REDAlert+:
Medical/Fire Emergency and Warning System using Android Devices

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ABSTRACT

Each year, thousands of people in developing countries die due to delayed medical response. A common complaint is that emergency vehicles respond late and when they reach the hospital, precious time is lost in understanding the patient trauma before the doctors can get to work. A large number of deaths can be prevented if medical services can be provided to the victims in time, which can happen when the emergency wing of a hospital has advance information about the trauma before the patient reaches the hospital. Most hospitals lack communication infrastructure that allows them to coordinate with emergency vehicles bringing patients to hospital. In developed countries, Vehicular Ad-hoc Networks (VANETs) are prevalent. These networks use vehicles as mobile nodes to create a small-interconnected network on the road. A mobile application based on the principle of VANETs in combination with wireless communication and database management has been devised, that when integrated with emergency vehicles and hospitals, provides a seamless medical response system at times of an emergency.

KEYWORDS

Alert, Android, Application, Emergency, Health, Hospital, Medical, Mobile, Traffic Management, VANETs

INTRODUCTION

Administering prompt medical attention to a trauma victim is the goal of every emergency care responder. However, despite the best of intentions, a large percentage of patients lose out on the benefits of timely medical care. One of the main reasons for this is attributed to delayed medical treatment, prompted by a delay in reaching critical care facilities. Lack of advance preparation at the emergency center in handling for the trauma further accentuates the delay.

While many mobile solutions have been created to address this issue, they all suffer from some infirmity or the other that has precluded their widespread use. This paper explains the functioning of REDAlert+, a mobile application solution whose objective is to reduce delays in receiving medical care, by analyzing the shortcomings of some existing applications and creating a solution that addresses these issues.

Consider a typical scenario where a road accident has taken place. The user places an emergency call to a hospital, which may or may not be nearest or equipped to handle the emergency, to request for an ambulance. After having made the request the user keeps on waiting, having no means of knowing when and where the ambulance is likely to arrive. With no real time data at hand, he is also not in a position to guide the ambulance to the accident spot. The ambulance driver on the other hand, with no outside help and lack of terrain knowledge, ends up losing precious time to arrive at the accident

site. Furthermore, the lack of a common communication platform between the user and the hospital hinders making advance preparations to receive the patient.

The authors conducted a detailed analysis of the steps required to ensure speed and ease of use both by the user in distress as well as the other stakeholders in the treatment cycle i.e. the driver of the ambulance and the medical supervisors receiving the victim in the emergency ward. Using the application developed, the user can quickly locate the nearest hospital, inform it about the emergency and ensure that an ambulance will be deployed to the user's location. Concurrently the user can track the ambulance on a map after making the request. This application not only allows the user to estimate the likely arrival time of the ambulance but also provides the ability to guide the ambulance to the accident spot using the shortest possible route using a map. In the meantime, the user's medical profile is forwarded to the hospital en route so the hospital staff is better prepared to receive the patient. This application positively impacts the life of millions of people that face medical emergencies and suffer due to delayed medical response.

The remainder of this paper is organized as follows. Section II presents the relevant related work. Section III describes the system architecture, the functioning, the technologies used. Section IV presents the testing results under various emergency scenarios. Section V explains the findings and discusses the future work. Section VI concludes the paper.

RELATED WORK

Various mobile applications and IT solutions dealing with coordination, communication and tracking during emergencies have been developed in the last lustrum. The pervasiveness of mobile devices has obviated the need for using costly equipment and the fast expanding universe of mobile apps has helped ease creation of solutions that address specific issues. However only a few of these solutions have been successful in streamlining communication in times of emergency.

Chang et al. (2012) proposed to store critical information like observations of earthquake, debris flow, abnormal weather, river pan abuse, abnormal weather, etc. in an online web emergency database system, thereby developing an Android-based emergency SMS broadcasting application where people of the region could receive real-time messages in case of any natural disasters. They identified a design, which included requirement specification of three functional subsystems, namely, web application subsystem (WAS), an emergency database subsystem (EDS) and an embedded mobile application subsystem (EMAS).

Hariprasath et al. (2013) proposed an emergency alerts system where they developed certain efficient mathematical techniques to avoid network congestion while broadcasting SMS alerts. They also calculated the minimum time required for the delivery of those bulk messages using GSM network in smartphones.

Applications like IPROB (Kumar & Rajkumar, 2014) have also been developed that tackle the issue of safety. This application, specially designed for women makes use of the tri-axial accelerometer in the smartphone as a result of which the victim simply needs to shake the phone to send a location aware emergency SMS alert. This application was made for android-based smartphones with requirements including a GPS tracking service, a network provider and a SMS Manager Module.

The downside of these solutions is that they use GSM connectivity and network provider based SMS alerts, which makes uninterrupted network connectivity imperative to receive real time alerts. Such connectivity may not always be available during emergencies.

There have also been numerous discussions on Technology and Innovation that addressed the issues relating to medical emergencies. West and Valentini (2013) have stated how there has been a transformation in public safety and disaster relief with the help of mobile devices in recent years. They have presented example of Japan's EEW (earthquake early warning systems), where Mobile Ad-hoc Networks (MANETs) work efficiently in the absence of Wi-Fi or cellular networks. They also talked about scenarios where citizens and first responders have been provided with the necessary tools and services, which have significantly reduced the chances of loss of lives.

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