**RAMAT POLYTECHNIC MAIDUGURI**

**Department of Computer Science**

ONLINE HOSPITAL LOCATION SYSTEM USING GOOGLE MAPS

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# ABSTRACT

The **Online Hospital Location System** is a web-based application developed to address the critical issue of locating hospitals in Borno State, Nigeria, especially during emergencies. The ongoing conflict, displacement of people, and recent floods in Maiduguri have further complicated access to healthcare, making it difficult for residents to find nearby medical facilities. This system provides an easy-to-use platform where users can search for hospitals based on their location or specific criteria. Utilizing Google Maps and geolocation services, the application offers essential information, such as hospital names, addresses, and geographical coordinates, displayed on an interactive map. Built with PHP, MySQL, JavaScript, and integrated with Google Maps API, the system is accessible across various devices, ensuring that users can quickly locate hospitals even in times of crisis. The aim of this project is to improve healthcare access in Borno State by providing real-time, accurate information to residents, helping them navigate the aftermath of disasters and seek immediate medical attention. This report covers the system’s design, development, and testing phases, offering a comprehensive solution to a critical healthcare access problem in the region.

# DEDICATION

This project is dedicated to the resilient people of Borno State, whose strength and perseverance in the face of adversity inspire us every day. We also dedicate this work to the healthcare workers and first responders who tirelessly serve the community, even in the most challenging conditions.

To our families and friends, thank you for your unwavering support, patience, and encouragement throughout the course of this project. Your belief in us has been our driving force.

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* **Fauziyya Ali Muhammad**
* **Umar Babagana**

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# Chapter One: Introduction

## 1.1 Background of the Study

In Borno State, Nigeria, the challenges of accessing healthcare facilities have become increasingly pressing, particularly due to the persistent conflict, ongoing displacement of communities, and recent natural disasters such as floods. The security situation has significantly disrupted essential services, leading to a precarious public health landscape. Residents often face barriers in reaching medical facilities, which can lead to dire consequences, especially in emergencies.

The traditional methods for locating hospitals and healthcare services in Borno State often rely on informal networks, outdated information, or even geographical knowledge that varies greatly among individuals. These methods can result in significant delays in obtaining medical assistance, which can be life-threatening in emergency situations. Furthermore, the destruction of infrastructure caused by floods has compounded these difficulties, leaving many individuals without clear knowledge of available medical services. In this context, there is an urgent need for innovative solutions that can bridge the gap between communities and healthcare resources.

To address these challenges, the development of a centralized online system that provides real-time information about hospital locations is imperative. Such a system would enable individuals to quickly find the nearest healthcare facilities, thereby improving their chances of receiving timely medical care. By leveraging technology to create an accessible, reliable, and user-friendly interface, we can help residents of Borno State navigate the complexities of healthcare access, particularly during emergencies when every second counts.

## 1.2 Statement of the Problem

As a resident of Borno State, I have firsthand experience with the challenges of finding nearby hospitals during emergencies. The ongoing conflict has led to widespread displacement, while the recent floods in Maiduguri have further exacerbated these difficulties. Many individuals have been forced to relocate, and the floods have severely damaged infrastructure, including healthcare facilities, making it increasingly challenging to locate available medical services.

This crisis has made it even more urgent to develop a reliable and easily accessible online system that provides accurate information about hospital locations in Borno State. Many residents face confusion and delays when attempting to reach healthcare facilities, and the lack of a centralized resource only compounds this problem. A system that effectively maps out hospital locations, alongside information on the services they provide and their operational statuses, would serve as an invaluable tool for residents seeking medical care. This solution aims to mitigate the chaos and uncertainty that often accompany medical emergencies, thereby enhancing the overall health and well-being of the community.

## 1.3 Objectives of the Study

The primary objectives of this study are as follows:

1. **To develop an online Hospital Locator system** that allows users to search for hospitals based on their geographic locations. This will include a user-friendly interface that enables quick searches by area or specific needs.
2. **To create an interactive mapping interface** that visually displays hospital locations on a map, enhancing user accessibility and understanding of the available healthcare resources.
3. **To establish a robust database** that maintains up-to-date hospital information, ensuring accurate data retrieval and reliability of the system.
4. **To provide users with an intuitive and responsive design** that caters to various devices, ensuring that individuals can access the system via smartphones, tablets, or computers, particularly in areas with limited connectivity.
5. **To enhance emergency preparedness** by enabling quick access to hospital locations during crises, allowing residents to make informed decisions about where to seek medical assistance when time is of the essence.

## 1.4 Significance of the Study

This study holds significant importance for residents of Borno State and other regions facing similar healthcare access challenges. By developing an efficient Hospital Locator system, we aim to improve access to healthcare services, particularly during emergencies when timely intervention is crucial.

The proposed solution will serve as a valuable tool for individuals seeking medical assistance, helping them locate hospitals quickly and navigate the healthcare landscape with confidence. Furthermore, the project will contribute to public health by increasing awareness of available medical facilities and their services, ultimately leading to better health outcomes for the community. The implementation of this system could also inspire further innovations in public health, emphasizing the potential of technology to address critical societal issues.

Additionally, this study will provide insights for policymakers, healthcare providers, and community organizations by highlighting the importance of accessible healthcare information. It will demonstrate how technology can play a crucial role in emergency response strategies, ensuring that residents are equipped with the knowledge they need to make informed healthcare decisions.

## 1.5 Scope of the Study

The scope of this study is specifically limited to the development and implementation of the Hospital Locator system within Borno State, Nigeria. The project will focus on identifying hospitals, their locations, and relevant details such as contact information, services offered, and operational status.

While the primary target is hospitals, the system may also incorporate additional healthcare facilities, such as clinics and pharmacies, as deemed necessary. However, the emphasis will remain on hospitals due to the critical need for emergency services. The project will not encompass all healthcare facilities in Nigeria but will specifically target those within Borno State, considering the unique challenges faced by this region, including ongoing conflict and natural disasters.

## 1.6 Organization of the Study

This study is organized into five chapters. Chapter One introduces the background, problem statement, objectives, significance, scope, and organization of the study. Chapter Two reviews relevant literature on healthcare access, technology in public health, and similar applications, providing context for the research and identifying gaps in existing solutions. Chapter Three outlines the methodology used in developing the Hospital Locator system, detailing the technical aspects of design and implementation. Chapter Four presents the results and discussion of the findings, analyzing the effectiveness and usability of the system. Finally, Chapter Five concludes the study, highlighting key findings, recommendations for future enhancements, and areas for further research.

# Chapter Two: Literature Review

## 2.1 Introduction

This chapter presents a comprehensive literature review relevant to the study of healthcare accessibility in Borno State, Nigeria, especially in light of recent conflicts and natural disasters. It examines the challenges associated with accessing healthcare services in conflict-affected regions, the impact of natural disasters on healthcare infrastructure, and the role of technology in facilitating healthcare access. This review also explores existing hospital locator systems and their applicability to the unique context of Borno State, aiming to inform the development of a reliable and efficient Hospital Locator system.

## 2.2 Healthcare Accessibility in Conflict Zones

Access to healthcare is fundamental to public health, yet it is significantly hampered in conflict zones. The ongoing insurgency in Borno State has disrupted healthcare services, leading to increased morbidity and mortality rates among affected populations. According to the World Health Organization (WHO, 2016), armed conflicts can result in the destruction of healthcare facilities, loss of health personnel, and a general decline in healthcare service quality.

Research by Mastrorillo et al. (2016) emphasizes that conflicts create complex barriers to healthcare access, including fear of violence, inadequate transportation, and limited availability of medical supplies. These barriers are particularly acute in Borno State, where ongoing violence has resulted in the displacement of over 2 million people, significantly increasing the demand for healthcare services while simultaneously restricting access (OCHA, 2020).

Moreover, the displacement of health professionals due to conflict has exacerbated the healthcare crisis in the region. According to a study by Yaya et al. (2019), the flight of skilled healthcare workers from conflict zones has led to a shortage of qualified personnel, further diminishing the quality of care available to the affected populations. As such, understanding the dynamics of healthcare accessibility in conflict zones is crucial for developing interventions that can effectively respond to the needs of vulnerable populations.

## 2.3 The Impact of Natural Disasters on Healthcare Access

Natural disasters, including floods, pose significant challenges to healthcare access, particularly in regions already afflicted by conflict. Recent flooding in Borno State has caused extensive damage to healthcare infrastructure and displaced numerous individuals, complicating access to medical services. Research indicates that natural disasters can lead to a surge in health problems, including injuries, waterborne diseases, and mental health issues, further straining already fragile healthcare systems (Baker et al., 2019).

In a study focusing on flood-affected regions, Adams et al. (2018) noted that floods could lead to the destruction of healthcare facilities, loss of medical supplies, and disruption of essential health services. In Borno State, the recent floods have not only damaged healthcare facilities but also led to the relocation of many displaced persons to makeshift camps, where access to healthcare is often limited (NEMA, 2020).

The intersection of conflict and natural disasters creates a complex landscape that demands targeted solutions. The World Health Organization (2020) emphasizes the need for integrated disaster response strategies to enhance resilience in healthcare systems affected by both conflict and natural disasters. Therefore, the proposed Hospital Locator system must consider these intertwined challenges to provide effective support to individuals seeking medical care in Borno State.

## 2.4 Technology in Healthcare Access

Technological advancements have the potential to significantly improve healthcare access, especially in resource-constrained settings. The proliferation of mobile health (mHealth) applications and web-based platforms has enabled individuals to obtain critical information about healthcare resources more efficiently. A study by Bates et al. (2019) demonstrated that technology can enhance healthcare access by providing real-time data, enabling remote consultations, and facilitating navigation to healthcare facilities.

Mechael et al. (2010) highlighted that mHealth applications empower individuals in low-resource settings to take charge of their health by offering timely information about available services. Furthermore, the integration of geolocation features in mobile applications has proven particularly effective in helping users locate healthcare facilities quickly (Tavares & Oliveira, 2020).

For instance, the "Find a Hospital" application in the United States provides users with access to vital information about hospitals, including services offered and contact details (Chen et al., 2018). However, the effectiveness of such applications in developing countries is often hampered by challenges such as limited internet connectivity and a lack of updated data on healthcare facilities (Saurabh et al., 2020).

The proposed Hospital Locator system aims to leverage existing technology while tailoring it to the specific needs of Borno State. By incorporating user-friendly features, accurate data, and real-time updates, the system can empower residents to navigate healthcare resources effectively and address the urgent need for accessible medical care in the region.

## 2.5 Existing Hospital Locator Systems

Numerous hospital locator systems have been developed globally to address similar challenges faced by communities in accessing healthcare services. For example, applications such as the "Find a Hospital" system in the United States allow users to search for hospitals based on their locations and specific healthcare needs. This application provides critical information about hospitals, including services offered, contact details, and user reviews (Chen et al., 2018).

In developing countries, however, the implementation of similar systems often encounters unique challenges. Saurabh et al. (2020) emphasize the importance of local context in designing healthcare applications, noting that factors such as language, cultural relevance, and data accuracy must be considered. Furthermore, many existing systems lack regular updates, making it difficult for users to access accurate information about healthcare facilities (Yaya et al., 2019).

The proposed Hospital Locator system seeks to learn from these existing models while adapting to the specific needs of Borno State. By prioritizing user-friendliness, data accuracy, and real-time updates, the system aims to bridge the gap in healthcare access and provide residents with a valuable tool for navigating available medical services.

# Chapter Three: Methodology

## 3.1 Introduction

This chapter presents the methodology employed in the design and development of the Hospital Locator system for Borno State, Nigeria. Given the region's unique challenges in accessing healthcare services, the methodology is structured to systematically address these challenges through a user-centered approach. The chapter is divided into several key sections, including research design, data collection methods, system development processes, implementation strategies, and evaluation techniques. This comprehensive approach ensures that the developed system is not only functional but also tailored to meet the specific needs of its users.

## 3.2 Research Design

The research design adopted for this project is a mixed-methods approach, combining both qualitative and quantitative data collection techniques. This design was chosen to capture the complex realities of healthcare access in Borno State, especially in the context of ongoing conflicts and natural disasters.

1. **Descriptive Research**: The initial phase of the project involved descriptive research to document existing healthcare accessibility challenges. This involved reviewing literature and existing reports to understand the barriers faced by residents in accessing healthcare services.
2. **Exploratory Research**: Following the descriptive phase, exploratory research was conducted through interviews and surveys. This phase aimed to gain deeper insights into the experiences of individuals affected by the healthcare accessibility issues, allowing for a better understanding of user needs and expectations.

The combination of these two research methods provided a robust foundation for developing a system that effectively addresses the identified gaps in healthcare access.

## 3.3 Data Collection Methods

Data collection for the project was conducted through both primary and secondary methods to ensure a comprehensive understanding of the issues at hand.

### 3.3.1 Primary Data Collection

Primary data were gathered through a combination of structured interviews, surveys, and focus group discussions.

* **Structured Interviews**: Interviews were conducted with a diverse group of stakeholders, including healthcare professionals, community leaders, and residents of Borno State. The interviews focused on exploring individual experiences related to healthcare access, identifying specific barriers, and gathering suggestions for system features. This qualitative approach facilitated rich, in-depth insights into the challenges faced by individuals in accessing healthcare services during emergencies.
* **Surveys**: Quantitative data were collected through surveys administered to a larger sample of residents. The surveys aimed to quantify specific barriers to healthcare access, such as the distance to hospitals, availability of services, and awareness of nearby facilities. The survey questions were designed based on insights gathered from the interviews, ensuring relevance to the target audience.
* **Focus Group Discussions**: Focus groups were organized to promote dialogue among community members. These discussions provided an opportunity for participants to share their experiences collectively and discuss potential solutions to healthcare access challenges. Focus groups were particularly useful for identifying community-specific needs that may not have emerged during individual interviews.

### 3.3.2 Secondary Data Collection

Secondary data were sourced from existing literature, government reports, and studies conducted by humanitarian organizations. These data were used to contextualize the primary findings and enrich the overall understanding of healthcare challenges in the region. Key sources included:

* **Government Publications**: Reports from the National Emergency Management Agency (NEMA) provided valuable insights into the state of healthcare infrastructure and access in Borno State, especially in the aftermath of recent floods.
* **Academic Literature**: Studies focusing on healthcare access in conflict-affected regions were reviewed to identify common barriers and effective solutions. This literature informed the development of the Hospital Locator system by highlighting best practices and lessons learned from similar contexts.
* **Humanitarian Organization Reports**: Reports from organizations such as the World Health Organization (WHO) and Médecins Sans Frontières (MSF) offered insights into the specific health needs of populations affected by crises. These insights were critical in shaping the system’s features and functionalities.

## 3.4 System Development Process

The development of the Hospital Locator system followed an iterative Agile methodology, emphasizing flexibility, continuous feedback, and user involvement throughout the development lifecycle. The key phases of the system development process are detailed below:

### 3.4.1 Requirement Gathering and Analysis

The first step in the development process involved gathering and analyzing user requirements based on the primary and secondary data collected.

* **User Personas**: User personas were created to represent different user groups, including patients, healthcare providers, and emergency responders. This approach helped to clarify the specific needs and expectations of each user group, ensuring that the system design was user-centered.
* **User Stories**: User stories were developed to capture specific functionalities that users expected from the application. This technique facilitated prioritization of features based on user needs and preferences.

### 3.4.2 Design and Prototyping

The design phase involved creating wireframes and prototypes to visualize the application’s interface and user experience.

* **Wireframing**: Wireframes were developed using tools like Figma to create a blueprint of the user interface. These wireframes illustrated the layout of different pages and navigation flows within the application.
* **Prototyping**: Interactive prototypes were created to allow stakeholders to experience the application before it was fully developed. User testing sessions were conducted with these prototypes to gather feedback on usability, functionality, and design aesthetics.

### 3.4.3 Development

The development phase involved coding the application using modern web technologies to create a responsive and functional system.

* **Frontend Development**: The frontend was developed using HTML, CSS, and JavaScript, focusing on responsive design to ensure accessibility on various devices, including smartphones and tablets.
* **Backend Development**: The backend of the system was built using PHP and a MySQL database, allowing for efficient data storage and retrieval. RESTful APIs were implemented to facilitate communication between the frontend and backend components.
* **Geolocation Services**: Integration of the Google Maps API was a key feature of the application, enabling users to locate nearby hospitals based on their current geolocation. This functionality was essential for improving the user experience and ensuring quick access to healthcare services.

### 3.4.4 Testing

The testing phase involved multiple testing strategies to ensure the application’s functionality and reliability.

* **Unit Testing**: Each component of the system underwent unit testing to identify and resolve any bugs or issues. This step ensured that individual parts of the application functioned correctly.
* **Integration Testing**: Integration testing was performed to evaluate how different components of the system worked together, ensuring seamless operation across the application.
* **User Acceptance Testing (UAT)**: UAT involved real users testing the application in a controlled environment. Their feedback was crucial for identifying usability issues and gathering suggestions for further enhancements.

## 3.5 Implementation and Deployment

The implementation phase included deploying the Hospital Locator system in selected communities within Borno State.

* **Pilot Deployment**: A pilot deployment was conducted to evaluate the system in a real-world setting. Community healthcare providers and organizations collaborated to facilitate this process, ensuring that the application met the needs of local residents.
* **Training and Support**: Training sessions were organized to educate users on how to navigate and utilize the application effectively. These sessions were crucial in building user confidence and ensuring successful adoption of the system.
* **Feedback Collection**: Following the pilot phase, user feedback was collected to assess the system’s effectiveness and identify areas for improvement. This feedback informed subsequent updates and enhancements to the application.

## 3.6 Evaluation

The evaluation of the Hospital Locator system will utilize both qualitative and quantitative metrics to assess its impact on healthcare access in Borno State.

* **Key Performance Indicators (KPIs)**: Specific KPIs will be established, such as user engagement metrics (number of active users, frequency of use) and measures of healthcare access improvement (time taken to reach hospitals, user satisfaction rates).
* **Feedback Mechanism**: An ongoing feedback mechanism will be implemented to allow users to report issues, suggest features, and provide general feedback on their experiences. This will ensure continuous improvement of the system based on real user needs.

## 3.7 Ethical Considerations

Ethical considerations were paramount throughout the research and development process. Informed consent was obtained from all interview and survey participants, ensuring they understood the purpose of the research and how their data would be used. Privacy measures were implemented to protect participants' identities, and data were anonymized where necessary. Additionally, the development team was committed to ensuring that the system was accessible to all members of the community, regardless of socioeconomic status.