**FIRE ACCIDENTS IN RECENT TIMES**

Fires impact people, lives and property and the environment in all countries around the world.in some cases, the resulting losses are extra ordinary causing hundreds of lives and properties to be lost. Fires are adverse events with tangible costs for property and human life. Quantification of the immediate and direct  
costs of fire provide a metric for understanding the social and economic impact of fire and for assessing progress in fire prevention and protection. In addition to their physical costs, fires have a range of less immediate and obvious adverse consequences on the natural environment. These include air contamination from the fire plume (whose deposition is likely to subsequently include land and water contamination), contamination from water runoff containing toxic products, and other environmental discharges or releases from burned materials. Current efforts to improve the sustainability of buildings focus on increasing energy efficiency and reducing the embodied carbon. This overlooks the fact that a fire event could reduce the overall sustainability of a building through the release of pollutants and the subsequent re-build. Several pieces of work exist on the quantification of the environmental impact of fire, but there is a need to pull this information together and to identify the technical gaps that still exist (martin et al, 2016).

**Sample fire incidents**

**Onitsha 10 am**

**Fire service was reached 2pm**

**And other examples**

since reaching an already known location would increase response time

it’ll help reduce damage during fire accidents.

**EMERGENCY NOTIFICATION/COMMUNICATION**

In an emergency, information is as critical as food and water to people (FEMA, 2014).

Emergency communication refers to communication in the context of emergencies, disasters, catastrophes and other crises. There is a little agreement on what this term means, so this entry uses the term **emergency communication** for the communication needsfaced in this and similar situations in which safety is threatened. Indeed emergency communication is not a clearly demarcated field, since it encompasses many field of risk as well as substantial subparts of (Allen, 2017)

Technological advances have transformed how communication teams disseminate information to the public during crisis event. Traditional media such as television, radio and newspapers is no longer the primary source of information as smart phones and tablets enable immediate mobile access to digital and social media platforms. In a sea of information, a crises communication team must be first, right and credible (e.g. fire service) to gain control of a situation and the trust of the public. While large scale emergencies are often difficult to predict and mitigate against, pre constructed support models can help facilitate a more effective emergency response (Collins et al, 2016).

Crisis informatics has made significant advancements over the last few years, emerging as a major topic in information systems (IS) research. Research shows that a main reason for this increased scholarly attention is that social media has produced numerous enablers for managing information during crises.. The multifaceted nature of this particular literature stream has recently brought some literature reviews to the scene focusing on different aspects of crisis informatics, such as communication barriers, collective behavior , etc. With respect to technical enablers, social media often plays a central role in crisis informatics as it has become be an important source for assessing, understanding, and locating crises quickly and accurately. More than that, it enables actors to react involved.

The research on crisis management has brought up several approaches for dividing and breaking down a catastrophe into several phases (e.g., the eight  
socio-temporal stages of disaster. In addition to this breakdown of a crisis into phases, crisis management has also been modeled into phases. In the literature, we find a consensus on four time-oriented phases for crisis management mitigation, preparedness, response, and recovery. In this time-oriented view, mitigation and preparedness are pre-crisis phases, and response and recovery are post-crisis phases. Mitigation is a preventive phase and “consists of the efforts/actions aimed to minimize the degree of risk, to prevent disasters and to reduce the vulnerability of both the ecosystem and social system”. Its objective is to develop “sustained measures to reduce or eliminate risks and impacts associated with natural and human induced disasters”. As the second phase, preparedness “involves actions to prepare responders and common people to post-disaster activities”. Its objective is the “development of effective policies, procedures and capacities to plans for how best to manage an emergency”.  
The response phase “consists of actions to manage and control the various effects of disaster (also the ripple effects) and minimize human and property losses”. Examples for actions during the response phase are evacuation, sheltering, medical care, search and rescue, and damage control (lee et al, 2017).

Although in the course of this research, the major concern is the post crisis management which is getting **notifications (**from informants**)** and **response (**fire service**)** during cases of emergency in fire accidents, since fires cannot be predicted sometimes.  
Compared to most other disaster related jobs such as emergency operations center personnel, ambulance services and medical rescues, fire fighters face comparatively stressful and life threatening environments where they have very little time to make a life and death decision. Such contextual differences create a unique set of needs and requirements for the frontline fire fighters. Although there has been several attempts according to (Raj et al, 2017) to design or develop information systems supporting fire emergency response it has been a challenge to conceptualize the essential components of an information system (IS) for fire emergency response (ER) addressing needs of different job roles and the functionality of such  
an IS. There have been several attempts to develop Information Systems Architectures (ISAs) for exclusively supporting ER.. The scope of this architecture remains limited to the technological capabilities  
of mobile phones on the Life Net project, May et al. (2014) on potential benefits of wireless networks for tunnel fire response, Roh (2015) on integrating technologies supporting decision making using the transmitted  
information, and Scholz et al. (2013) on a system supporting frontline fire fighter  
communications. These examples represent significant efforts to develop firefighter related ISs. However, and although all this work looked at systems supporting fire ER in built environments, none of it focused on supporting the specific response operations of the Fire and Rescue Service (FRS), through the development of an overarching IS architecture.

(Dorasamy et al, 2013), which explored knowledge driven information systems in support of emergency management in last two decades identified 51 significant pieces of emergency management information systems research. Much of this research was presented at highly ranked IS conferences, including the Americas Conference on Information Systems, and published in prominent journals such as Technological Forecasting and Social Change, Journal of Information Technology Theory and Application, Management Information Systems Quarterly, and Disaster Prevention and Management.   
When considering technology platforms proposed in last two decades, it appears that the FireGrid Project (Upadhyay et al., 2008) and the hybrid architecture of Nguyen et al. (2015) are the only substantial architectures exclusively designed for supporting fire ER in built environments. The high-level architecture proposed for the Fire Grid includes sample components along with data and control connections. This architecture integrates various  
technologies in a distributed design. However, and although the FireGrid architecture recognises a need to use diverse technology to capture contextual information, it does not identify the technological diversity required for the successful presentation of information to various types of firefighters. Furthermore, this architecture does not reflect how differences  
in firefighter roles, behaviours and working contexts create demands for different Human Computer Interaction (HCI). Therefore, the proposed Fire Grid architecture does not appear capable of addressing the distinct needs of different firefighter job roles. A more recent study conducted by Nguyen et al. (2015) in Germany proposed a hybrid architecture for firefighters and examined how different smart technologies could be coupled to support fire fighters. However, this latter study does not substantially address the research and conceptual gap concerning ISAs for fire ER. (Nguyen et al, 2015) appear to have been driven by traditional software engineering techniques. As a result, their study has not clearly identified the unique information needs of different fire fighter job roles.  
There are three key limitations in the wider literature related to ER ISAs. Firstly, most of the proposed architectures are technologically biased and only focus on common needs held among a broad range of emergency responders. Although there have been some efforts to support fire ER specifically, these efforts appear to focus on a selection of common needs.  
They do not address the needs of different key fire fighter job roles experienced while responding to a large incident. Most of the architectures proposed are therefore not comprehensive enough to cover the full scope of expectations of the fire and rescue hierarchy during fire ER in a built environment. At the time of writing, there appears to be very little evidence of an existing ISA that supports the diverse needs of different firefighter job roles.  
Secondly, and even more importantly, there is a very little literature on the systems architecture of an IS for fire ER, which is well understood by both the end users of the system as well as system architects. Instead, most of the available ISAs are only capable of communicating system characteristics to IS architects and developers. Although there are a few highly sophisticated and technically advanced ISAs for supporting fire emergencies, the development of such architectures appears to have excluded communication with the actual  
end-users, especially during very early stages of systems design such as requirements gathering. It is critically important to review the architecture of an IS, to reduce the cost of mistakes and to find and fix architectural problems as early as possible. Architecture review is a proven, cost-effective way of reducing project costs and the chances of project failure.  
This helps systems designers to identify issues and recognize areas for improvement (Microsoft, 2015). As part of this process, especially when designing a complex system for stressful environments such as fire emergencies, it is essential to communicate the intended system and its architecture to, and get the feedback from, the owners of the system. In this case, the owners of the system are fire fighters with a specific range of different job roles. Finally, there has been a lack of meaningful ISAs, which comprehensively address the  
varying Situation Awareness (SA) needs of different fire fighter job roles. For many decades, Situation Awareness (SA) has been identified as one of the critical concepts to be considered when designing information systems supporting end-users working under stressful environments. (Salmon et al, 2016) argued that systems which are not capable of enhancing SA lead to decision making failure causing huge economic and human losses. To make things worse, there has been very little evidence to substantiate the success of any IS implemented for supporting fire ER. A lack of available technology platforms for  
exclusively supporting fire fighters is highlighted in one of the recent studies into fire fighter acceptance of new technology platforms (Yang et al., 2013). In this research (Yang et al, 2013) concluded that firefighters fear using technology as they are worried about the reliability of the existing systems and have procrastinated in adopting them. This clearly indicates that there is a significant lack of current literature outlining appropriate technology architectures for supporting unique and individual information requirements of different fire  
fighter job roles when responding to fire emergencies.  
To start overcoming this above described gap in the current literature, this study aimed to define an Information Systems Architecture (ISA) to support firefighters’ response to fires in large scale built environments. This ISA is based on the comprehensive needs of potential  
end users. We aimed to develop definitions which were clearly understood by the system’s potential end users, as well as by the system’s designers and architects. Importantly, the architecture would not be limited to relying on one particular technology or one established set of technologies. (CERC, 2014) noted that a variety of Internet-based tools have made media access much easier and more cost-effective. Releases can be posted to media pages on your website. FAQs, background information, and event videos can be linked to releases. Videos can be archived and streamed. Webinars can provide detailed information and access to subject matter experts. Web-based tools have significantly bolstered access to media organizations and direct access to the public although they are time consuming, particularly during a crisis.

The past few decades have seen major advancements in the communications industry. Portable communications devices have gone from being used mainly in public safety and business applications to a situation where they are in every home and in the hands of almost every American man, woman and child. As users are added, there is more stress on the system, and there is only so much room on the radio spectrum. The communications industry and the government have responded by making changes to the system that mandate additional efficiency.  
These advancements have improved radio frequency (RF) spectrum efficiency but have added complexity to the expansion of existing systems and the design of new systems. Some of these advances in technology are mandated by the Federal Communications Commission (FCC), while others are optional. Many users of public safety spectrum have endured the time, effort and costs associated with narrow banding (FEMA, 2016).

Significant attempts has also been made to improve fire notification systems using specific sensors (with GSM module integrated) to sense smoke and give specific high temperature values that could lead to fires, then send a notification to fire service in the form of SMS (Reddy and Rao, 2016)

In the fall of 2017, a comprehensive Wireless Emergency Alerts (WEA) landscape assessment was conducted through an extensive literature review and series of interviews with subject matter experts and alert originators. The assessment examined the current WEA landscape, alert originator usage challenges, and the future state of emergency alerting. Initial findings suggested WEA messages based on the Common Alerting Protocol (CAP) provide a mechanism for rapid alerting and warning with significant benefits, including the ability to support immediate situational awareness, geo-target mobile users, and use standardized CAP encoded messages as a universal language. Alert originators consistently voiced that WEA is most effective when paired with other forms of alerting and warnings systems. However, there was not consensus on which combination of tools is generally most effective (Homeland Security, 2018).

In Nigeria, the most widely used communication or notification system to fire service is phone calls which has its limitations of which one of was stated by (Masjedi, 2019) that direct cost comes from calling and giving descriptions and narration of accidents/ emergency incidents. Though there are methods of making emergency phone calls as depicted in (Browsers et al, 2016) of which includes telephone, an emergency call button, and a controller. When the emer gency call button is pressed, the controller is configured to: (i) terminate an existing call being made on the telephone; (ii) place an emergency call using the telephone to a public safety answering point; and (iii) prevent the emergency call from being terminated at the PCS.

Mailing systems are also used in fire notification systems as stated by (CERC, 2014) that A community mailing is a way to send information to key contacts, and concerned or involved members of the community. Mailings disseminate information easily, in writing. They are particularly useful when there are updates for the community. However, many crises disrupt local mail service and can delay or impede mailings. As electronic forms of communication have grown, traditional mail delivery has become less popular and less expected with its disadvantage been It is not as quick as electronic methods of delivering information ­ Mailings allow no interaction or opportunity for community members to ask questions. ­ Residents may not read the mailing. ­ Mailings are only an option if mail service is available. ­ Large mailings may present logistics concerns and cost challenges.

(Romano et al, 2016) emphasized human as a sensor, due to advancement in technological evolution, humans have modern phones with GPS receivers, Wi-Fi accelerators or cameras that can transform users into well-equipped human sensors. For his reason emergency organizations and small and medium enterprise have demonstrated a growing intrest in developing smart applications for reporting any exceptional circumstances.

**INCORPORATED GIS FUNCTIONALITY IN EMERGENCY NOTIFICATION SYSTEM**

Looking into factors that will yield quick response to emergency, knowledge of location is vital, which will bring about the incorporation of GIS (geographic information system) which is a mapping, analytical, data management and visualization (Holdeman, 2014) to minimize the problem of incident location search since it can visualize, GIS can assist in locating, identifying and understanding relationships between areas of social vulnerability and potential hazard exposure (Holser, 2016). There are recent testimonies to the use of GIS, one of which is narrated in the news article by Charles Lefebvre on how the Fire Chief of MEDICINE HAT, AB, Bryan Stauth had testified on the 13th of November, 2019 to the fact that GIS had been a bonus in their operations an station modeling since 1999 (Chat News Today, 2019).

Also (O’Brien, 2019) stated that the application of GIS and the shared data holds immerse potential of for those with emergency management responsibilities as emergency managers currently rely on wide variety of location based data to support their mitigation preparedness, response and recovery missions.

**INCORPORATED VISUAL EVIDENCES FOR EMERGENCY REPORTING**

**WEB TO MOBILE APP REPORTING/ COMMUNICATION SYSTEM**