper websites. The home page contains features that allow the administrator to publish content to the users after entering a category (that could range from security, health, natural disaster, finance/economy, war, education, transport and food crisis), a heading the article body and the keywords as shown in Fig.2.

![Fig. 2: The Drop-down Menu for Category Selection](image)

3.2 The client application
The client application runs on the user's mobile phone and connects to the SITUWARE server as necessary. The client is the end application that accepts the information entered by the administrator and displays it to the user. The application features a home page that displays all the groups of disasters peculiar to Nigeria and every entry by the administrator is specific to a genre.
As mentioned earlier, most other news and situation awareness applications take the easier way out by warning users that information entered is not provided by them (the developers) and they will not be liable for errors or misinformation, the existing system was modified. In our proposed SITUWARE, information is gotten from the users but posting cannot be done by them. Information is posted only after thorough verification by the administrator and users are given an option of learning more about the situation at hand by clicking a button that initiates a Google search using relevant keywords that the administrator provides. These features do not exist on any of the reviewed existing systems.

Every platform technology uses different terminologies to describe its application components. The three most important classes on the Android platform are Context, Activity and Intent. While there are other, more advanced, components developers can implement, these three components form the building blocks for each and every Android application. An Android application is a collection of tasks, each of which is called an activity. Each activity within an application has a unique purpose and user interface. MoSync SDK, (Fig.4) a free and open source software development kit (SDK) for mobile applications was used. MoSync IDE features JavaScript Proposals and C++ template. MoSync communicates through USB port or Bluetooth which involve sending the .SDK file to an android phone and running the built program from there.
In the context of this application (SITUWARE), HTML was used to design the basic interface and served as a template upon which all other languages were structurally inputted. CSS was used to control the look and feel of the content written in HTML due to its efficiency in design, faster updates; faster page downloads for the application and ease of use. The output from the use of HTML (layout) and CSS (colors and formatting) is shown in Fig. 5. PHP was used to access the APIs that exist on the twitter servers to gain access to their allowed resources.

![Fig 4: MoSync Display](image)

**Fig 4: MoSync Display**

![Fig 5: The home page for the client app (a) and the admin (b)](image)

**Fig. 5: The home page for the client app (a) and the admin (b)**
4. DISCUSSION OF RESULTS

As mentioned earlier, the idea for this work is to create an online social network-based application that would provide prompt information regarding situation awareness and crisis management to its users. The data to be used by the application was to be provided by the users themselves through the internet over a large coverage area. In this paper, Twitter a social media platform is implemented to obtaining data and actionable intelligence for situation awareness. It was observed that Twitter only allows third-party clients to display tweets under the stipulation that those apps only serve banner ads, and not in-stream ads such as promoted tweets. This limited the flexibility that we could get from Twitter. Before development of SITUWARE began, we had hoped to fetch tailored trends specific to certain tweet keywords and to a particular geographic area but all twitter could offer through their API was the first twenty tweets each for the first twenty trends specific only to a country.

5. CONCLUSION

Nigeria like any other country is exposed to a wide range of social hazard which could be natural or man-made in which the lives of the citizens as well as infrastructures may be endangered or adversely affected. Such hazards could lead to great or sudden misfortune causing severe widespread disruption to normal patterns of life, injury, hardship and adverse effect on health. In this paper, design of SITUWARE, a situation awareness application that takes advantage of the vast usage of mobile and portable electronic devices to provide handy, prompt, precise and instructional information about critical situations around people was presented. This undoubtedly is a step in the right direction towards bringing life-saving information right into the hands of the people that need it.

6. RECOMMENDATION

It is recommended that SITUWARE should be adopted as a tool in the struggle for advancement in situation awareness and crisis management.

7.1 FUTURE WORK

Possible future work is the design of a system with the ability to guarantee and protect the integrity and dependability of information while maintaining sustainability through possible improvements upon its implementation.
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