CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

In this era of crime, personal safety problem is getting worst and worst. There are many cases happened such as robbery, snatching, rapping, fire, terrorist attack, civil disturbance, vehicular accidents and etc. These cases will seriously affect social stability and could reduce people step out their door. Furthermore, everyone is worrying about their personal safety and also their love one, especially their family and beloved partner. For some of the people, they tend to worry other people safety more than themselves.

Nigeria is a nation of diverse landscapes and communities, each with its unique set of emergency challenges, from natural disasters to security concerns. Mobile technology, which is widely accessible across the country, can serve as a powerful tool to address these issues. The existing emergency response systems often face issues of inefficiency, slow response times, and limited coordination. The rapid proliferation of smartphones across the country provides an unprecedented opportunity to address these challenges. This study, grounded in the local context, seeks to develop a mobile application tailored to Nigeria's needs, thereby revolutionizing the way public safety and emergency services are managed in the country.

The actions and responses taken in the initial minutes of an emergency are critical. These life threatening events may happen any moment. Being always prepared and ready can save lives. A call for help to public emergency services that provides full and accurate information will help the dispatcher send the right responders and equipment.

Environmental emergencies are incidents or events that threaten public safety, health, and welfare and include hurricanes, floods, wildfires, industrial plant explosions, chemical spills, acts of terrorism, and others. Emergency response is the organizing, coordinating, and directing of

available resources in order to respond to the event and bring the emergency under control. The goal of this coordinated response is to protect public health by minimizing the impact of the event on the community and the environment. One of the most popular and well known emergency systems in the world is America's 911. The system was designed to provide a universal, easy-to-remember number for people to reach police, fire or emergency medical assistance from any phone in any location, without having to look up specific phone numbers. The technology, regulations and funding that make the system possible are largely based on the technology that existed at the time 911 was first implemented during the late 1960s –i.e., wired phones in residences and businesses.

With the increasing frequency and severity of emergencies, there is a pressing need for an innovative solution that leverages technology to enhance communication, coordination, and response during critical incidents. This project aligns perfectly with the skills and knowledge I've acquired during my studies, and I am enthusiastic about the opportunity to contribute to the field of public safety.

One tool for improving emergency management is quick access to accurate and updated information about the emergency situation or disaster. Such information can be of vital importance for emergency management to enable distribution of the right resources to the right places at the right times and for prioritizing the efforts which have the greatest benefit. Much of this essential information has a spatial component, such as extents and locations of damaged areas, the locations of resources and services or safe transportation routes. Such geographic information, or spatial data, are useful in all phases of emergency management (Cutter 2018; Al-Khudhairy 2010).

1.2 STATEMENT OF THE PROBLEM

The challenges facing public safety and emergency services in Nigeria are multifaceted. These include inadequate communication between the public and emergency authorities, inefficient resource allocation, and slow response times. Additionally, the lack of real-time information sharing often hampers the effectiveness of emergency response efforts. To address these issues, there is a pressing need for a mobile application that bridges these gaps and optimizes the coordination between authorities, citizens, and first responders during emergencies.

1.3 AIM AND OBJECTIVES OF THE STUDY

The project aim and objectives that will be achieved after completion of this project are discussed in this sub chapter.

1.3.1 AIM

The aim of this project is to design, develop, and implement a mobile application that serves as a reliable and accessible platform for both citizens and emergency services.

1.3.2 OBJECTIVES

The objective of this project, mobile application for public safety and emergency services includes the following:

1. To design and develop a user-friendly mobile application for both iOS and Android platforms.
2. To integrate features such as geolocation services, and two-way communication with emergency services.
3. To establish a robust, secure, and scalable infrastructure for data storage and transmission.

4. To provide users with informative resources on disaster preparedness and safety measures.
5. To collect and analyze user data to optimize emergency response efforts and improve public safety.

1.4 METHODOLOGY:

To develop a mobile application for public safety and emergency services, the following methodology can be employed:

Needs Assessment: Understand the specific needs of the target population and the requirements of emergency service providers through surveys, interviews, and research.

Feature Selection: Identify essential features such as emergency contact buttons, GPS-based location services, real-time communication, and incident reporting.

Technology Stack: Choose appropriate technologies and platforms (iOS, Android) for development. Ensure that the app is user-friendly, accessible, and compatible with various devices.

User Interface (UI) Design: Develop an intuitive and user-friendly interface, keeping in mind the urgency and stress that users may experience during emergencies.

Backend Development: Set up the server infrastructure for data storage, authentication, and real-time communication between users and emergency services.

Security Measures: Implement robust security protocols to protect user data and ensure that the app cannot be misused.

Testing: Rigorously test the app for performance, reliability, and usability. Simulate emergency scenarios to ensure that the app functions correctly.

1.5 SIGNIFICNT OF THE STUDY

The study's significance lies in its potential to revolutionize the way society deals with emergencies. By providing a mobile application that enables quicker, more efficient, and coordinated responses to crises, it can save lives, reduce property damage, and enhance overall public safety. This research also offers insights into how technology can play a pivotal role in disaster management and preparedness.

1.6 SCOPE OF THE STUDY

The scope of this study encompasses the design, development, implementation, and evaluation of a mobile application for public safety and emergency services. It includes defining the features, functionality, and user experience of the application. However, it does not delve into the legislative, policy, or financial aspects associated with emergency services.

1.7 LIMITATION OF THE STUDY

1. The study's focus is on the technical aspects of the mobile application, and it does not address the broader policy, legal, or budgetary challenges that may affect its implementation.
2. The application's effectiveness will depend on user adoption and the availability of adequate network connectivity, which may vary across different regions.
3. The study's timeframe is limited, and the long-term impact of the application may require further research and evaluation.

1.8 DEFINITION OF TERMS

Mobile Application: A software program designed to run on mobile devices, such as smartphones and tablets, to provide specific functionalities or services.

Emergency Services: A collective term encompassing agencies and organizations responsible for responding to emergencies, including law enforcement, fire departments, medical services, and more.

Geolocation Services: Technologies that determine the precise location of a mobile device using GPS, Wi-Fi, or cellular network data.

Emergency Alerts: Notifications sent to mobile devices to provide real-time information about critical incidents or events, such as severe weather warnings or public safety threats.

User Data: Information collected from the application's users, which may include location data, user preferences, and feedback used to improve the application and emergency response efforts.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction to Safety.

Safety is the state of being safe, the condition of being protected from harm or other danger. The existing environment of our society could be improved more in order to tackle the problem of public safety as well as emergency services. We cannot deny that the abandoned infrastructure that we have in our cities as well as the rural areas are the area that should be focused on and be improved so that these locations would not be an attraction for crime activities to happen.

Technological exploration have enable humans to explore the type of technological security devices currently in exist that will enable a person or an organization to effectively improve the capabilities of any security plan(Katz and Caspi 2018). Nowadays, there are devices of such specifications exist to the public market as to near confirming that it will be impossible to have access to a secured facilities without being detected and effectively intercepted before any crime occurs (Katz and Caspi 2018).

The optimization of technology usage should be implemented and growing in the aspect of public and personal security as we are moving towards in the era of globalization. This is crucial as the risks of security in every aspects of our life are in jeopardy as we move forward in the globalization timeline.

Study on crime statistics has proved that crime occurrence is not simply an event where criminals live but also reflects the focus of chances for crime to happen. Crime tend to be happening more in some places or “hot spots”, theft is increasingly focused on specific hot products, and some repeat victims are tend to be experiencing crime than other people (Roberson and Birzer 2010). They also propose that assessing opportunities that specific environment encourage for crimes to happen, can go a long path in prevention efforts.

As the saying goes, “Prevention is better than cure”, the law enforcers should really consider the implementation of technology in preventing crime. This could benefit the law enforcers in terms of their duties as it would be potentially efficient and effectively improve the result of crime prevention.

Disaster management is generally understood to consist of four phases: Mitigation, Preparedness, Response and Recovery (Zlatanova and Li 2008). Mainly, preparedness emphasizes on regular preparation within the law enforcers and rescue forces (e.g., police, ambulance, fire) for emergency situations. While all phases are interconnected and crucial, the response and recovery phase phases are regularly seen as the most critical from the aspect of saving lives.

Therefore, the law enforcers should really emphasize on responding the calls from the crime victims as soon as they received the call. Critical times such as this should be tread carefully and as fast as possible in order to reduce the after effect of a crime towards the victim(s) who have made the call.

One widely used concept in emergency response is that of the event timeline. This describes the sequence of incidents, emergency calls, responses, and actions etc. which occur during an event (Sene 2008). Timelines are used in post event assessment of response, and may also be available in real time to assist other responders in understanding the situation.

2.2 The Implementation of Mobile Application in public Safety and emergency services

For a public safety and emergency services mobile application to be effective, it has to be user-friendly, and the triggering time of the request for help has to take the least time, (P. Kalyanchakravarthy, Lakshmi et al. 2014). They further discuss on the matter that this particular feature has to be made as the crucial feature so that the emergency parties could avoid arriving late at the crime spot and thus hindering emergency help.

Therefore, this specific aspect of the mobile ‘apps’ should be taken in consideration and be made as the main goal of any personal safety mobile ‘apps’ because a crime or emergency requires help from people as fast as possible. Besides that, to avoid further harm to the victim, the emergency response by the law enforcers and other emergency institution could be improved with the existence of this mobile ‘app’.

Research has proved that, the use of mobile devices have significant impact on the duty of the law- enforcers, (Straus, Bikson et al. 2017). Moreover, the recent generations of information & communication technologies will assist the spread of technological implementation to fulfill the requirements of emergency responses and also other professional fields than the law enforcers. Therefore it is required to learn about the recent launch of technology in the field of safety to assist potential implementation and usage.

In today’s world, technology has become the most significantly developed field and it is normal for some of the industries including the security industry to implement and optimize the usage of technology to become more efficient and effective in terms of what they supply to the public, which is the tool for private (personal) security.

It is very important for the public to optimize the usage of the mobile devices in emergency situations because it would help the law enforces to extract the necessary information(s) needed for the necessary action to be taken, (Erickson, Weinert et al. 2016). According to (Columbia 2015), the essential information when one makes a phone call to report a crime are contact number, location where the crime took place and the description of people involved in that particular crime.

In order to ease the emergency help protocol, the law enforcers would need any useful information regarding the situation of the emergency, so that necessary help could be delivered to be more effective. Moreover, with this information, the emergency response could plan

additional emergency help to be delivered to the incident scene so that further harm and trauma towards the victim could be avoided.

When a victim of an emergency or criminal activity is struggling to request for help in the situation, the process of requesting help is delayed, and the victim will be too late to be helped, if it takes a long time and the longer the response time of the help will worsen the condition of the victim,(Wijaya, Setiawan et al. 2013). Besides that, delayed response from the law enforcers and emergency help could result in a more severe harm to the victim of crime(Wijaya, Setiawan et al. 2013).

An instant response by the law enforcers towards delivering help during emergency could be a major factor avoiding potential harm towards the victims. For an effective emergency help to occur, emergency institutions have to be prepared all the time in the case of any call from a potential victim.

In a research by (Westmarland, Hardey et al. 2013), they explore the significance of smartphone usage in relation to domestic and sexual violence behaviour. Their findings concluded that, most of the existing personal safety mobile ‘apps’ has a quite similar main functionality which was built on system architecture with a form of ‘panic button’ in their respective ‘apps’. Moreover, based on their tests, they found the benefits of information and proof gathering capabilities and their value towards the law enforcers once the law enforcers have received them.

With the significant advancement of smartphone technology nowadays, ‘apps’ developers should consider exploring more potential of smartphones towards the personal safety aspect. Besides that, ‘apps’ developer should make use and optimize the existing functionalities in the smartphones or mobile phones such as the GPS function, camera, audio recorder, and etc. and implementing these functionalities towards the objective of personal safety.

While women regularly become the victim(s) in criminal situation, (Mandapati, Pamidi et al. 2015), gender shouldn't be the argument in the case of personal safety. Crime and disaster happens to everyone without considering which gender they are.

Besides that, not only women and men are affected with personal safety issues, children and golden ages society are too affected by this issue. Therefore, we should always consider every level of the society when discussing the matter such as this.

As stated by (Ramalingam, Dorairaj et al.), security threat can occur anywhere at any time. Therefore, it is important for people to be prepared in case of anything bad should happen to them. In terms of preparedness, pepper spray and stun gun is a good example of self- defense tools that have been implemented for quite some time, but the usage of mobile phones in terms of personal safety is not very regularly heard of.

These statements are pivotal in ensuring that the aspect of personal safety should be taken in consideration heavily by everyone for them to realize the importance aspect of preparedness towards crime and the potential of mobile phone usage in the terms of ensuring personal safety in the modern era.

The objective for each location based information system is: "To assist with the exact information, at right place in real time with personalized setup and location sensitiveness" (Kushwaha and Kushwaha 2011). The research regarding location based services emphasizes on the need of accessing the essential information of potential threats such as seeing a suspicious car that has been reported missing and the ability to check the legitimacy of the car in a trusted public database.

Further application of location based services can be potentially implemented in the case of personal safety issue. Law enforcers could benefit the information of the exact location which

the is sent by the victims and plan ahead on which emergency help could be used can effective to response to the emergency requests.

Another in built functionality of most smartphones in the market is the accelerometer. Android proved to be a versatile processing system which allow us to manipulate various in built feature of an Android mobile which can be developed into various applications in life (Nirbhavane and Prabha 2014). The growing displays and internet connectivity also makes these phones excellent sinks of just-in-time information, including information from other sensors deployed in the infrastructure (Yu, Bamis et al.).

As mentioned in earlier paragraph of this section, manipulation of in built functionalities in smartphones should be a major development effort for any 'apps' developer. This is because, it would be a waste if these in built features are not being enhance further as it would bring so many benefits to the society including in the aspect of personal safety.

2.3 Evolution of Mobile Applications in Public Safety and Emergency Services:

2.3.1 Early Adoption of Mobile Technology

Adoption is the result of a decision-making process whereby an individual, group, or organization engages in activities that lead to a decision to use an innovation (Rogers 2015). Today's advanced devices combine communication and computing into a multipurpose gadget that provides users with various types of services (Bergman 2020). Furthermore, they have a one-to-one binding with the user, offer ubiquitous access, and provide a set of utilitarian and hedonic functions (Hong and Tam 2006). With this definition, we consider mobile services and applications as part of advanced mobile devices.

Since the early 1990s, research on mobile devices has gained increased attention, as these devices were expected to "revolutionize many aspects of everyday life in the Western world" (Green et al. 2001, p. 146). Adoption research has typically been centered on studies of either the

artifact being adopted or the user setting. While adoption research in general has been criticized for lack of attention to the attributes of the adopted devices and services (Orlikowski and Iacono 2001), few studies have considered the mobile artifact as an object of expression (Chuang et al. 2001) and related mobile device design issues (Lee and Benbazat 2018; Tarasewitch 2018).

Historically, the majority of mobile users acquired their device through work, although this did not prevent private and leisure usage (Fisher 1994). Early studies have, therefore, in general studied mobile adoption in organizations, for example, changes in organizational structure (Meehan 1998) and effects on the divide between work and leisure (Nippert-Eng 1996). Later work has also studied the blurring of work- and leisure-related functions of the mobile device (Palen et al. 2001) and the possibilities of business-to-business e-commerce (Wang and Cheung 2004). More recently, the focus has increasingly shifted toward individual adoption, as the mobile device has become the personal information-processing interface of choice. Studies are now concerned with the commercial possibilities, e.g., how mobile commerce exposure influences adoption (Khalifa and Cheng 2002); how users create value when adopting mobile banking services (Laukkanen and Lauronen 2005); and which factors induce users to accept mobile devices to communicate promotional content (Bauer et al. 2005).

In 2005, Google acquired Android from Android Inc. which was found in year 2018 by Andy Rubin and they dealt with developing software for mobile devices. Later, OHA which comprises of 79 companies along with Google developed their new mobile platform for mobile devices. This alliance was formed so as to develop open technologies for mobile devices and make those applications easily available in the market. This new open source technology was named as **Android**

2.3.2 Real-time Alerts and Notifications:

Real-time alerts and notifications are immediate and time-sensitive messages or signals that convey critical information to individuals or groups.

According to a Clark School study at the University of Maryland, every 39 seconds, a cyberattack occurs somewhere on the Web. This means an organization's systems suffer an attack dozens of times while its IT support team is on a quick break. As such, it is crucial to have a robust alert management platform that ensures critical alerts are received no second later. Otherwise, delayed alerts also mean a delayed response, giving attackers more time and opportunities to wreak havoc or steal confidential data. To avoid this issue, IT security teams now leverage live event notifications or real-time alerts in their incident response plan (IRP). Read on to understand what these alerts entail and their role in an organization's.

2.3.3 Geolocation Services:

Geolocation Service is one of the popular applications in the field of mobile Internet. The mapping process takes the software development method and the Essence framework as inputs and produces "essentialized" model as an output in the Essence language.

Most people today use mobile phone to navigate around the world. Many of users are using applications that providing directions, places or other information that are based on the current location Ibach, P., & Horbank, M. (2005).

Location of smart phone can be easily identified due to special internally equipped chip that support the Global Positioning System (GPS). Using GPS along with Google map can help the user to discover then ear by bookshops, restaurants, etc… Tanenbaum, Andrew S., (2011).

These applications either be navigation systems, find nearby places or display locations on a map. However, online map applications do not support the ability to add or delete a specified location. To support this goal, we provide a systematic approach for mapping methods to the

elements of the Essence framework. To illustrate our approach, we use the mapping API of the Google maps.

2.3.4 Two-way Communication:

Mobile apps designed for public safety often incorporate two-way communication features, enabling users to report emergencies, send distress signals, or request assistance. Likewise, emergency services can respond, track, and coordinate their efforts efficiently through these applications. This fosters a more collaborative approach to crisis management.

CHAPTER THREE

METHODOLOGY

3.1 QUALITATIVE RESEARCH METHODOLOGY

The qualitative research methodology is chosen and implemented by the author for the purpose of this study:

3.1.2 REVIEW EXISTING STUDY BY OTHER RESEARCHERS

Several journal articles, newspaper articles, and books were referred in this study to get a clear and more in depth knowledge regarding the subject mattered. This approach is necessary for the author to determine whether the chosen topic of study is feasible or not.

3.2 EXISTING SYSTEM

In 2014, the government approved '112' as Nigeria's toll-free emergency number for fielding and dispatching distress calls. A number Nigerians could call to get a swift response from health, security, and other services. Call centers came much later and by 2019, 18 call centres were made operational around the country. In 2016, Nigeria developed a policy on Emergency Medical Services (EMS). Its goal was to coordinate and integrate emergency medical services in Nigeria with the aim of ensuring a systematic implementation of the National Health Act 2014, among other things. The EMS policy should be reviewed every 5 years. Therefore, a review was due in 2021.

In a bid to boost emergency response, government recently launched a new initiative, the National Emergency Medical Service and Ambulance System (NEMSAS). The emergency system will be operated by the Federal Ministry of Health (FMoH) in collaboration with the Federal Road Safety Corps (FRSC), Nigerian Communications Commission (NCC), National Health Insurance Scheme (NHIS), Guild of Medical Directors (GMD) and other private sector

partners. The aim is to provide urgent health service to Nigerians at the point of distress, with no cost at the point of care within the first 48 hours.

3.3 WHY PEOPLE DO NOT USE THE EXISTING SYSTEM

Out of 103 persons who participated in the Twitter poll asking why they do not use the 112 emergency number, 8.7 percent said that they do not use the Nigerian emergency number because they do not trust the operators to answer. 49.5 percent do not use it because they think the number is not functional, while 41.7 percent of the participants do not use it because they are not aware that an emergency number is in existence.

Hum Angle conducted another poll asking Nigerians who they would rather contact during an emergency situation, and of the 88 people that participated in the poll, only 4.5 per cent said they would contact the Nigerian emergency while the other 95.4 per cent said they would rather contact family or neighbours for an emergency.

In a poll on other social media platforms, it was deduced that while some persons are completely unaware of the number's existence, some others are aware but do not bother to try because they lack faith in the system.

3.4 CHALLENGES AND PROBLEMS OF THE EXISTING SYSTEM:

Lack of Awareness: Many Nigerians were not aware of the 112 emergency number, leading them to continue using the older emergency numbers.

Inconsistent Response Times: Inefficient coordination and limited resources led to slow response times in many cases.

Inadequate Training: Operators and emergency responders may not have received proper training, affecting their ability to handle emergencies effectively.

3.5 Research Questions:

i. What are the specific needs and requirements of emergency responders for a mobile application to improve their response times and effectiveness in emergency situations?
ii. How can the public be best engaged and educated through a mobile app to enhance their preparedness and safety awareness?
iii. What are the most critical features and functionalities that should be integrated into a public safety mobile app, such as real-time communication, geolocation services, or emergency alerts?
iv. What are the potential challenges and limitations in implementing a mobile app for emergency services, such as interoperability with existing systems or data security concerns?

3.6 Expected Outcomes:

i. Improved response times and coordination among emergency services through the mobile app, leading to more efficient and effective crisis management.
ii. Increased public awareness and preparedness for emergencies, potentially resulting in a reduction in the number of casualties and property damage during disasters.
iii. Enhanced communication and information sharing among emergency responders, including real-time tracking.

3.7 OVERVIEW OF NEW SYSTEM DESIGN

The Public Safety and Emergency Services Mobile App is a cutting-edge application designed to provide rapid response and support during emergency situations. This mobile app is aimed at both the general public and emergency service providers to enhance the coordination, communication, and accessibility of critical services.

3.7.1 KEY FEATURES:

User Registration and Authentication:

- Users can create an account or log in securely using personal credentials.

User Profile Management:

- Users can maintain their profile information, including personal details and emergency contacts.

Emergency Reporting:

- Users can report a wide range of emergencies, such as medical incidents, fires, or criminal activities.
- The app automatically detects the user's location to ensure accurate response.

Real-time Communication:

- Users can establish direct communication with emergency services via text or voice calls within the app.
- Dispatchers can provide instructions or updates in real-time.

Emergency Services Dispatch:

- Dispatchers receive, process, and manage emergency requests.
- They have access to the user's location and can coordinate responses effectively.

3.7.2 BENEFITS:

Rapid Response: The app reduces response times by providing real-time communication and accurate location information.

Enhanced Coordination: Emergency services can efficiently coordinate and manage resources.

User Empowerment: Users have a powerful tool for accessing help and information during emergencies.

Public Awareness: The app promotes public awareness and preparedness for various emergency situations.

3.8 Development Methodology

Developing a mobile application for public safety and emergency services requires a comprehensive methodology to ensure it’s effective and reliable. Here's a step-by-step development process:

1. **Technology Stack Selection:**
    I. Choose the appropriate technology stack based on the platform (iOS, Android, or cross-platform) and the application's requirements.
    II. Consider factors like scalability, security, and compatibility with existing systems.
2. **Development:**
    I. Begin the development phase, adhering to agile or iterative development methodologies to allow for flexibility and continuous improvement.
    II. Implement core features and functionalities, focusing on reliability and security.
3. **Integration of Data Sources:**
    I. Integrate relevant data sources, such as Geographic Information Systems (GIS), and emergency databases, to provide real-time and accurate information.
    II. Ensure data accuracy, consistency, and security.
4. **Testing and Quality Assurance:**
    I. Conduct thorough testing, including functional testing, usability testing, security testing, and performance testing.
    II. Address and rectify any identified bugs, vulnerabilities, or usability issues.

5. **Geolocation Services Integration**

   I. Implement geolocation services (GPS, Wi-Fi, or cell tower triangulation) for precise location detection during emergencies.

6. **Emergency Reporting Features:**

   I. Create features for users to report emergencies, including selecting the type of emergency and providing additional details.

7. **Real-time Communication:**

   i. Incorporate real-time communication features, allowing users to communicate directly with emergency dispatchers and responders within the app.

8. **Data Security and Privacy:**

   I. Implement strong security measures to protect user data and ensure secure communication between users and emergency services.

3.9 Tools and Equipment

3.9.1 Hardware

- Laptop for software IDE installation platform
- Smartphones (android phone) or emulator for mobile application testing.

3.9.2 Software

- Android Studio and visual studio code that support flutter, web-application development language and other programming language.

3.9.3 Programming Language

- Flutter (dart framework), Node Js, Socket I.O

3.9.4 Database

- Mongo Db

3.10 DESIGN MODELS:

i. **User Interface (UI) Model:**

Home Screen: The main screen with prominent buttons for quick access to emergency services.

Navigation: A clear and simple menu to access different features.

Emergency Contact List: A directory of emergency contacts.

Incident Reporting: A feature for users to report emergencies with relevant information.

ii. **Security Model:**

User Authentication: Implement secure user authentication, including biometrics or multi-factor authentication.

Privacy Settings: Allow users to control their data and privacy settings.

Secure Data Storage: Safeguard user data against unauthorized access.

iii. **Real-time Communication Model:**

Chat Services: Enable real-time chat with emergency responders.

Push Notifications: Send push notifications to update users on the status of their emergency requests.

Emergency Broadcasts: Allow authorities to broadcast important information or alerts to app users.

iv. **Incident Reporting Model:**

Multimedia Attachments: Let users attach photos, videos, or audio recordings when reporting incidents.

Categorization: Allow users to categorize the type and severity of incidents.

Incident Tracking: Provide a way for users to track the progress of their reported incidents.

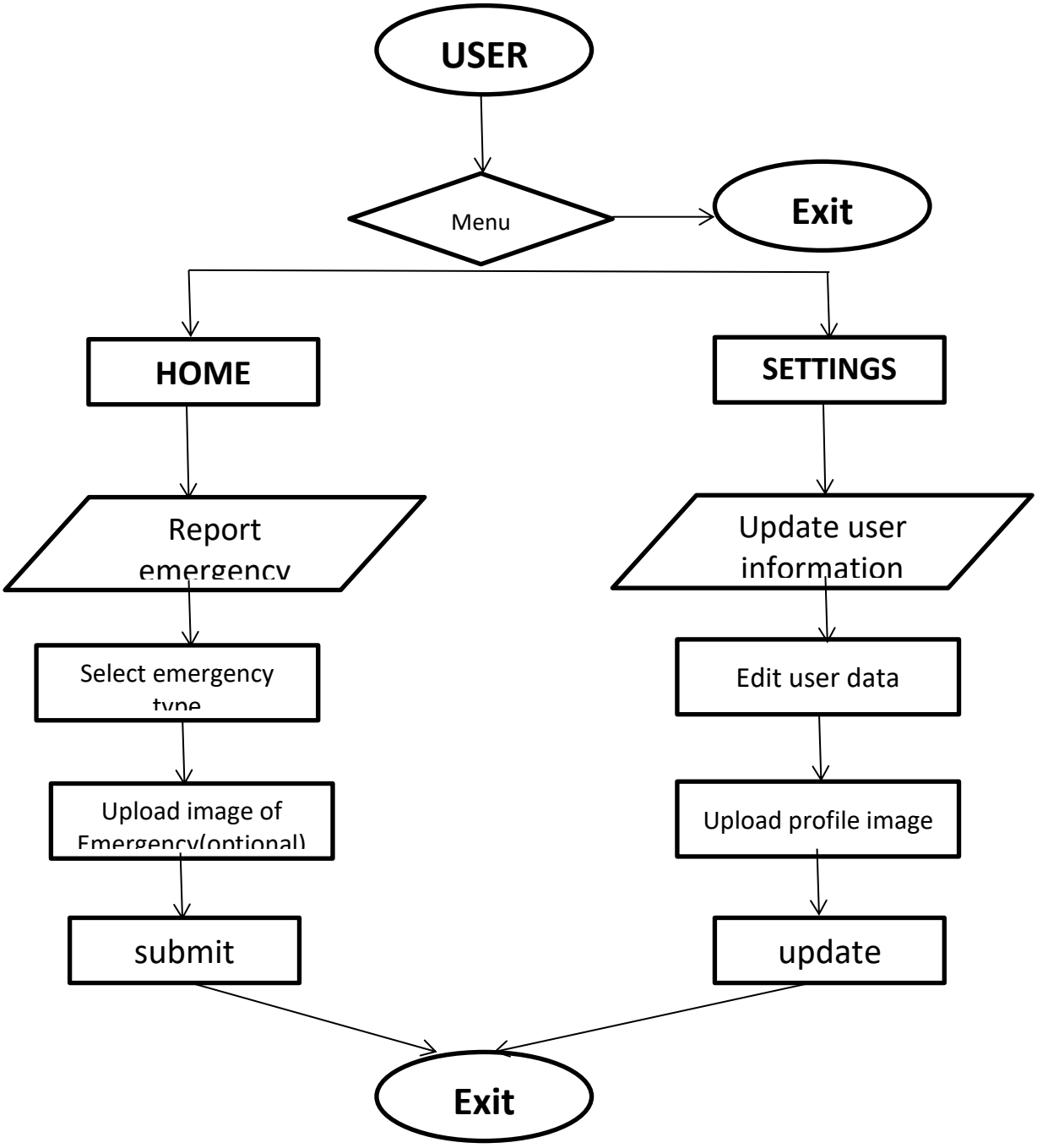

Fig 1.0 System architecture of mobile application

Orlikowski, W.J., and C.S. Iacono, "Research commentary: Desperately seeking the "IT" in IT research a call to theorizing the IT artifact," Information Systems Research, 2001, 12, pp. 121–134.

Laukkanen, T., and J. Lauronen, "Consumer value creation in mobile banking services," International Journal of Mobile Communications, 2005, 3:4, pp.325–338.

Nippert-Eng, C., Home and Work: Negotiating Boundaries through Everyday Life, Chicago IL: University of Chicago Press, 1996.

Oestreicher-Singer, G., and A. Sundararajan, "Recommendation networks and the long tail of electronic commerce," Mimeo, New York University, 2008.

Palen, L., M. Salzman, and E. Young, "Discovery and integration of mobile communications in everyday life," Personal and Ubiquitous Computing, 2001, 5:2, pp. 109–122.

Khalifa, M., and S.K.N. Cheng, "Adoption of mobile commerce: Role of exposure," in Proceedings of the 35th Hawaii International Conference on System Sciences, 2002, pp 1–7.

Meehan A., "The impact of Mobile Data Terminal (MDT) Information Technology on communication and recordkeeping in patrol work," Qualitative Sociology, 1998, 21, pp. 225–254.

Ibach, P., & Horbank, M. (2005). Highly available location based services in mobile environments. In Service Availability (pp. 134-147) Springer Berlin Heidelberg.

Ibach, P., & Horbank, M. (2005). Highlyavailable location-based services in mobile environments. In Service Availability (pp. 134-147). Springer Berlin Heidelberg.

https://www.sendquick.com/real-time-alerts-and-their-role-in-incident-response-planning/

Katz, D. S. and I. Caspi (2018). Executive's Guide to Personal Security.

Roberson, C. and L. M. Birzer (2010). Introduction To Private Security Theory Meets Practice, Prentice Hall.

Kushwaha, A. and V. Kushwaha (2011). "LOcation Based Services Using Android Mobile Operating System." International Journal of Advance in Engineering & Technology: 7.

Mandapati, D. S., et al. (2015). "A Mobile Based Women Safety Application (I Safe Apps)." IOSR Journal of Computer Engineering (IOSR-JCE) **17**(1): 6.

Nirbhavane, M. and S. Prabha (2014). "Accident Monitoring System using Wireless Application." **3**(4): 4.

Erickson, P., et al. 2016 "Designing Public Safety Mobile Applications for Disconnected, Interupted, and Low Bandwidth Communication Environments." 7.

P.Kalyanchakravarthy, et al. (2014). "Android Based Safety Triggering Application." International Journal of Computer Science and Information Technologies **5**(1): 2.

Ramalingam, A., et al. "Personal Safety Triggering System on Android Mobile Platform." 19.

Roberson, C. and L. M. Birzer (2010). Introduction To Private Security Theory Meets Practice, Prentice Hall.

INFOHOWN (2012). "Emergency Response Time." from http://www.infohow.org/statistics/emergency-response-time/.

Straus, S. G., et al. (2017). "Mobile Technology and Action Teams: Assessing BlackBerry Use in Law Enforcement Units." RAND: 10.
TDAXP (2017). "DREAMING 5GW, PART III: LESSONS FROM SOFTWARE DEVELOPMENT." from http://www.tdaxp.com/archive/2017/07/28/dreaming-5gw-part-iii-lessons-from-software-development.html.
Westmarland, N., et al. (2013). "Protecting Women's Safety? The use of smartphone 'apps' in relation to domestic and sexual violence." 6.
Whitzman, C., et al. (2013). Building Inclusive Cities
Women's safety and the right to the city, Routledge.
Wijaya, W., et al. (2013). "Pengembangan Sistem Notifikasi Situasi Darurat Personal Berbasis Android dengan Global Positioning System sebagai Solusi Alternatif Penanganan Keselamatan bagi Masyarakat." JURNAL TEKNIK POMITS **2**(1): 6.
Yu, A., et al. "Personalized Awareness and Safety with Mobile Phones as Sources and Sinks." 5.
Zlatanova, S. and J. Li (2008). Geospatial Information Technology for Emergency Response.