Impact Factor Value: 4.029 ISSN: 2349-7084
International Journal of Computer Engineering In Research Trends
Volume 4, Issue 11, November - 2017, pp. 456-460 www.ijcert.org

Improving Public Safety in Everyday's Life Using Mobile Computing Applications

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Abstract: - Keeping the public safe has always been the most important task of the country. Different kinds of incidents happen almost every day and usually, they are not reported correctly to the intended department. The main departments in the country are (1) law enforcement, (2) fire department, and (3) emergency medical services. This paper presents several improvements for selected research studies in order to make the three departments well-connected and suitable for public areas. Indoor GPS helps in locating specific incidents' area inside buildings, this helps in saving the time and effort to assist any incident. Saving lives is an important aspect to maintain a healthy and safe environment where an immediate health care is provided to the injured which increases their chances to heal faster. Also, improved fire detection and controlling system helps in eliminating the danger and damage to other's property. Further, we should engage the citizens in the incident reporting process via providing user-friendly applications, arranging awareness campaigns, and adopting new technologies to make devices intelligent enough so they won't need a human controller.

Keywords: Safety, Public, GPS, Emergency, Incident.

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1. Introduction

Of late, there have been many incidents in almost all advanced countries, which are not related in time. This has led a chaos wherever there is an unwanted incident. Therefore, the responsibility lies with the citizen to report such incidents. Nowadays, governments and ministries are involving the citizens in incidents reporting process via mobile and web-based applications. Mainly, there are three types of incident reporting: (1) reporting a criminal activity, (2) reporting a fire, and (3) reporting as an emergency situation. Most of the time, the reporter misses some of the important details of the incident such as the status of the incident and its location which affect the in-progress work of the intended department. Also, in some situations, two different departments are required to be engaged in one scene (e.g. A fire with some injured people). The reporter will inform the fire department and the emergency medical services separately. Hence, there will be some inconsistency in the provided services and the damage might be larger. Ideally, citizens should have the ability to inform an incident from one place in which several parties are involved depending on the GPS (Global Positioning System) location. GPS has a variety of applications such as navigation and positioning [11]. Therefore, the nearest office of each department will serve that case; this will ensure a high consistency, detailed information about the incident, and a minimum risk level.

On the other hand, the police force, fire department, and emergency medical services have the right to receive detailed and serious requests to channel their resources efficiently. The police force specifically is the most important part of every society. Hence, their internal system that provides more leverage on the system's entities should be consistent, reliable, recoverable, and fast in performance.

2. Literature review

Many research groups and organizations have conducted different kinds of hypothesis and studies that aim to increase the public safety from several threats. Reducing the danger of fire, criminal activities or even responding to an emergency are important things that contribute to saving human lives and maintaining a safe environment.

A. Law Enforcement

In the law enforcement aspect, we can implement and adapt different kinds of positioning tools in order to maintain a low-level of criminal activities. Additionally, engaging the citizens in the reporting process of any incident will increase the responsibility towards their society and make better and fast response to any situation requires the presence of the police force.

The Okumura-Hata (OH) model is one of the most commonly used prediction models, it is a group of empirical propagation formulae based on several extensive environmental measurements and analysis which has been done by Okumura [6,7]. In 2007, Ozgun Bayrak and other scientists proposed a positioning algorithm for mobile devices based on an estimation of radio propagation environment in cellular networks. They reversed and improved the Okumura-Hata (OH) model in a way to make them able to determine the relationship between the signal attenuation and the distance which enables them to get an estimation accuracy up to 95% in rural areas. The performance of this algorithm has been evaluated with data collected during numerous field measurements in a GSM network in different geographic environments [1]. Record Management System (RMS) for crimes is improved as well by Muyanja with several other scientists and Uganda's police parties in 2013, they presented a requirement engineering process that strengths the performance of RMS functions. Uganda's police force identified several limitations on their systems; (1) limited capacity for tracking filed cases, (2) lack of system support, and (3) lack of searchable crime database for cross-referencing. To overcome those problems, a set of goals was specified like implementing an electronic case file management, electronic profiling of crimes, supporting internal communications, and maintaining the key libraries of the system. Achieving these goals will be done by improving the requirement elicitation, analysis, and specification for each case file [3]. This all can be done efficiently using Java Mobile Information Device Profile (MIDP) record management system (RMS) in the mobile device for a faster record initiation, retrieval, and update using a small memory portion [10]. Another way to keep a safe environment is to maintain a monitoring system by using a CCTV cameras system in the public areas. In 2015, Shahil et al, presented the idea of making a low energy consuming CCTV cameras by using a laser sensor in which whenever a moving object is detected the camera will be triggered and start recording. These cameras will consume less power while maintaining a secure and well-monitored environment [12].

B. Fire Departments

Fires can destroy everything in few seconds. So, it is necessary to invest in fire detection system and improve the workflow of fire departments all around the country to make the fastest possible response which will result in reducing its damage. In Kuala Lumpur 2015, Azmil and a group of scientists have developed a fire detection system using an Arduino kit and some extra sensors such as a smoke sensor to make a fire monitoring system on a laptop device. The microcontroller in Arduino will consistently read a value from the smoke sensor. The microcontroller will send the value wirelessly to the monitoring system, it will evaluate that value to see if it exceeds a certain limit or not. If the value exceeded the expected limit, it will send back a warning to the microcontroller which activates a connected buzzer and an image sensor. The buzzer will generate an alarm and the image sensor will take a clear photo of the situation and send it to the monitoring system to be displayed on the laptop to help in locating the smoke source [4]. In 2016, an automobiles fire detection and control system was invented by Sowah and other researchers via applying a fuzzy logic using an Arduino kit connected to the automobile air conditioner. The system consists of two subsystems a fire detection and a fire controller. The detection subsystem is divided as well into the engine and fuel subsystem and cabin and boot subsystem. Figure 1 illustrates all the subunits in the system. The fire detection relies on three main sensors: (1) temperature, (2) flame, and (3) smoke. Using a probability table, the system will determine the appropriate action for every situation whether to Stand By, Alarm, or Spray depending on the values using fuzzy logic. For example, the crisp values for the temperature are (1) C=0→Stand By, (2) C=45→Alarm, and (3) C=100→Spray. In case of abnormal values, the system is equipped with nozzles and Carbon Dioxide gas for fire extinguishment process [5].

C. Emergency Services

Responding to an emergency is a critical thing in which a fast response will help in saving more lives. Citizens should be aware of the criticality of the time spent to report an emergency to the Emergency Medical Services (EMS).

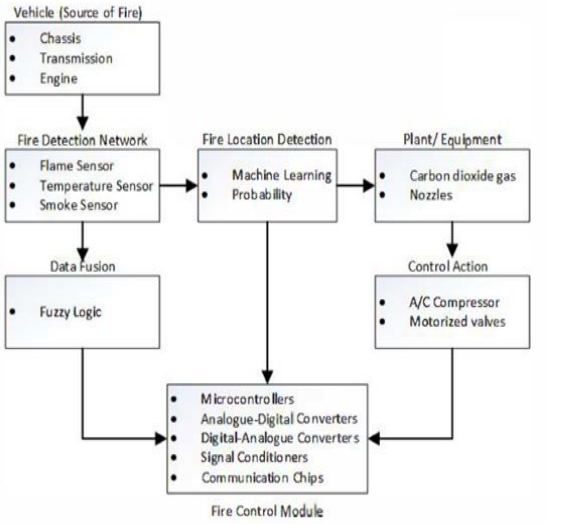

Figure 1: Fire Detection System architecture

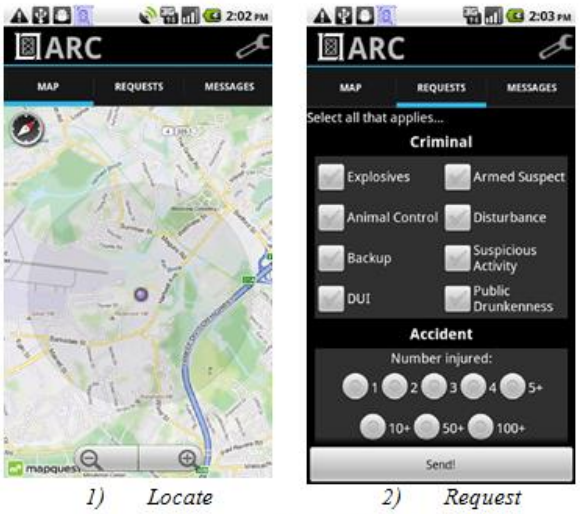

Figure 2: NICS application

Every second matter in saving lives in an emergency situation. Hence, reporting such situations should be a fast and productive process to ensure a more reliable response.

In 2016, Malany has made an improvement to the E911 services in which he proved that the key point of E911 VoIP networks is GPS service and he enhanced the emergency services of E911 in VoIP networks by (1) adopting a motion detection to the wireless network which will rely on received signal strength (RSS) and angle of arrival (AoA), (2) using a single access point in the WiFi network which depends on AoA for efficient motion detection, (3) positioning verification of E911 VoIP [9]. Erickson presented a Web-based Next-Generation Incident Command System (NICS) in 2013, which provide to the user several important functionalities and those are: geolocation and situation awareness of a specific location of the city, ability to request resources in case of criminal activity, reporting and collaborating via text or multimedia messages, and standardizing the interfaces among system modules messages to minimize the integration development time with NICS. You can see in figure 2 the simplicity of reporting a criminal activity which requires specifying the location and some more information. Basically, NICS is a reliable, distributed, and scalable architecture that enables a common situational awareness picture to enhance the collaboration [2].

3. Proposed Work

Maintaining a safe environment is the most important and critical task of the country. For example, malls are such an open and wide public areas in which we may not be able to control every incident that occurs inside them. One solution to handling those incidents and increasing the safety is by monitoring the mall areas with the low cost multi-purpose cameras CCTV [12]. However, there might be some spots in the mall that are not covered by the CCTV cameras. Therefore, citizens should have a high sense of responsibility to report incidents depending on a unified system in the mall that gathers the police force, fire departments, and emergency services. Having a place to report incidents inside these public spaces will help in getting a faster response and accurate location of the incident. Malls may provide SOS (Save Our Lives) Screens that present a special application to call for help in an easy and friendly way. The user of these SOS screens should specify the incidents' type and if it needs the involvement of EMS, police, or fire departments.

Fire detection is an important aspect also because discovering the fire in its early stages is going to save many lives. Developing cameras with an embedded system controlled by Arduino with smoke sensors will help in detecting the early stages of fire. Hence, the system will send outdoor and indoor location via GPS, take a photo to locate the exact source of the fire and enable the alarming system by using a connected buzzer. The sensors will detect the smoke level and send signals to the mall's monitoring system which will trigger the camera, the camera will take pictures of the fire and send it along with the GPS location to the same application installed on the SOS screens. The application is responsible for sending a request to the fire department center in which they will send the nearest firefighter group to the mall. Additionally, adopting a firefighter system by using the fuzzy logic is so feasible [5]. In each floor of the mall, there will be several fire extinguisher stations connected to the ceiling for more coverage in which if the sensors detect any abnormal values, they will locate the source and one of the fire extinguisher stations will be

triggered based on its coverage, the arm will be positioned towards the source and starts fighting the fire and sending a request to the fire department for a faster response without the human involvement.

Combining the three major departments that the country has; law enforcement, fire department, and emergency medical services in a unified system will ensure a higher work consistency and a faster response to any reported incident. Building an application to report incidents is so feasible as it will be connected to one database only which is the unified system's database. Furthermore, it will force an easy way to communicate with these three departments and facilitate drawing the connections between incidents in a faster way that has a high impact on the public safety. Also, arranging campaigns to increase the awareness of the citizens from different classes is necessary as it will positively affect their responsiveness towards different kinds of incidents. Hence, those citizens will learn how to report any incident of a criminal activity by using NICS in which they will report the incident including its geographical location, indoor location, and situation status via a text or multimedia message [2]. In addition, discovering the location of a criminal activity through locating the mobile devices by the reversed OH model combined with an Indoor Wi-Fi positioning system via advanced GPS chipset developed by Diggelen and Abraham in 2001 is going to be easier and more accurate [8]. After filing those reports the nearest police car will go to that specific location in the mall and file the case electronically by using the RMS system [3].

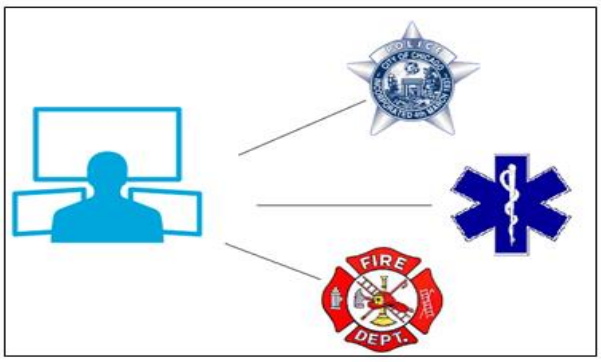

Figure 3: Unified system for all departments

4. Conclusion

This paper presented an improvement on the public safety in any country in the world. The main objective of the work is to increase the awareness and responsibility of everyone in the county in which a faster incident reporting leads to a faster response that might help in increasing the safety of the public. A unified system must be constructed as in figure 3 to ensure a higher consistency in the incident responding process; therefore, three major departments are to be connected in one system (1) law enforcement, (2) fire departments, and (3) emergency medical services. Having a connected system will make incident reporting much easier and smoother for the citizens by adopting new technologies.

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