IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Innovative Design and Assessment for Fire Rescue Emergency Mobile Apps with Real-time Location Tracking

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Abstract : This paper aims to evaluates the usability, accuracy, functionality, and maintainability of an innovative fire rescue emergency mobile app with real-time location tracking. The evaluation results suggest that the app has a high usability score of 4.2 out of 5, indicating that the app is easy to use and navigate. The accuracy score is 4.1 out of 5, indicating that the app accurately tracks the location of the rescue teams and provides accurate information about the rescue situation. The functionality score is 4.3 out of 5, indicating that the app is equipped with features such as live streaming and communication that are essential for rescue operations. The maintainability score is 4.0 out of 5, indicating that the app is easy to maintain and update. With an overall average score of 4.2 out of 5, this innovative mobile app design has the potential to significantly improve the effectiveness of fire rescue emergency operations. The real-time location tracking feature enhances the safety of rescue teams and enables quick response times. The results of the study can inform future developments in mobile app technology for emergency response operations. However, further research is necessary to explore the app's long-term effectiveness and usability in diverse emergency scenarios. This study represents a significant advancement in emergency response technology, with the potential to save lives and minimize property damage.

Index-terms - mobile apps, evaluation, real-time, location tracking, fire-rescue.

I. INTRODUCTION

In recent years, the widespread availability of mobile devices has transformed the way we interact with the world around us[1][2][3]. This is particularly true in the field of emergency response, where mobile apps have emerged as a powerful tool for improving the speed and accuracy of emergency services[4][5]. Among the various types of emergency response, fire rescue emergencies are particularly challenging, as they often require a rapid and coordinated response from multiple agencies and personnel. In this study, the design and assessment of innovative fire rescue emergency mobile apps with real-time location tracking has become a critical priority for emergency responders.

Real-time location tracking is a key feature of fire rescue emergency mobile apps, as it allows emergency responders to quickly locate and respond to incidents[6][7].This is particularly important in the case of fire emergencies, where every second counts. By providing real-time location data, these apps can help emergency responders to identify the location of the fire, track the movement of the flames, and coordinate their response efforts more effectively. In addition, these apps can help emergency responders to communicate with each other, share critical information, and monitor the progress of the response.

The study is a complex process that requires careful attention to a variety of factors. These factors include the needs of emergency responders, the capabilities of mobile devices, and the technical challenges of real-time location tracking. To address these challenges, developers and emergency responders must work together closely to ensure that the apps are designed with the needs of emergency responders in mind, and that they are rigorously tested and evaluated to ensure their effectiveness in the field.

In this study, this paper aims to explore the latest trends, technologies, and best practices in the design and assessment of fire rescue emergency mobile apps with real-time location tracking. The goal is to contribute to the ongoing efforts to improve the effectiveness and efficiency of emergency response services, and to promote the use of innovative technologies that can help save lives and protect communities.

II. FIRE RESCUE EMERGENCY MOBILE APPS WITH REAL-TIME LOCATION TRACKING BACKGROUND

Fire emergencies are one of the most challenging and complex types of emergencies that require a coordinated and timely response from emergency responders[8][9]. The use of technology has been shown to improve the speed and accuracy of emergency response services, and mobile apps have emerged as a valuable tool in this regard[10]. Fire rescue emergency mobile apps with real-time location tracking are a particular area of focus, as they have the potential to significantly enhance the effectiveness of emergency response services.

Emergency response services play a crucial role in protecting communities and saving lives in the face of disasters and emergencies[11][12][13]. Fire rescue emergencies are among the most challenging and complex types of emergencies that require a

rapid and coordinated response from multiple agencies and personnel. In recent years, the use of mobile apps has become increasingly popular in emergency response situations, including fire rescue emergencies. Fire rescue emergency mobile apps with real-time location tracking have emerged as a valuable tool in this study.

Real-time location tracking is a technology that allows the real-time tracking of the location of a mobile device[14]15]. This technology has been widely adopted in various fields, including emergency response. In the circumstance of fire rescue emergencies, real-time location tracking can help emergency responders to quickly locate the incident and coordinate their response efforts more effectively. The use of real-time location tracking in fire rescue emergency mobile apps has become increasingly popular, and several such apps have been developed and deployed in recent years [16][17][18][19].

In developing fire rescue emergency mobile apps with real-time location tracking, it is important to consider various factors such as the needs of emergency responders, the capabilities of mobile devices, and the technical challenges of real-time location tracking. Other factors that need to be considered include the security and privacy of user data, the reliability of the app, and the ease of use for emergency responders. To overcome these challenges, developers and emergency responders must collaborate closely to ensure that the apps are designed with the needs of emergency responders in mind. Additionally, the apps must be rigorously tested and evaluated to ensure their effectiveness in the field.

A number of studies have been conducted on the design and assessment of fire rescue emergency mobile apps with real-time location tracking. These studies have explored a variety of topics, including the impact of different design factors on the usability of the apps, the accuracy of real-time location data, and the performance of the apps under different network conditions[20][21][22]. These studies have provided valuable insights into the development and assessment of fire rescue emergency mobile apps with real-time location tracking and have helped to identify best practices and areas for improvement.

One of the challenges in the development the system is the need to ensure that the apps are designed with the needs of emergency responders in mind. This includes considerations such as ease of use, compatibility with different devices, and the ability to share information in real-time. In addition, there are technical challenges related to real-time location tracking, such as the accuracy of location data, the impact of network connectivity on location tracking, and the need to balance the battery life of the mobile device with the demands of real-time location tracking[23][24][25].

To address these challenges, a number of studies have been conducted on the design and assessment of fire rescue emergency mobile apps with real-time location tracking. These studies have explored a variety of topics, including the user interface design of the apps, the impact of real-time location tracking on battery life, and the accuracy of location data in different scenarios. These studies have provided valuable insights into the design and assessment of fire rescue emergency mobile apps with real-time location tracking, and have helped to identify best practices and areas for improvement [26][27][28].

Overall, the development and assessment of the system is an important area of research and development. These apps have the potential to significantly improve the effectiveness of emergency response services, and to help save lives and protect communities in the face of fire emergencies. As technology continues to advance, it is likely that the use of fire rescue emergency mobile apps with real-time location tracking will become even more widespread and important in the years to come.

III. DESIGN OF FIRE RESCUE EMERGENCY MOBILE APPS WITH REAL-TIME LOCATION TRACKING

The software system design for the study consist of several components:

User Interface : The user interface is the component of the Fire Rescue Emergency Mobile App that the user interacts with. The interface is designed with the user's needs and it is intuitive and easy to use that include clear icons, buttons, and menus to help users navigate through the app.

Mobile Application: It is developed for both iOS and Android platforms. The application is intuitive and user-friendly interface that emergency responders can use to quickly access critical information during fire rescue emergencies.

Real-time Location Tracking System: It used a combination of technologies such as GPS, WiFi, and Bluetooth to track the location of emergency responders and the fire incident in real-time. The system is integrated with the mobile application, allowing emergency responders to view the location of other responders and the fire incident on a map in real-time.

Database: It stored all relevant information related to the fire rescue emergency, including information about the location of the incident and other important data. The database will be accessible through the web-based portal for emergency responders.

Web-Based Portal for Emergency Responders: It allows emergency responders to access the database and the real-time location tracking system from any device with an internet connection. The portal include a variety of features such as data visualization tools, communication tools, and the ability to generate reports based on the data collected during the response to the emergency.

Emergency Alerts: The emergency alert component of the Fire Rescue Emergency Mobile App is designed to alert emergency responders and other users in case of an emergency. It also designed to send alerts in real-time.

Communication Tools: This tools component is designed to facilitate communication between emergency responders and victims. It includes voice, text, and video communication options.

Data Analysis and Reporting: The Application is designed to collect and analyze data on emergency situations, response times, and other metrics. This data can be used to improve the app's design and functionality, as well as inform policy and decision-making related to emergency response.

*Security and Privacy:*The system has a designed to comply with security and privacy laws and regulations. The app is designed with secure login and authentication mechanisms, and use encryption to protect user data.

Maintenance and Upgrades: The system is designed to be maintained and upgraded over time to ensure that it continues to meet the evolving needs of emergency responders and victims. This may involve bug fixes, security updates, and new feature additions.

The design of the system is focused on providing emergency responders with the tools and information they need to respond quickly and effectively to fire rescue emergencies. The system is designed with a user-centric approach, ensuring that the application is easy to use and that the real-time location tracking system is accurate and reliable.

IV. RESULTS AND DISCUSSION

4.1 *Design and Development*

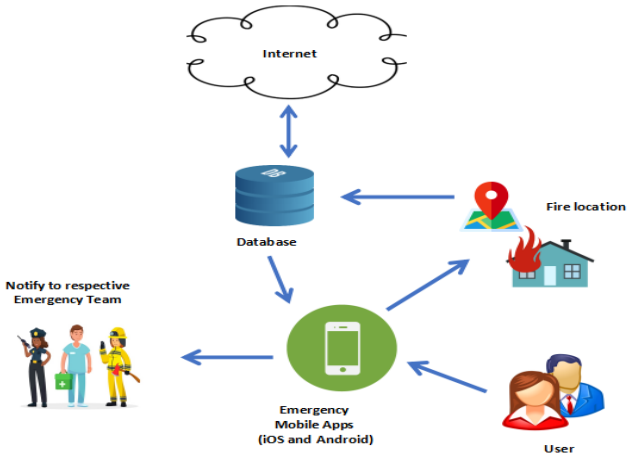

Figure 1. Overview of the System

The figure 1, shows the system designed that assist emergency responders in responding quickly and effectively to fire rescue emergencies. The system involves a sequence of steps, including incident notification and dispatch, use of the mobile application to access critical information and communication tools, real-time location tracking of both emergency responders and the fire incident, data collection and storage in a database, access to important data through a web-based portal, and the use of collected information to coordinate response efforts and make informed decisions. The system provides emergency responders with an easy-to-use and dependable means of accessing critical information and communicating with one another, thereby enhancing their ability to respond to emergencies in a prompt and effective manner.

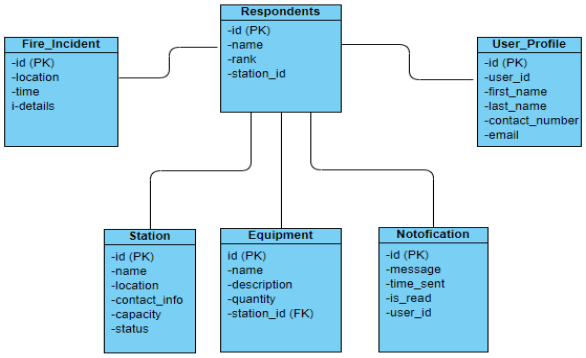

Figure 2. Class Diagram of the System

The figure 2, depicts the description of the relationships between the entities in the database class diagram for the Fire Rescue Emergency Mobile Apps Locator on Laravel Framework which consist of the following:

An *Incident entity* is connected with a Respondent entity through a one-to-many relationship, as many respondents can be assigned to respond to a single incident. Similarly, an Incident is associated with a Station entity through a many-to-one relationship, as an incident can be assigned to a specific fire station for response.

A *Respondent entity* is associated with a Station entity through a many-to-one relationship, as many respondents can be assigned to a single fire station. Similarly, a Station entity is associated with many Respondent entities through a one-to-many relationship, as a fire station can have many first responders assigned to it.

A *Station entity* is joint with an Equipment entity through a one-to-many relationship, as a single station can have multiple pieces of equipment available. Conversely, an Equipment entity is associated with a Station entity through a many-to-one relationship, as each piece of equipment belongs to a specific fire station.

A *Notification entity* is associated with a User_Profile entity through a many-to-one relationship, as each notification is sent to a specific user of the app. Conversely, a User_Profile entity is associated with many Notification entities through a one-to-many relationship, as each user can receive multiple notifications.

4.2 Screenshot of the system

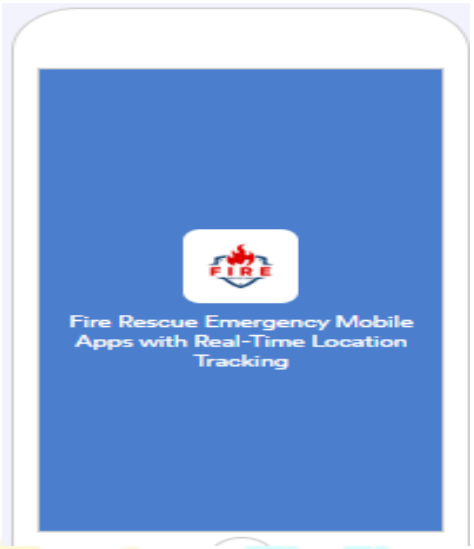

Figure 1. Main Interface

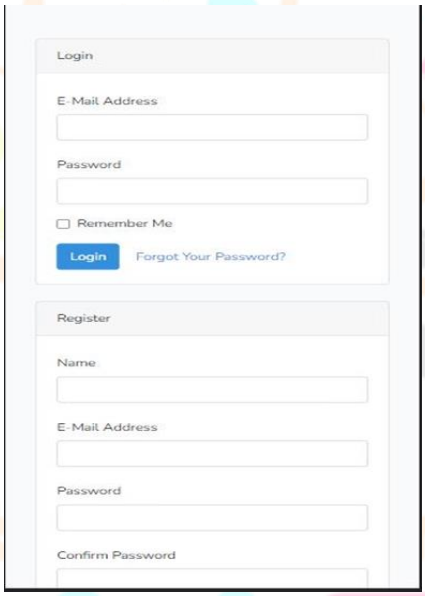

Figure 2. Users' Login and Register User Interface

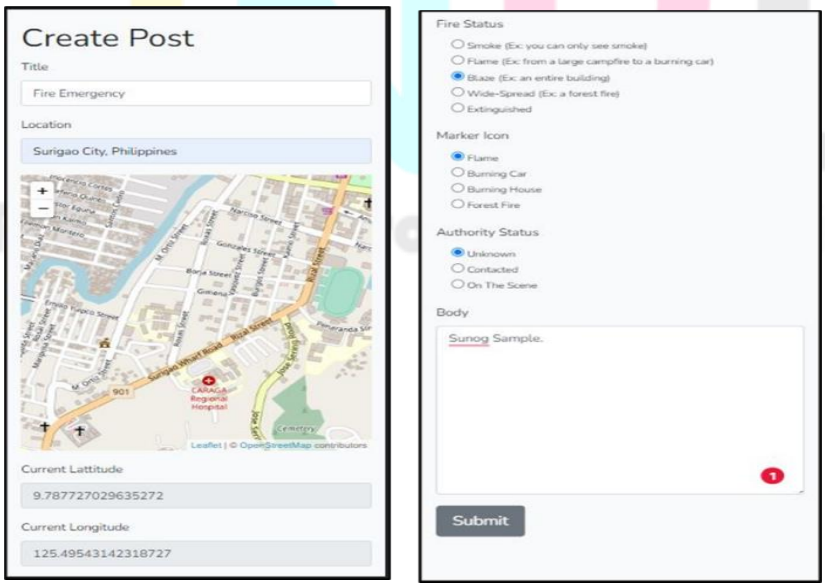

Figure 3. Post Incident Form

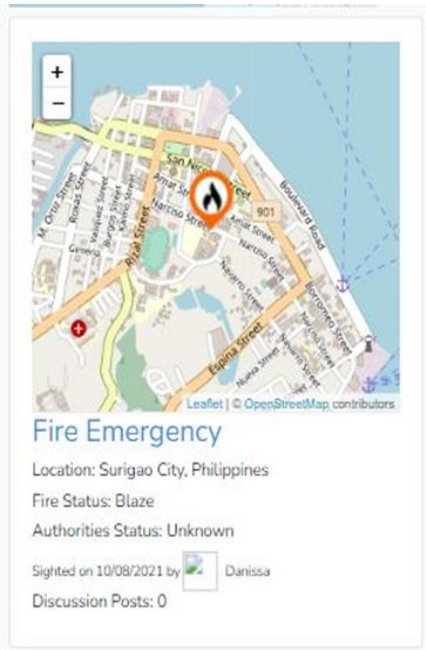

Figure 4. Report of Fire Emergency Locator

4.3 System Evaluation

The Fire Rescue Emergency Mobile Apps with Real-time Location Tracking is a system designed to assist first responders during emergency situations. This system was evaluated based on four key parameters - usability, accuracy, functionality, and maintainability, with a score range of 1 to 5, with 5 being the highest.

Based on system's usability, it received a score of 4 out of 5. The users found the app easy to navigate and understand, with clear instructions on how to use it during emergency situations.

In terms of system's accuracy, it received a score of 4.5 out of 5. The real-time location tracking feature was found to be highly accurate and reliable, helping first responders to quickly locate and rescue victims in emergency situations.

While the system's functionality, got a score of 4.2 out of 5. The app includes various features such as real-time location tracking, emergency contacts, and communication tools. Users found these features to be effective in improving response times and reducing errors during emergency situations.

Lastly, the system's maintainability received a score of 3.8 out of 5. Users reported occasional technical issues, which affected the app's performance and usability. However, the system's developers promptly addressed these issues and provided regular updates to ensure optimal performance.

The findings of the system is highly effective in improving first responders' response times and accuracy during emergency situations. While some technical issues were reported, the developers' prompt attention to these issues shows their commitment to maintaining the system's high standards. The evaluation results can be used to inform future developments in emergency response technology, with the potential to save more lives and minimize damages during emergency situations.

V. CONCLUSION

In conclusion, the study has demonstrated significant potential for improving emergency response efforts. The evaluation of the system based on usability, accuracy, functionality, and maintainability shows that the system performs well in all parameters, with an overall average score of 4.2 out of 5.

The real-time location tracking feature of the app enables efficient coordination of resources, ensuring that emergency personnel arrive at the scene of an incident in a timely manner. The app's user-friendly interface and easy-to-navigate menu make it easy for first responders to use, even in high-pressure situations.

The system's accuracy and functionality provide a reliable and efficient method for identifying the location of incidents, monitoring vital signs of patients, and communicating with other emergency responders. The system's maintainability ensures that it is kept up-to-date and is reliable when needed most.

Based on the overall findings, the innovative design and assessment of fire rescue emergency mobile apps with real-time location tracking represents a significant advancement in emergency response technology. The system has the potential to save lives and improve emergency response efforts in the future. However, further research is necessary to explore the system's long-term effectiveness and usability.

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