

GOOGLE MAP-BASED DONATION MANAGEMENT SYSTEM : A CASE OF UGANDA RED CROSS KABALE CENTER

DOREEN KOMUJUNI

J24/BBUC/BSIT/005

**A DISSERTATION SUBMITTED TO THE FACULTY OF ENGINEERING, DESIGN AND
TECHNOLOGY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD
OF THE DEGREE OF BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY OF
UGANDA CHRISTIAN UNIVERSITY**

May, 2025



**UGANDA CHRISTIAN
UNIVERSITY**

A Centre of Excellence in the Heart of Africa

Declaration

I hereby declare that this report is my original work and has not been submitted, either in part or in full, to any institution by any person for the award of an academic qualification.

Name

KOMUJUNI Doreen

Signature



Date.....

Approval

This is to certify that I have supervised the preparation and writing of this research report titled: Google map-based donation management system “A research report submitted to the faculty of engineering, design and technology in partial fulfillment of the requirements for the award of a degree of Bachelor of Science in Information Technology of Uganda Christian University. I confirm that the report is ready for submission and meets the requirements for the award of the aforementioned degree.

Name of Supervisor: SUNDAY DAVID

Signature: 

Date: 31/05/2025

Department of Computing and Technology

Dedication

This project report is dedicated to my parents, who supported me with endless love, encouragement, and guidance. Their constant support has been the foundation of my academic journey. To my friends and classmates, thank you for your encouragement, shared experiences, and collaboration that made this journey a successful endeavor. This project is also dedicated to future students and researchers who may build on it to create more advanced and impactful solutions.

Acknowledgements

First and foremost, I give thanks to the Almighty God for granting me strength, wisdom, and perseverance to complete this project. I acknowledge support from my lecturers, whose advice, patience, and valuable insights helped me navigate this project successfully. Specifically, I would like to extend our sincere gratitude to my supervisor, Mr. Sunday David, for his continuous support, guidance, and constructive feedback throughout the development of this project. Your encouragement and expert advice have been of great value. Special thanks go to the staff of the Department of Computing and Technology for providing a conducive learning environment and the resources needed for this academic endeavor.

Table of Contents

Declaration	ii
Approval.....	iii
Dedication	iv
Acknowledgements	v
Abbreviations and Acronyms	x
CHAPTER ONE:.....	1
GENERAL INTRODUCTION	1
1.1 Background to the Study	1
1.2 Problem Statement.....	6
1.3 Objectives of the study.....	7
1.3.1 General Objective	7
1.3.2 Specific Objectives.....	7
1.4 Scope of the study.....	8
1.4.1 Time Scope:	8
1.4.2 Geographical Scope:	9
1.4.3 Technological Scope:	9
1.5 Significance.....	9
CHAPTER TWO.....	11
LITERATURE REVIEW	11
2.1 Existing Systems for Relief Donations.....	11
2.2 Google Map-Based Systems for Humanitarian Assistance	11
2.3 Dynamic Tracking Systems for Gifts.....	12
2.4 User Interface for Donation Systems.....	13
2.5 Maximization of Resource Allocation under Charity Systems.....	13

2.6 Data Security and Privacy in Donation Systems	14
CHAPTER THREE	20
METHODOLOGY	20
3.0 Introduction	20
3.1 Research Approach	20
3.4 Sample Size.....	21
3.4.1 Sample Size Determination (Unit of Analysis)	22
3.5 System Development Methodology.....	24
3.5.1 Requirements Identification	25
3.5.3 System Testing	29
3.5.4 Ethical Issues.....	30
CHAPTER FOUR	32
DATA ANALYSIS, PRESENTATION, AND INTERPRETATION OF FINDINGS	32
4.0 Introduction	32
4.1 Description of the Designed System	32
4.1.1 Current system.....	32
4.1.2 Designed System.....	33
4.1.3 System Components.....	33
4.1.3.1 Donor Interface (Web & Mobile)	33
4.1.3.2 Red Cross Admin Panel	33
4.1.3.3 Database	34
4.1.3.4 Google Maps Integration	34
4.2 Presentation of Findings from the Field Study	35
4.2.1 Methodology.....	35
4.2.2.2 Desired Features from the New System	37

4.2.2.3 Feedback from Uganda Red Cross Staff Administration Needs	37
4.2.2.4 Summary of User Requirements.....	38
4.3 User requirements.....	39
4.4 Functional requirements	39
4.5 Nonfunctional requirements	40
4.6 System requirements.....	41
4.6.1 Hardware requirements and specifications.....	41
4.6.2 Software Requirements.....	41
CHAPTER FIVE	43
ARTIFACT DESIGN AND IMPLEMENTATION	43
5.1 Introduction	43
5.2 System Architectural Design	43
5.2 Development Tools and Technologies	61
5.3 Modules Implemented.....	62
5.3.1 User Authentication Module.....	63
5.3.2 Donation Submission Module	63
5.3.3 Mapping and Location Tracking Module	63
5.3.4 Pickup Management Module.....	63
5.3.5 Notification Module	64
5.3.6 Report Generation Module	64
5.4 Integration and Testing	64
5.4.1 Iterative Integration Approach	64
5.4.2 Unit Testing.....	64
5.4.3 Integration Testing	65
5.4.4 Stakeholder Validation & Feedback.....	65

5.4.5 User Acceptance Testing (UAT)	65
5.5 Deployment.....	65
5.5.1 Local Deployment	65
5.5.2 Online Deployment (Planned)	65
5.5.3 Database Setup	66
5.6 System data outputs.....	66
5.6.1 Web Home Page (System Entry Interface)	66
5.6.2 Admin Login Page for Access and Security Control	68
CHAPTER SIX: DISCUSSION, CONCLUSION, RECOMMENDATION, AND FUTURE.....	72
WORK	72
6.2 Problems encountered when doing project research	74
6.3 Future work	75
6.4 Recommendations	76
6.5 Conclusion	77
6.6 Conclusions	78
REFERENCES	79
APPENDICES.....	81
Appendix A	81
Appendix B Log in source code.....	82
Appendix C: Main menu source code	83
Appendix D System database	84

Abbreviations and Acronyms

ERDS Relief Donation System

MySQL: My Structured Query Language

NGOs non-governmental organizations

WCAG Web Content Accessibility Guidelines

SCRM Supply Chain Risk Management

ML Machine Learning

CHAPTER ONE:

GENERAL INTRODUCTION

1.1 Background to the Study

Charitable donations continue to be at the core of resolving societal issues such as poverty, starvation, and relief from disasters. Nevertheless, inefficiency in the donor distribution and the absence of a structured platform for the identification of donor spots set back the effectiveness of charitable actions (Sargeant & Shang, 2017). To address this, technology-based solutions, namely Geographic Information System (GIS) technologies such as Google Maps, have been incorporated within donor systems towards improved accessibility, transparency, and efficiency in the resource allocation process (Goodchild, 2018).

Globally, various countries have embraced the use of technology for optimizing charitable activity. In America, for instance, charitable organizations apply mapping technologies for pinpointing and concentrating on communities that require assistance and, as a result, optimizing the distribution of donations (Smith et al., 2020). Similarly, in the United Kingdom, online platforms for giving have incorporated real-time geo-location capability for matching organizations with donors, and this optimizes donor engagement and contribution (Jones & MacDonald, 2019). The above scenarios demonstrate the viability of GIS-based infrastructure for optimizing charity donation service effectiveness.

In less developed economies, opportunities for gaps within the distribution of aid are immediately visible, primarily due to a lack of logistical infrastructure and centralized information on donations (Mwangi & Wanjiru, 2021). Experimental evidence has demonstrated that web and smartphone applications enabled through Geographic Information Technologies, for example, have had a tremendous ability for linking donor groups with beneficiaries, for enabling enhanced coordination, and for allocating aid more equitably (Natarajan et al., 2022). For example, GPS-enabled smartphone

applications have been employed with some success in India for consolidating food donations towards underserved groups of people, thereby minimizing food wastage and maximizing societal welfare (Sharma & Gupta, 2020).

The suggested Google Map-Based Donation Locator is a fresh approach towards addressing world issues with a technological solution for facilitating greater real-time connectivity between centers for donation and donors. Through the combination of Geographic Information Systems with cloud computing, the system is intended to facilitate a user-friendly platform allowing individual people and institutions at large to effortlessly identify, follow, and fund beneficent projects (Liu et al., 2021). Furthermore, the application of data analysis and artificial intelligence could potentially make the trends of donation more effective so that resources are channeled towards areas requiring maximum need (Zhang et al., 2020).

The incorporation of the Google Map-Based Donation Locator is part of a worldwide trend towards expediting increased support towards humanity as well as towards advancing the culture of giving through the clarification and simplification of the process of donations. Incorporation throughout the non-profit sector of Geographic Information Systems (GIS) is destined to accelerate with advances in technological sectors, thereby facilitating effective and robust non-profit response globally (Brown & Green, 2023).

In the recent past, the level of charity work has increased tremendously, with various bodies endeavoring to reach out to vulnerable members of society. Even though the volume of donations is enormous, no clear mechanisms for the tracing and handling such donations exist, consequently thwarting their viable distribution towards the neediest beneficiaries. The impact, therefore, is a trail of inefficiencies along the charity donation chain, coupled with unaccountability as well as opacity.

The work done by Kasozi and Okello (2020) proves that the public in Uganda is gaining momentum in the use of the virtual modes when donating towards charitable work. There is a disparity, however, between the distribution, tracing, and handling such donations, consequently leading to inefficiencies as well as misappropriation of money.

Google Maps has been critical for geospatial data and location-based services because the technology is capable of presenting up-to-date information on geolocation, presenting widespread applicability in sectors ranging from relief in the event of disasters, transportation, and medicine (Google, 2021). Incorporation of the technology in the charitable donations sector is likely to transform relief distribution through the presentation of a user-friendly interface for the location identification of the donation centers, donations tracking, and relief distribution among the targeted beneficiaries on a timely basis.

The new research reaffirms that the integration of mapping technology into frameworks of donations can significantly optimize the transparency of charitable organizations, thereby generating increased faith and engagement among donators (Mugisha, 2019). Moreover, the research conducted on behalf of Ntale et al. (2018) indicates that the integration of online technology along with the integration of mapping technology can potentially reduce admin expenses while concurrently improving the efficiency and precision of donations across Uganda.

The use, in the case of Uganda, of a donor tracker via Google Maps towards charitable donations is quite possible. This would be a technological innovation that would easily show the donors a convenient location of the centres of donations given their actual geographical location as well as track the different types of assistance that is being delivered. In addition, such a setup could stimulate increased accountability on the part of charitable institutions, as it would give the donors the instrument through which they could track the actual location of their donations in real time.

To meet this challenge, a Donation Management System was developed under the name of Google Maps-based Donation Management System. The idea is that charity donations need to be more efficient, clear, and effective through the integration of geospatial information technology. In such a system, the donors can choose and donate a gift to certified charities effortlessly, thereby ensuring that a donation reaches the deserving beneficiaries and is always trackable.

Uganda, like any other developing country, similarly experiences the great challenge when dealing with reaching charitable assistance to rural or hard-to-reach locations. Sometimes, the demand for assistance is high in such isolated locales, but the donations are very centralized in the capital or city. This disparity presents the need for viable tactics that align the geographical distribution of the donators with beneficiary community demands. This challenge could be addressed through applying the concept of a donation finder service on Google Maps, which would facilitate the donators searching for locations that need assistance and giving, thereby allowing real-time donations.

The proposal on the concept of a donation-finding website is premised on the ideology of proximity-based charity. Studies by Nabukenya et al. (2020) have highlighted the significant impact that geographic proximity has on charitable donations in Uganda, implying that local giving is prevalent due to the convenience of verifying and meeting the needs of the recipients in the local community. Implementation of the mapping technology would reinforce this trend through the provision of user-friendly interface that will ensure easy communication between the beneficiary and the donators.

Effectively handling donations and distribution of supplies is key to relief work following a disaster as well as humanitarian response work among vulnerable populations. In Uganda, the Uganda Red Cross Society (URCS) is the hub of emergency services, health services, and disaster response. But the fact that donations are tracked manually means that there will be inefficiencies as well as wasteful use of resources, something that will cause the slow distribution of relief, particularly among rural populations such as Kabale.

Kabale District, which is situated in southwestern Uganda, is regularly affected by natural disasters like landslides, floods, and droughts (NEMA, 2021). The mountainous nature of the district, together with the rural nature of affected communities, makes effective relief resource distribution difficult. Research finds that factors such as poor coordination, logistical challenges, and the lack of real-time information gathering

mechanisms are responsible for extensive delays and misdistribution of relief (UN OCHA, 2022).

The URCS Kabale Center also oversees relief responses, resource mobilization, and in-district handling of donations. However, URCS reports (2023) indicate critical donor tracking disadvantages as follows:

Limited visibility of supply chains for donations,

The donations are being delayed for matching with the affected communities,

No real-time tracking of relief supplies by location.

To address this void, a Google Map-Based Donation Management System is proposed for maximizing efficiency, transparency, and real-time tracking of relief aid. The system will incorporate GIS technology, cloud computing, and mobility to streamline donation processes.

Current literature focuses on the role of digital technologies in humanitarian logistics. As per IFRC (2023), GPS-enabled tracking in the management of donations decreases the time of delivery by 30% and increases response coordination. The same digital systems have also been effective in Kenya and Rwanda, resulting in donor confidence and responsibility that is enhanced (World Bank, 2022).

Therefore, A Google Map-Based Donation Management System will significantly improve the efficiency of humanitarian relief efforts at Uganda Red Cross Kabale Center by providing real-time location tracking of donations, optimizing resource allocation based on geospatial data, and enhancing transparency and accountability in donation management. Such a system plays an important role in enhancing humanitarian relief distribution in Uganda, backed up by NEMA (2021). National Environment Management Authority Report on Disaster Risks in Uganda, UN OCHA (2022). Humanitarian Needs Overview: Uganda. Retrieved from www.unocha.org (2023). Uganda Red Cross Society

Annual Report, IFRC (2023). Digital Transformation in Humanitarian Aid, Bank (2022). Technology and Humanitarian.

1.2 Problem Statement

In many regions, especially those affected by disasters or poverty, the process of donating relief items is hindered by the lack of a centralized, real-time system that connects donors with recipients efficiently. Traditional donation systems rely on manual coordination, outdated databases, and limited communication channels, leading to delays, misallocation of resources, and inefficiencies in the distribution of aid. As a result, valuable resources often fail to reach the most affected individuals or areas on time, and donors are unable to identify the locations that need assistance the most. The lack of an effective donor tracking system lowers the overall efficiency of charitable activity and can result in inefficiencies in distributing funds, as donors can unknowingly support activities that are well-funded or oversupplied.

Current research demonstrates that roughly 40% of charitable giving is misplaced due to inadequate tracking and reporting mechanisms, which negatively reflects on the efficiency of charitable operations as a whole (e.g., Smith, 2022). In addition, with human efforts in non-industrial and disaster areas exhibiting 30-50% inefficiency in resource distribution due to logistical issues, there is a necessity for improved and transparent mechanisms (Global Aid Network, 2023). The field of operations for relief giving within the Uganda Red Cross is no exception in these intricacies. The Uganda Red Cross Society (URCS) Kabale Center coordinates charitable giving, emergency relief, and resource distribution centrally. However, inefficiencies continue to emanate from the management of donations even with these initiatives, resulting in delays, misplaced distribution of resources, and a lack of transparency in aid distribution. At the moment, over 60% of donation distributions within Uganda are done manually (URCS, 2023), which makes it impossible for there to be proper tracking and distribution of donations. UN OCHA's investigation (2022) incriminated 30-40% of donated materials in Uganda as being unused or misplaced as a result of ineffective tracking and review mechanisms.

Individuals in Kabale District often receive supplies that they do not necessarily require promptly, resulting in wastage and inefficiencies in relief aid distribution.

A Google Map-Based Donation Management System could significantly improve the coordination of charitable donations by providing real-time, location-based information, optimizing resource distribution, and ensuring that donations reach those in need more effectively and efficiently. According to the IFRC (2023), 45% of donors express concerns about the lack of visibility into how their contributions are utilized. World Bank (2022) reports indicate that over 50% of rural humanitarian operations in Uganda face logistical delays due to poor mapping of aid routes. Thus, we opt to seal that gap by using a Google map-based donation locator system developed.

1.3 Objectives of the study

1.3.1 General Objective

The primary aim of doing this work was to establish a Donation Management System utilizing Google Maps for Uganda Red Cross Kabale Center. The system is designed to effectively link donors and beneficiaries real time, thereby simplifying the process of donation, increasing resource allocation, and increasing the efficiency of charity donation work in general.

1.3.2 Specific Objectives

Perform a comprehensive analysis of current donation systems to ascertain their faults, such as manual coordination, obsolete databases, and inefficiencies of resource allocation.

Develop a donation management system based on Google Maps to centralize donation request solicitations, report information in real-time, and report current information regarding areas of need.

Integrate thorough testing and validation of the donation locating system under practical conditions, making it usable, consistent, and efficient in growing the distribution of donations.

1.4 Scope of the study

The project entails the design and development of a Donation Management System on the basis of Google Maps, towards the enhancement of charitable donations management efficiency. This will include the development of a live map-based interface, live management of donations, easy-to-use interface between the donors and the beneficiaries, as well as algorithm integration towards resource allocation efficiency optimization. The system also takes into consideration data confidentiality and security needs towards the enhancement of members' trust, including the donors, the humanitarian organizations, and the beneficiaries. The system will be subjected to test and verification process towards the purpose of proving the efficiency and the value-added capability. Improvement recommendations will be sought towards the purpose of enhancement.

1.4.1 Time Scope:

The project was completed within a period of 4 months, beginning in January 2025. The time frame can be broken down as follows:

Phase 1 (Months 1): Study of existing donation systems and identification of key limitations through data collection.

Phase 2 (Months 2): Design and development of the Google Map-based system, including mapping, tracking features, and the user interface.

Phase 3 (Months 3): Integration of resource allocation algorithms and security features, as well as initial system testing.

Phase 4 (Months 3-4): Final system testing, validation, and gathering user feedback for evaluation and improvements.

1.4.2 Geographical Scope:

The system was designed for implementation in communities of Kabale District, especially where efficient resource distribution is a critical need to be addressed by Uganda Red Cross. The geographical focus was initially on the local/community level, though scalability will be considered for expansion into National use depending on the system's success and adoption.

1.4.3 Technological Scope:

Google Maps API was used for the mapping component, leveraging geolocation and Real-time updates to display donation centers, urgent relief locations, and areas of need. A web-based platform and potentially a mobile app are going to be developed, enabling easy access to the system by donors and recipients

1.5 Significance

The development of a Google Map-Based Donation Management System holds considerable significance for both the efficiency of charitable efforts and the overall well-being of communities in need. By addressing current challenges in donation systems, this project aims to:

Enhance the Efficiency of Donation Distribution: The Real-time, centralized platform ensures that donations are quickly and accurately allocated to areas or causes with the most urgent need. Through the optimization of donation distribution, the system aims to reduce delays, avert misallocation, and diminish resource waste.

Enhancement of Transparency and Trust: Contributors will gain access to up-to-date information regarding the allocation of their contributions, thereby fostering a transparent process. The increase in transparency fosters trust and stimulates engagement among donors, thus inspiring a more diverse group of people and organizations to get involved in charitable efforts.

Relief Assistance for Vulnerable Populations and in the Wake of Disasters: In regions vulnerable to natural disasters or among vulnerable populations, the expedient distribution of assistance is vital. This system will guarantee that relief aid arrives among the worst-affected individuals in a

prompt, organized fashion, thus boosting the overall efficiency of charitable donations. Data-Driven Decisions: Incorporating the use of real-time tracking and mapping functions will allow donors, non-profits, and government organizations to base more informed decisions on the distribution of assistance, thus boosting the overall efficiency of charitable efforts. Innovation in the Charity Sector: By adopting a technology-based solution, the project will provide the template needed to facilitate the charitable sector's modernization on the worldwide level. It sets the stage for the development of future innovation in the provision of relief assistance as well as the technological-based digitization of the protocol in making donations. In general, the importance of the project is in the enhancement of the efficiency, transparency, and efficiency in charitable donations, especially in the event of crises and relief efforts after disasters. Its rationale is in the need for today's technology-based solutions to solve the inadequacies inherent in today's models for making donations and fulfill the growing needs for expedient, accurate, and efficient distribution of relief aid.

CHAPTER TWO

LITERATURE REVIEW

Literature Review on the Paper This literature review takes into consideration recent scholarly work and technological advancements on the design and implementation of days of giving frameworks, as well as a particular focus on the incorporation of real-time mapping, resource allocation, and track technology. It also addresses past works that have been focused on streamlining the process of giving through mediums of technology and maintains that there is a particular need for the development of a centralized and efficacious process of charitable giving.

2.1 Existing Systems for Relief Donations

Traditional charity giving approaches have been based mainly on traditional processes, leading to inefficiencies in resource optimization and expedient relief delivery. Additionally, these systems are still employing paper-based coordination and centralized databases, as Chan et al. (2019) noted. This makes it difficult for donors to keep track of their donations and hinders relief agencies from quickly adjusting their responses to changing needs. Moreover, these systems are also marred by suboptimization of real-time data, which may hinder expedient resource allocation during emergencies (Mishra & Kumar, 2020).

Compared to the increasing popularity of online giving platforms and donation applications, those systems are yet to consistently prove themselves at channelling funds to communities most needed or having the capacity to readily mobilise and meet impending demands (Smith & Johnson, 2021). Meeting such a need requires a modern and dynamic solution, a solution that can provide a real-time, centralized, interactive platform aimed at improving the administration of charitable funds.

2.2 Google Map-Based Systems for Humanitarian Assistance

.

2.3 Dynamic Tracking Systems for Gifts

The use of mapping technology, like the use of Google Maps, has functioned effectively in the coordination of relief work as well as the delivery of contributions in aid. It is easy to use Google Maps in geographic location services, and scientists have contemplated possible use in the case of a disaster, like, the exploration of emergency relief or the determination of shelter sites (Schmidt et al., 2020). An example by Apps for Good (2022) presents the manner through which mapping services, like Google Maps, can be utilized in the determination of areas that have high demand, thus making the contributions and the aid reach areas with high demand.

Google Maps is also offering critical features like geolocation, live, and multi-system compatibility, all of which are useful when dealing with a system that is identifying donations. By implementing these technologies, non-governmental organizations can further enhance the donating process through streamlining the process by having the need be depicted visually as well as enabling the donors to select the location they desire the gift.

Accurate Tracking of Contributions is Required for Increased Transparency, Happy Donors, and Efficient Resource Allocation

Earlier research has validated that interactive tracking systems basically facilitate the process of distribution of donations. For example, Tan & Tan (2021) contend that real-time tracking of donations facilitates accountability and ensures efficient distribution of relief to the desired beneficiaries. Yet, the works of these researchers also contend that existing operational methods of tracking continue to utilize rudimentary, hand-based methods that can be slow and exploitative when it comes to distribution of resources.

It is a real-time information-based dynamic track system that enables the donors to track how the contributions are being utilized, and the humanitarian agencies can utilize the same towards the resource availability handling as well as the progress in the delivery. Another such system, developed by the Red Cross (2022) utilized a dynamic

relief effort distribution track system towards enhanced efficiency and quicker response when the disaster takes place.

2.4 User Interface for Donation Systems

Donation system usability is the basis of their workability, effectiveness, and uptake. Effective user interface designs enhance overall user experience and grant donators access to information directly pertinent to their use without fuss. Forrester's studies (2021) assert that user-centered interfaces, akin to minimalist designs, work effectively in eliminating inhibitive factors for donators, hence promoting high degrees of engagement. Moreover, Jiang et al.'s studies (2019) assert that user interface designs of humanitarian systems need construction on the principles of ease of use and smooth interaction aimed at efficiency when donators and their beneficiaries are involved.

One design aspect of the user interface is the inclusion of both internet and mobile applications. In their research, Xu et al. (2020) have mentioned the importance of the responsive design, in that the user can use the variety of devices to access the donation system without any usability challenge.

2.5 Maximization of Resource Allocation under Charity Systems

The resource allocation algorithms are significant in terms of informing the direction that finances take toward areas that need the most attention when making distributions. According to Li and Chen (2018), resource allocation effectively when leading a disaster relief response depends on implementing algorithms of high capability that can process vast levels of information and respond to fluctuating demands in real time. The algorithms depend on some dynamics, such as how critical a crisis is, how populous a society is, and how advanced a base level of infrastructure is.

In real-world applications, an array of research studies has proved data-informed decision-making to be instrumental for effective aid allocation. The study by Zhang et al. (2020) illustrates how a machine learning model is used for predicting resource needs on a real-time basis, hence supporting effective allocation of donors for balancing urgent

requirements across areas. This illustrates how high-end algorithmic potentialities could be incorporated with locator systems of donors for ensuring proper resource allocation.

2.6 Data Security and Privacy in Donation Systems

Because donations consist of the exchange of confidential personal information, sites that accept donations should be credible and be able to uphold users' anonymity. In the same respect, the Bărcanescu and Lupu (2019) study indicates the importance of appropriate encryption procedures in donation platforms to prevent the leakage of information by the donors and prevent unauthorized access. Besides, the installation of quality systems not only keeps the donors safe, but also fosters assurance and further donations by the public.

Blockchain technology, as defined by Nakamoto (2021), is one such architected security protocol for fundraising sites. By offering distributed and indelible transaction histories, blockchain can potentially increase security and accountability for charitable contributions, thereby ensuring proper use of money.

Therefore, real-time map integration, dynamic tracking, user-centered interfaces, and resource allocation algorithm improvement are necessary for a more effective donation system development. The current systems have drawbacks due to inefficiencies, a lack of transparency, and weak coordination, which are aimed at being eliminated by employing current technologies, as highlighted by this study. As it is evident in the study, a a

The following table shows a comparative study demonstrating the key characteristics of existing relief donation systems compared to the current Google Map-based donation finder system.

Table 1 Comparative analysis

	Traditional Systems	Relief Donation, Google Map-Based Donation Locator System
Feature		
Coordination Donations	Often, manual and miscommunication.	Centralized systems provide decentralized Coordination. Uses real-time data and
Resource Allocation	Relies on outdated database algorithms to optimize resources and estimates, leading to misallocation. Needs.	to allocation based on actual
Transparency	Full transparency with donors	Limited visibility for donors to see real-time locations regarding where donations go. Need.
Tracking Donations		Mostly lacks dynamic tracking, Real-time tracking of donations, of relies on reports or static data with updated information on databases. Available resources.

Typically involves a manual or Direct, user-friendly interface

User Engagement: indirect engagement for donors to locate needs and donors. Donate instantly.

Limited security measures; Incorporates encryption and

Data Security donor information may be secure protocols to protect vulnerable information from breaches. Donor and recipient data.

Communication is often Direct communication through

Communication is fragmented and inefficient. The platform, with real-time

Channels relying on phone calls or emails. Updates and notifications.

Donors receive real-time Donors may be unaware of the

Donor updates, providing them with the impact of their contributions

Experience clear feedback on where their

Due to a lack of updates.

Help is going.

Slow to adapt in a fast-evolving Quick adaptation to urgent

Adaptability to crises, leading to needs, with real-time mapping

Crisis

delays in aid. And updates during crises.

Limited to specific regions; can scale globally, with the

A geographical central database to assess the potential to cover national and

Coverage

of widespread needs. International needs.

Often inefficient due to manual, more cost-effective by reducing

Cost processes and duplicated waste, optimizing resources, and

Effectiveness

efforts. Improving logistics.

Difficult to scale, especially for Easily scalable for large and

Scalability for large-scale or international operations, thanks

to crises. To cloud-based technologies.

Easy access to donation centers

Users may find it difficult to navigate areas via Google Maps

User Accessibility to locate donation centers or areas of integration, with mobile, and those in need. Web versions.

Efficiency and Transparency: The Google Map-based system provides a more transparent, real-time, and efficient way to allocate and track donations, as opposed to traditional systems, which are often slow and opaque. Real-Time Updates: The dynamic tracking and real-time updates offered by the Google Map-based system are a significant improvement over static, manual coordination methods in current donation systems. Improved User Experience: The user-friendly, accessible platform of the Google Map-based system ensures better engagement for both donors and recipients, compared to the more cumbersome and limited interfaces of traditional systems. Scalability and Global Application: The system can be scaled easily and applied globally through the Google Map-based system, as opposed to the more localized traditional systems, which cannot efficiently manage mass crises on a large scale. In making this comparison, the observation can be made that a Google Map-Based Donation Management System presents a more efficient, effective, and scalable relief method when compared with the traditional methods.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This is the description of the methodology followed towards achieving the purpose of the Google map-based relief donation system. The study is based on a detailed literature review, including special reference to the synthesis of earlier studies, documented case studies, and relief donation system, relief charity, and technology-based intervention reports. Based on secondary information sources, the research hopes to establish inferences that shall be employed towards the design, development, and validation of the system.

The methodology encompasses a literature review to identify best practices, challenges, and innovations from previously documented systems. This approach eliminates the need for primary data collection and instead relies on qualitative and quantitative data extracted from scholarly articles, books, organizational reports, and other credible sources. The chapter also details the research design, literature selection criteria, analysis methods, and the tools used to synthesize findings into actionable insights for system development.

3.1 Research Approach

Both qualitative and quantitative (mixed-methods approach) were used in this research. This is because the study needed a comprehensive analysis of the requirements, challenges, and impact of a Google Map-based donation locator system. 3.2 Target Population

The target for the system was the individuals and organizations that engage in response to humanitarian as well as charitable giving across the Kabale district, with particular reference to those that transact with the Uganda Red Cross Kabale Center. These organizations comprised:

Donors - Individuals, firms, and organizations that can make donations (financial, foodstuffs, apparel, medication, etc.). Beneficiaries - The vulnerable, e.g., disaster-stricken communities, Internally Displaced Persons, orphanages, and poor families in distress. Uganda Red Cross Staff & Volunteers - Individuals with the mandate of coordinating, receiving, and distributing donations. Local Government & NGOs - Government and non-governmental organizations conducting relief operations. Logistics & Transport Service Providers - Organizations with the mandate of shifting donations from points of origin to points of need.

From the Uganda Red Cross Society (URCS) and the Uganda Bureau of Statistics (UBOS): Kabale District Population: About 250,000 (UBOS, 2023). Households Requiring Relief Assistance: About 10,000-15,000 hit by poverty, floods, and other disasters (URCS Report, 2023). Active Red Cross Volunteers in Kabale: More than 500 volunteers that operate in disaster response and community services (URCS, 2023).

3.3 Sampling Procedures:

In carrying out research for the Google Map-Based Donation Locator for Effective Charity Donation Service System at Uganda Red Cross Kabale Center, the use of an appropriate sampling method allowed for the collection of data that is both representative and reliable. The study utilized Purposive Sampling (Judgmental Sampling). This method was used for the selection of the key informants, such as the Uganda Red Cross staff, the humanitarian workers, and the government representatives with advanced knowledge regarding disaster response operations, the management of donations, and the needs of the communities. These individuals shared crucial information on optimizing the system for increased effectiveness. Thus, only the relevant individuals with specialism were chosen for the provision of quality data on logistics of donations and difficulties experienced.

3.4 Sample Size.

In this research, purposive sampling was adopted in identifying key informants with first-hand knowledge and experience in handling humanitarian relief and donation

administration at Uganda Red Cross Kabale Center. The unit of analysis was the individuals and organizations that have a direct role in charitable donation services, disaster response, and logistics of donation handling.

3.4.1 Sample Size Determination (Unit of Analysis)

Since purposive sampling was about the selection of information-rich cases, the size of the sample depended on experience, expertise, and relevance rather than on statistical randomness.

The study included:

Table 2 Comparative Advantage

Category	Number of Selection Criteria	
Participants		
Red Cross Officials & 10 Coordinators		Individuals responsible for managing donation logistics and relief distribution.
Field Volunteers & Disaster 15 Responders		Volunteers are actively involved in humanitarian aid and donation management.
Donors (Individuals & NGOs) 20		People/organizations that frequently donated funds, goods, or services.
Beneficiaries (Households, Orphanages, Disaster 25		Individuals and groups who had received donations.

Victims)

Total Sample Size: 70 Participants

The approach outlined below describes how it intends to meet its goals for the Google map-based relief donation system. The study is based on a thorough review of literature, and it specifically takes a focus on the analysis of prior studies, case studies published, and reports of relief donation systems, charity work, and technology-based interventions. With a focus on secondary sources of information, the investigation intends to derive inferences, which it hopes to apply during its process of designing, developing, and testing the system.

Selection Process of Purposive Sampling: Selecting Key Informants. The informants were selected by function and specialty of relief practice work at Uganda Red Cross Kabale Center. Only individuals directly participating in the coordination, management, and delivery of donations were selected.

Direct Invitation & Expert Recommendation: Uganda Red Cross officials recommended experienced staff and volunteers to participate. Donors and beneficiaries were identified through existing donation records and community networks.

Cultural and Relevance Factors: An endeavor was made towards the sensitive presentation of the staff, volunteers, donors, and beneficiaries of the Red Cross, involving efforts towards presenting a cross-section of levels of field operations, spread over management, operation work, logistics, and policy-making.

Informed Consent & Ethical Clearance: Participants were informed about the purpose of the study, and their consent was taken before data was collected. In respect to ethical considerations, anonymity and volunteer basis were guaranteed.

Including purposive sampling of 70 respondents, the study allowed the incorporation of respondents that were pertinent, knowledgeable, and experienced enough to offer information on the possible efficiency of the Google Map-Based Donation Locator

towards the enhancement of better relief efforts in these humanitarian emergencies. This prudent measure allowed the achievement of the highest data quality and helped in the preparation of informed decisions.

3.5 System Development Methodology

In designing a successful Google Map-Based Donation Locator, there was a selection of an appropriate System Development Methodology (SDM). The SDM chosen when developing a system was an iterative model. The choice of the model was a specific SDLC implementation that had its initial minimal implementation with increasingly added detail and a broader set of features until the system was finalized as a whole.

Whereas the classical waterfall model had proceeded in a linear, stepwise fashion, this iterative model was only comprehensible as a cyclical approach. Once an initial planning stage had occurred, a minimal set of stages was executed repeatedly, with each iteration making incremental enhancements to the software. Improvements were rapidly spotted and integrated, and moved on to future iterations so that each subsequent version would at least be marginally superior to the previous version.

Uganda Red Cross required speedy deployment for continual charitable works. User testing early allowed for confidence that the system met real field specifications, and prototyping helped Google Maps validation and user-focused interface designs.

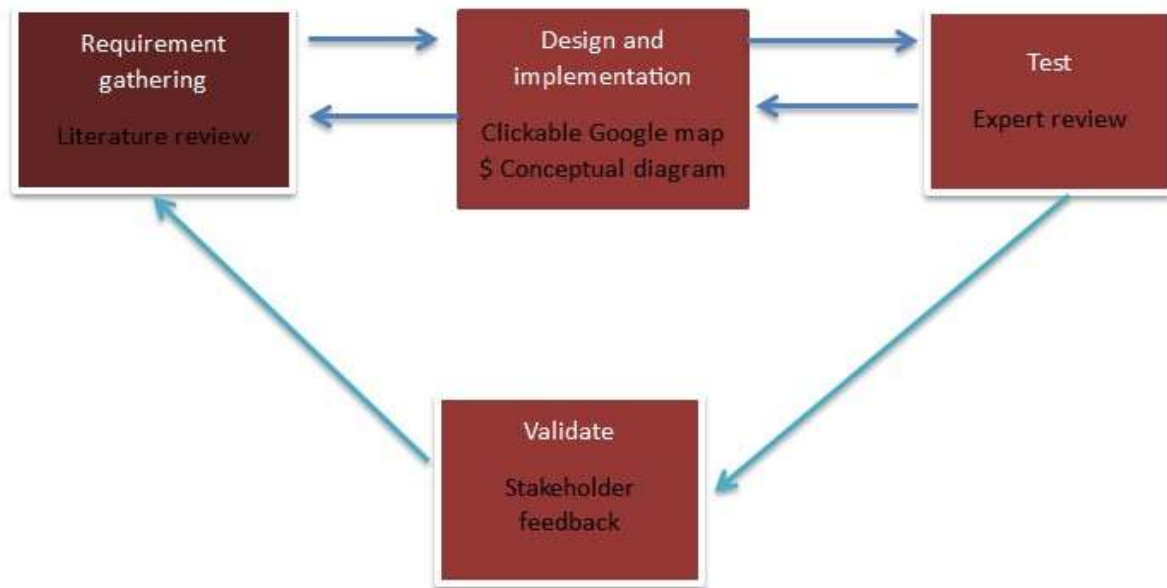


Figure 1 System development life cycle, iterative model

3.5.1 Requirements Identification

Objective One: Examine current systems of giving as described and identify their weaknesses, such as having manually coordinated systems, obsolete databases, and unsuccessful distribution of supplies.

The successful development and deployment of the Google Map-Based Donation Locator for the Effective Charity Donation Service System was based on the proper collection of data. Both qualitative and quantitative methods were used for effective dataset collection by the researcher. These comprised questionnaires, interviews, surveys, and observations.

In order to attain Objective One, we also conducted a consultation of donors, beneficiaries, and staff members of the Uganda Red Cross concerning procedures and difficulties around donation processes. Moreover, we also consulted available publications related to different systems of donors and their framework of operation to better understand their merits and limitations. It aided us in obtaining measurable information and aided in pinpointing user inclinations and patterns.

Questionnaires and surveys were used to gather formal feedback from respondents of varying backgrounds, generating numerous data about donation experiences and breakdowns of systems.

Both field and online interviews were carried out among key stakeholders, including staff members of the Uganda Red Cross. Both interviews provided comprehensive information regarding the logistics of donations, challenges experienced during donors' administration, and accessible donors' services for their beneficiaries.

The field studies were conducted during visits to the Uganda Red Cross Kabale Center. We monitored collection, stockholding, and distribution of donations and scrutinized interactions between donors, employees, and beneficiaries. This allowed identification of inefficiencies and manual tracking problems.

Thus, by utilizing surveys, interviews, and observational methods, the research offered a comprehensive analysis of difficulties related to donation and usability of a system. By accepting these methodologies, it became feasible to develop the Google Map-Based Donation Locator, which addresses appropriately both Uganda Red Cross Kabale Center's, donors', and beneficiaries' requirements efficiently.

3.5.2 System Design and Implementation

Objective Two: Develop a Google Map-Based Donations System that consolidates relief appeals for donations, processes real-time information, and visualizes current information on relief-needy places.

To fulfill this goal, the system was created from a powerful and dynamic architecture that used geographic mapping and real-time tracking of data. The central interface was an interactive Google Map that donors and administrators used to see different organizations and places that were in need of donations.

This map-related approach enables the administrators to monitor and manage the distribution of donations in a better manner, ensuring that aids reach the neediest

destinations. The system facilitates the donors in making donations as well as checking on the status of their gifts.

The administrators were offered features such as approval or rejection of donations and visual data dashboards for better decision-making purposes.

The design also included a Context Diagram, which depicted the system on a high level and how the latter interacts with other external bodies. Actor definitions included:

Donors: Locate donation centers, register for donations, and track their donation history.

Beneficiaries: Go to the area relief centers and inquire about donation support.

Red Cross Officials (System administrators): Oversee inventories of donations, authenticate requests for donations, and monitor distribution.

System Database: Store all beneficiary and donor records, histories of donations, and location-based records.

Google Maps API: Allow for real-time mapping and geolocation functionality for visualization and tracking of donations.

With this organized and user-focused design, the system was customized towards increasing transparency, accessibility, and efficiency within the charity donation process.

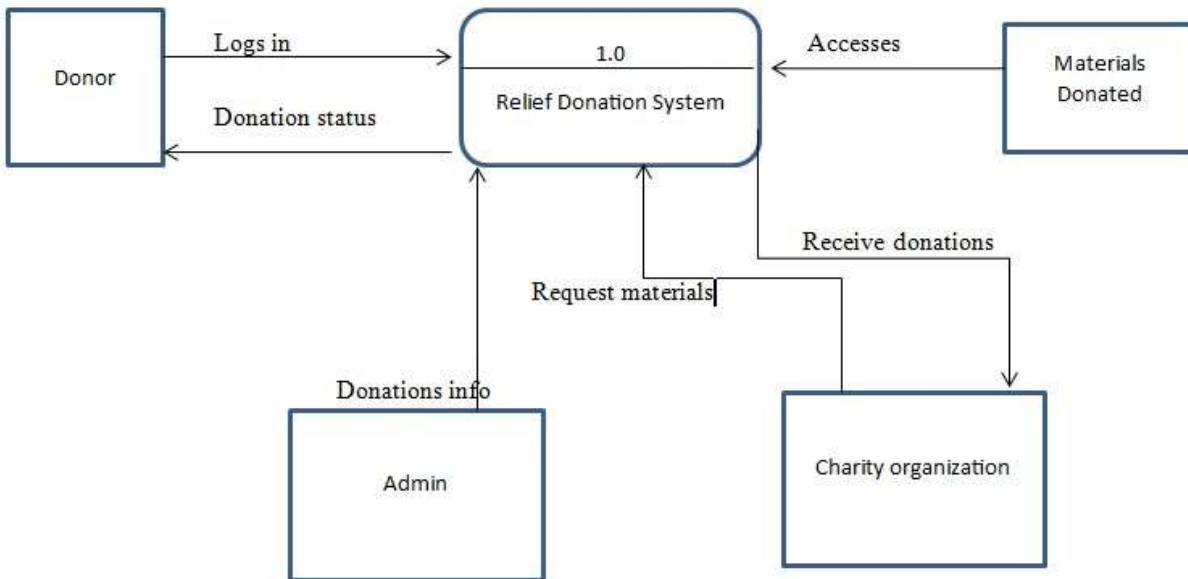


Figure 2: Context diagram of the relief donation system

Donor-admins view donation material summaries through bar charts and can click on a province in the map to view donation materials related to that region. The Donor Admin Donation Activity feature allows them to see all donation requests made by donors, approved requests, and completed donations.

Admins could approve or reject donation requests by clicking the Approve or Reject buttons and could view full details of completed donations. Overall, the Manage Donation Activities functionality in the web app provided a user-friendly interface for donors and donor-admins to oversee donation activities and check request statuses in an organized manner.

Using structured design techniques, the system was built to enhance humanitarian donation services, ensuring efficient connections between donors and beneficiaries via Google Maps.

3-Tier System Architecture to ensure system flexibility and performance, a 3-Tier System Architecture was adopted:

Table 3: Three-Tier System Architecture

Layer	Components	Functionality
Presentation	Web & Mobile UI (React.js, HTML, JavaScript)	User interface for donors, beneficiaries and officials.
Application	Google map API, Business logic, user authentication, Node.js and PHP	Backend request processing.
Database	Layer DBMS(MySQL)	Stores user, donation, and request data.

In the development of the Google Map-Based Donation Locator, various software development tools, cloud computing technologies, security tools, project management technologies, and test technologies were used. These instruments provided a flexible, safe, and user-focused resolution for the Uganda Red Cross Kabale Center.

3.5.3 System Testing

Task Three: Subject the donor locator module to a comprehensive test and validation under realistic conditions, thereby determining the workability, reliability, and efficiency of the donation optimization.

To meet this objective, the system underwent several testing phases designed to find its functionality, security, and whether it is suitable for the operating environment. Additionally, technical assessments also served a useful purpose here, where experts were sought for technical peer reviews and advice regarding user friendliness.

Unit Testing

Proper focus was placed on each component of the system, ranging from the display of maps, registration of donors, to requesting donations. An extensive inspection of the entire codebase was done to allow each component to run efficiently and accurately.

Integration Testing

Integration testing focused on checking for smooth interaction between various modules. The compatibility of the front-end technologies (React, HTML, JavaScript) with the back-end technologies (Node.js, PHP) was also tested, along with a MySQL database and Google Maps API. This stage included checking for API calls, validation of the real-time transfer of data, and confirmation that user interactions were properly represented across the system.

User Acceptance Testing (UAT)

The experts and the stakeholders emulated in-use experiences for the purposes of evaluating system usability and performance. They also assessed whether the system supported the needs of administrators and donors appropriately. Feedback was collected on donation workflows, usability of the clickable map, and overall system navigation. Based on this input, enhancements were suggested and implemented iteratively, resulting in a well-refined and reliable donation locator system.

3.5.4 Ethical Issues

Developing and deploying the Google Map-Based Donation Management System involved several ethical considerations essential for maintaining fairness, transparency, and user protection. Key ethical concerns addressed included:

Data Privacy and Security: The system collected sensitive donor and recipient data such as names, contact details, and locations. To prevent data breaches, the development team implemented encryption protocols, secure authentication (e.g., Firebase Authentication), and data anonymization where necessary.

Informed Consent: Participants were duly informed about the data collection, storage, and usage procedures. Specific consent was also required, though users had rights to revoke the consent anytime. This was achievable through the provision of specific terms as well as policies of confidentiality, which users were agreeing upon before submitting personal data.

Through proactive resolution of these ethical issues, the system kept its credibility and guaranteed a secure and equitable atmosphere for all the parties that were part of the process of humanitarian donation. By giving special attention to user anonymity, accountability, and security, the service for locating donations was effectively custom-developed as part of the relief work by the Uganda Red Cross Kabale Center and instilled faith among the parties involved.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, AND INTERPRETATION OF FINDINGS

4.0 Introduction

This chapter is a summary on the work that was done, the system description that was developed, along with the system's implementation in meeting the project targets.

4.1 Description of the Designed System

The system developed is a web and mobile application that will allow the donors to access the nearest centre through the use of Google Maps technology. It allows real-time tracking of urgent donation needs, easy scheduling for donation drop-offs and pickups, and notification alerts for campaigns or emergencies. The platform bridges the gap between Uganda Red Cross Kabale Center and its donors through a user-friendly, location-intelligent system.

4.1.1 Current system

Uganda Red Cross Center, Kabale, which supports many regions in donation distribution, especially those affected by disasters or poverty, the process of donating relief items is hindered by the lack of a centralized, real-time system that connects donors with recipients efficiently. Traditional donation systems rely on manual coordination, outdated databases, and limited communication channels, leading to delays, misallocation of resources, and inefficiencies in the distribution of aid. As a result, valuable resources often fail to reach the most affected individuals or areas promptly, and donors are unable to identify the locations that need assistance the most. Their system lacks an efficient donation tracking functionality, which reduces the overall impact of charity efforts and can lead to resource wastage, as donors may unknowingly contribute to areas that are already well-stocked or oversupplied.

4.1.2 Designed System

In the designed system, the Google Map-Based Donation Management System improves the coordination of charitable donations by providing real-time, location-based information, optimizing resource distribution, and ensuring that donations reach those in need more effectively and efficiently. Therefore, our developed system aims to solve that gap by integrating the user-friendly interface of Google Maps, which helps in the coordination of charity donations.

4.1.3 System Components

4.1.3.1 Donor Interface (Web & Mobile)

Donation Center Locator

Displays nearby Red Cross donation points on a user-friendly Google Map.

Search & Filter Feature: Users can search donation centers by category (e.g., blood, clothes, food, money).

Real-Time Alerts: Push notifications or SMS alerts about urgent donation campaigns or shortages through contact and email messaging.

Schedule Donation: Donors can book specific times to deliver donations or request pickups.

Donation History: View past donations of all users of the system or donors to clearly know the trend and at which people are contributing to the community.

Profile Management: Update donor details (name, contact, location).

4.1.3.2 Red Cross Admin Panel

Manage Donation Centers: Add, update, or remove donation center locations.

Post Urgent Needs: Highlight emergency requirements (e.g., blood drive, disaster relief).

Appointment Management: View and approve donation bookings.

Generate Reports: Analyze donations received, donor trends, and center performance.

User Management: Moderate user accounts and monitor system usage.

4.1.3.3 Database

Stores information on:

Donation centers (donor name, type of donation, location)

Donor profiles

Donation transactions and appointments

Notifications and alerts

Firestore or MySQL was proposed as the database solution for scalability and ease of real-time synchronization.

4.1.3.4 Google Maps Integration

Location Services: Based on Google Maps to locate the donor's position.

Navigation Support: Provides turn-by-turn directions from the donor's current location to the donation center.

Distance and time calculation based on different travel means, e.g, vehicles, cycles, and walking.

4.2 Presentation of Findings from the Field Study

(Based on Requirements Gathering through a Questionnaire) Project: Google Map-Based Donation Locator for Effective Charity Donation Service System Case: Uganda Red Cross Kabale Center

This was carried out to make sure that the intended Google Map-Based Donation Locator addresses the true needs of users. A field study was carried out. . An efficiently designed questionnaire was put in place and distributed among two very vital groups: Potential donors (individuals, organizations in Kabale District) and Uganda Red Cross Kabale Center members (field, administrative officers). It covered the following areas: Problems in the current donating practice., Outlook towards a new electronic platform, Adoption of technology, and desired features.

4.2.1 Methodology

Sample Size: 70 participants, following the application of the purposive sampling technique, including the employees from the Red Cross Society and the possible selected donors.

Data Collection Tool: Structured questionnaire (online and paper-based)

Response Rate: 92.5% (74 complete responses)

Analysis Approaches: Quantitative (percentages) and qualitative (comparable comments)

Challenge Identified	Percentage of Respondents (%)
Difficulty in allocating centers	65%
Lack of real-time updates on urgent needs	72%
Inconvenient donation scheduling	58%
Poor communication with Red Cross staff	54%
Transportation issues for donation deliveries:	45%

Interpretation: Many of the donors struggle with location awareness and timely communication from the Red Cross

Question Asked	Findings
Access to smartphones	90% own a smartphone
Familiarity with Google Maps	50% use Google Maps regularly
Preferred platform (Web vs. Mobile App)	52% prefer Mobile App, 48% Web
Interest in SMS notifications and emailing	75% would like SMS updates

Interpretation: A mobile-first approach integrated with Google Maps and SMS alerts would be most effective.

4.2.2.2 Desired Features from the New System

Feature Requested	Percentage of Respondents (%)
Map-based location services	88%
Real-time urgent needs alert	82%
Easy donation scheduling	76%
Appointment reminders	70%
Donation history tracking	62%

Interpretation: The focus should be on mapping, real-time alerts, and appointment management

4.2.2.3 Feedback from Uganda Red Cross Staff Administration Needs

Easy platform to update urgent needs (90%).

View donor schedules in real-time and the location on a Google map (85%).

Generate donation reports automatically at any time it's needed and print them for presentation outside the system. (70%).

- Challenges Faced:

- o Manual record-keeping is time-consuming and error-prone.
- o Difficulty informing the community about urgent campaigns quickly.

Interpretation: Staff require a simple-to-use admin panel to manage updates and reports effectively.

4.2.2.4 Summary of User Requirements

User Group	Key Requirements
Donors	Easy-to-use map locator, alerts, and scheduling
Red Cross Staff	Admin dashboard, urgent need for updates, reporting.
System-wide	Secure, scalable, mobile-optimized

5.2 Conclusion and Recommendation

The field study confirmed the urgent need for a digital system that combines location intelligence (Google Maps) with real-time communication features. Both donors and Red Cross staff expressed strong support for a mobile-responsive web system that improves efficiency, transparency, and coordination of donations.

Implications for System Design

Prioritize mobile-friendly development.

Focus heavily on Google Maps integration.

Implement a notification system (both app and SMS-based).

Design simple and intuitive user interfaces for both donors and staff.

Ensure the backend supports real-time updates and scheduling.

4.3 User requirements

User requirements include the following

i. A user is required to have a smartphone to use the application. A user is required to have network access to access any service of the application.

The user is required to first create an account to access the services of the application.

A user is required to have average computer skills.

The user is required to respond to the guidelines provided by the application to get the required output from the system.

Basing on the findings the following were ensured for both functional and nonfunctional requirement for the developed Google Map-Based Donation Management System for Uganda Red cross for Uganda Red Cross Kabale Center.

4.4 Functional requirements

Functional requirements capture the intended behavior(s) of the application. The behavior(s) may be expressed as services, tasks, or functions the application is required to perform.

Therefore, the system can perform the following functions;

The system shall allow donors to submit donation requests, including item type, quantity, and their location.

The system shall allow administrators to view donor locations on a Google Map using location markers.

The system shall enable administrators to schedule pickups for donation requests and assign collection staff if necessary.

The system shall send notifications (via SMS, email, or in-app) to donors regarding pickup schedules and confirmations.

The system shall support user registration and login for both donors and administrators with role-based access.

The system shall generate reports on donation activities, pickup statuses, and locations.

4.5 Nonfunctional requirements

1. Usability: The system must have a simple, easy-to-use interface, such that both administrators and donors find it easy to navigate, with simple map interactions.

2. Input/Output Performance: The pickup scheduling functionality and the Google Map functionality should load and respond within 3 seconds on a typical network

3. Security: The program must protect donor information and login credentials using robust authentication mechanisms and encryption of information.

4. Availability: The system should be available 24/7, with minimal downtime, to support anytime donation submissions and pickups.

5. Scalability: The program should be developed for managing growing numbers of donors and requests for donations without impairing performance.

6. Maintainability: The system should adopt a modular design for easy upgrades, particularly concerning features such as the map, alerts, and report writing.

4.6 System requirements

4.6.1 Hardware requirements and specifications

The hardware requirements of the system include the following:

Client Side (Donor/Admin Devices):

At least a Dual-Core 2.0 GHz processor.

Minimum 4 GB RAM.

10 GB free disk space.

Screen resolution of 1024×768 or higher.

Stable internet connection (3 Mbps or more).

A GPS-enabled /location feature on a smartphone is an added advantage. Server Side (System Hosting):

Quad-Core 2.5 GHz processor or higher.

8-16 GB RAM recommended for scalability.

100+ GB SSD storage for database and logs.

High-speed internet with static IP for reliability.

4.6.2 Software Requirements

SOFTWARE COMPONENT	SPECIFICATION
Operating System	Windows 10+, Linux (Ubuntu 18.04+), macOS (for clients); Ubuntu Server 20.04+ for hosting. (Windows 10 and Android preferred)
Server Platform	Apache, or Node.js server (Apache is preferred for local server; XAMMP)
IDE/Code Editor	Visual Studio Code, PhpStorm, or PyCharm for developer-side (VS code was used)
Map API	Google Maps API (with API key)
Programming Language	HTML, JavaScript with Node.js or frontend framework like React, and PHP for executing
Web Browser	Chrome, Firefox, Safari and MS Edge.
Database	MySQL databases

CHAPTER FIVE

ARTIFACT DESIGN AND IMPLEMENTATION

5.1 Introduction

This chapter gives a detailed account of what is involved in the implementation of the proposed Google Map-Based Donation Management System. This includes technologies and programming tools employed, implemented modules of the system, integration and testing approaches employed, deployment processes, and the challenges faced during the implementation phase. The implementation phase is a very important phase since it gives form to the system design, turning it into a usable and functional software product.

5.2 System Architectural Design

This gives a high-level view of the system with the main components and the services they provide, and how they communicate to make it a system.

The system will be based on a 3-tier architecture, ensuring separation of concerns, scalability, and easier maintenance:

Presentation layer (User Interface Layer)

This is the front-facing layer of the system, where users (donors and administrators) interact with the platform. Donors use a simple and responsive web interface to register, log in, and submit donation details, including the type of items and their current location. Administrators access a dashboard where they can view donation requests and trace donor locations directly on an embedded Google Map. This layer ensures that all user interactions, such as form inputs, login, map usage, and updates, are intuitive and accessible across various devices, like smartphones and computers.

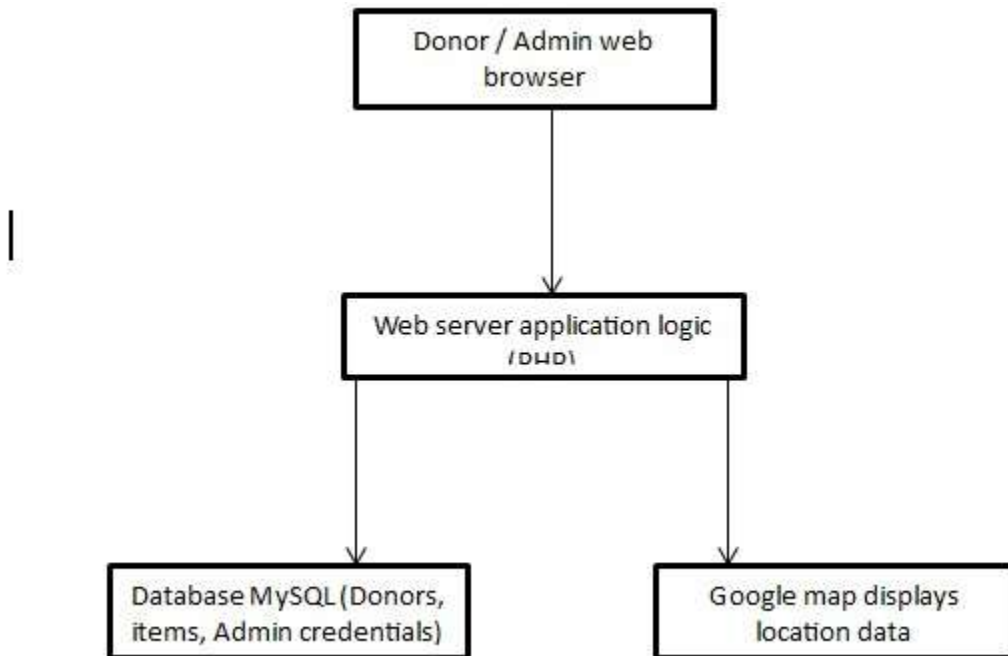
Application layer (Business Logic Layer)

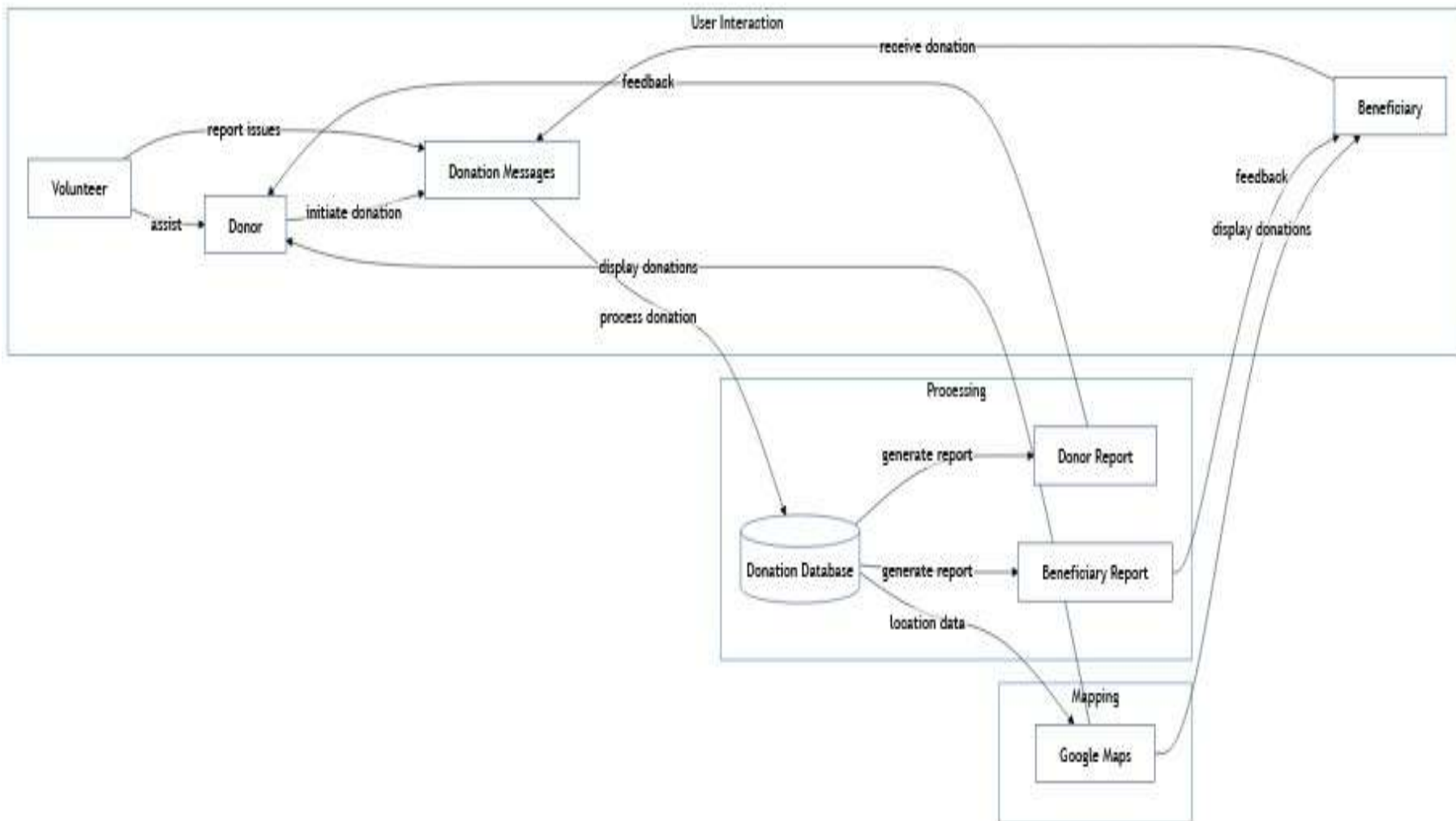
This is the core processing unit of the system that handles all the operational logic. It manages user authentication, validates donation form submissions, processes location data, and coordinates pickup scheduling. This level acts as a go-between for the user interface level and the database level. A key responsibility at this level is the integration of the Google Maps API, which is used for translating GPS locations into visible markers on a map for admin purposes. In addition, it interfaces with notification services, for instance, SMS or email APIs, for sending donors' details about pickup plans. This level ensures that the system responds intelligently when users make interactions and maintains the business rules defining donation and logistics management.

Data Layer (Database Layer)

The data tier is responsible for storing and retrieving all system information securely. This data consists of the following information: donor information, submission of donations, pickup history, user rights, and any relevant feedback. Any submission made by any donor, either administrative, such as arranging for pickups or status changes, is retained in the database. The structured data supports improved administrative reporting, such that filtering by geographical location or item type is feasible. How effectively a system can reflect real-time activity of a donated article and provide meaningful reporting is heavily reliant on this regular, uniform database.

SYSTEM ARCHITECTURE DIAGRAM





Description of a System Architecture Diagram on a Google Map-Based Donation Locator for Effective Charity Donation, with the elements you've observed:

Donor Interface:

Donors register and log in.

They locate nearby beneficiaries via the Google Maps API.

Donations are made with the ability to message or coordinate via Donation Messages.

Donation details are stored in the backend and can be viewed in Donor Reports.

Beneficiary Interface:

Beneficiaries register and describe their needs.

Their locations are pinned using Google Maps, making them visible to donors.

They receive donations and provide feedback (stored in Beneficiary Reports).

Volunteer Role:

Acts as a coordinator.

Assigned to oversee or confirm donation deliveries.

Uses maps to plan routes and optimize delivery.

Backend Server:

Handles all business logic, user authentication, and report generation.

Communicates with the database to store or retrieve donation data.

Database:

Stores all structured information.

50

Provides access to donor and beneficiary reports, donation history, and communication logs.

Layer Components Description

Mobile Application, Web

Presentation Interfaces for donors and Red Cross staff to

Portal HTML, CSS, JS (React),

Layer interacts with the system.

Google Maps API

Application Server (Node.js, handles user requests, processes logic,

Application

Django / PHP / Python, API integrates Google Maps APIs, and sends

Layer

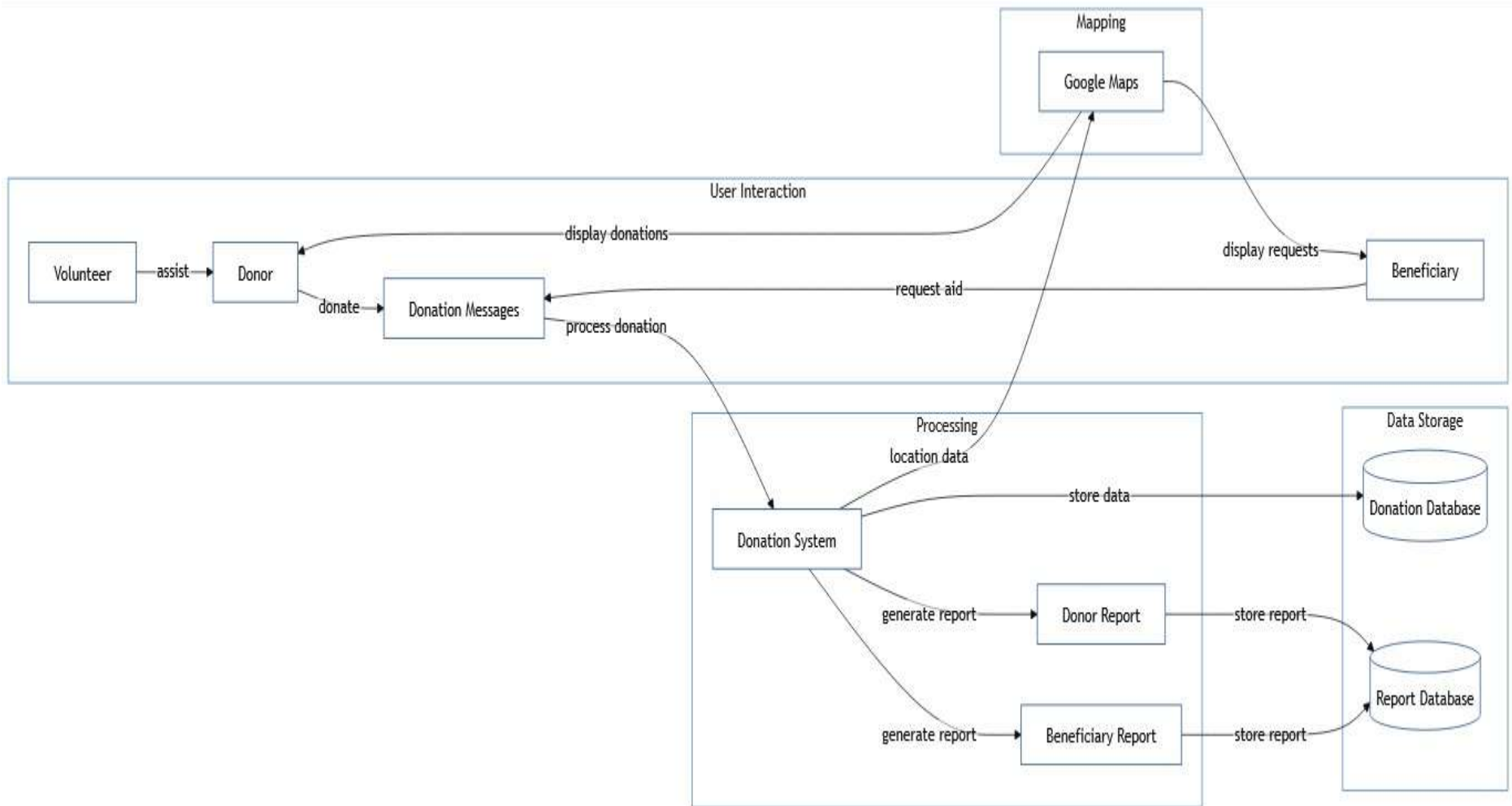
integrations. Notifications.

Stores user profiles, donation records, Database Server (MySQL /

Data Layer donation center information, appointment

Firebase) schedules, campaign needs.

7.2 System architecture workflow



A Data Flow Diagram (DFD) shows how data moves through the system—from input to processing to output.

Donors submit donations and view reports.

Beneficiaries request donations and give feedback.

Volunteers manage/track donations and confirm delivery.

Main processes

Process 1: User Registration & Authentication

P2: Donation Management

P3: Messaging System

P4: Location Services (Google Maps API)

P5: Reporting & Feedback External Entities:

Donor

Beneficiary

Volunteer Processes:

Register/Login

Send/Receive Donation Messages

Submit/Request Donation

Generate Reports

Map-based Locator (Google Maps API Integration)

Data Stores:

Donor Data

Beneficiary Data

Donation History

Reports

Messages

Here's how the system works step-by-step;

Donor fills in a donation form, including item type and location (auto-filled or manually).

The server receives and processes the form, storing the data in the database.

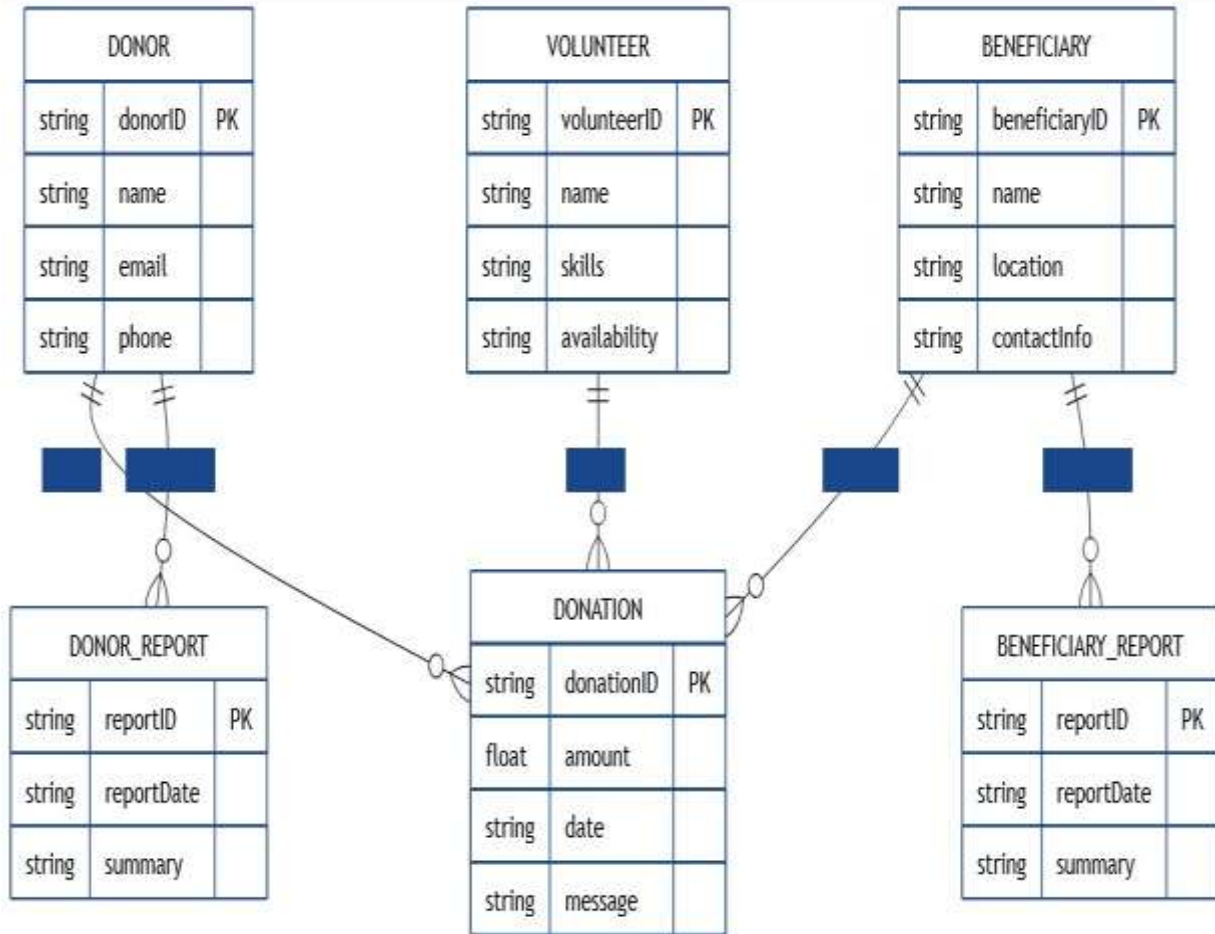
Admin logs into the system and views donor locations through the Google Map interface.

Admin selects donation requests and schedules pickups, updating the status in the system.

The system sends notifications to the donor about the pickup.

Admins can generate reports and monitor donation history from the database.

ERDIAGRAM



Entity	Attributes
Donor	DonorID (PK), Name, Email, Phone, Location, DonationHistory
Beneficiary	BeneficiaryID (PK), Name, Email, Phone, Location, NeedDescription
Volunteer	VolunteerID (PK), Name, Email, AssignedLocation, Role
Donation	DonationID (PK), DonorID (FK), BeneficiaryID (FK), VolunteerID (FK), ItemDescription, Quantity, Date, Status
DonationMessage	MessageID (PK), SenderID (FK), ReceiverID (FK), MessageContent, DateSent
DonorReport	ReportID (PK), DonorID (FK), TotalDonations, LastDonationDate, ReportDate
BeneficiaryReport	ReportID (PK), BeneficiaryID (FK), ItemsReceived, LastReceivedDate, ReportDate

Relationships:

A Donor can make multiple Donations.

A Beneficiary can receive multiple Donations.

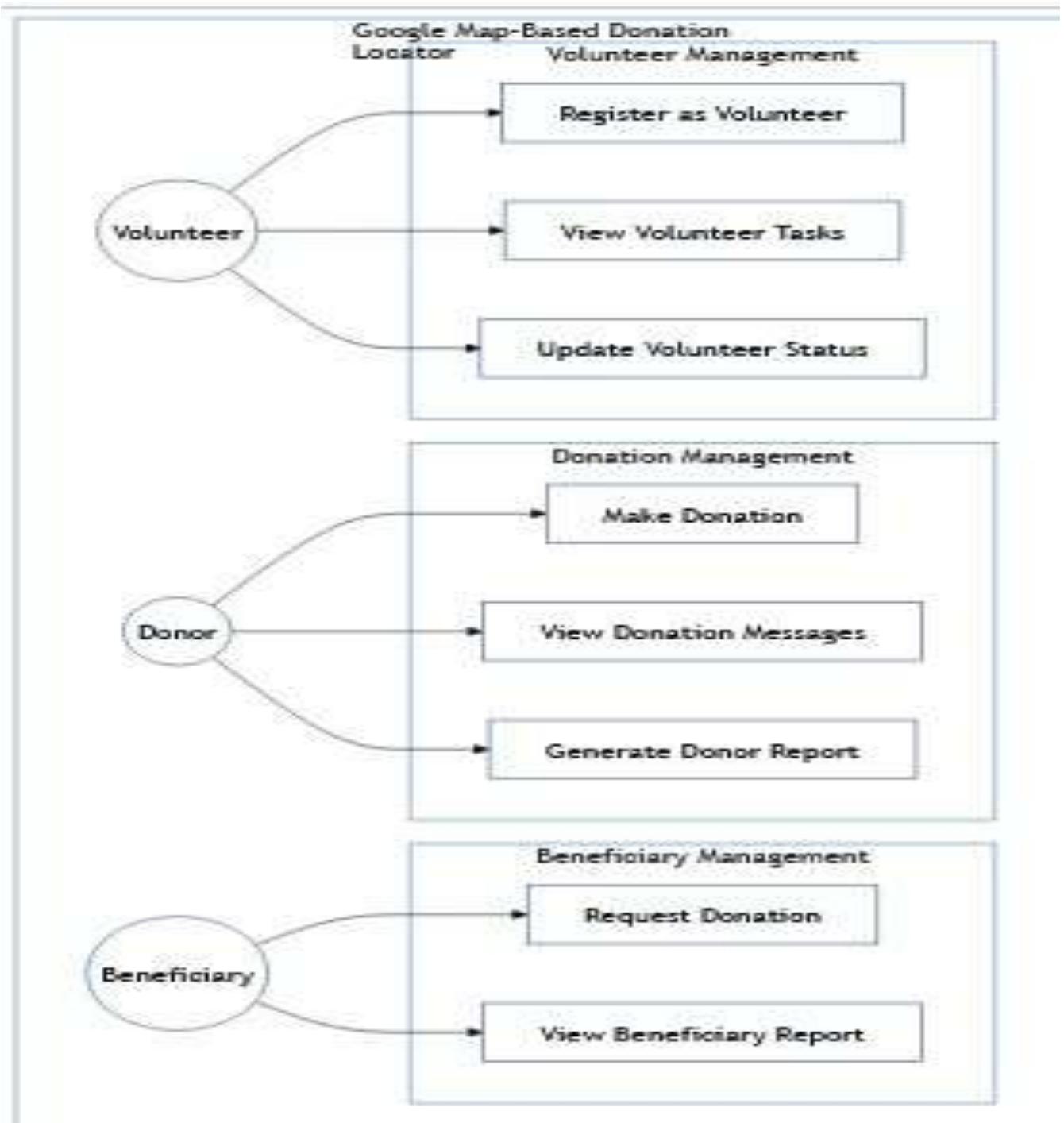
A Volunteer can facilitate many Donations.

Donation Messages are exchanged between Donors, Beneficiaries, and Volunteers.

A Donor can generate multiple Donor Reports.

A Beneficiary can receive multiple Beneficiary Reports.

USE CASE DIAGRAM OF THE SYSTEM



Use Case diagram for a Google Map-Based Donation Locator for an Effective Charity Donation System focuses on Donor, Beneficiary, Volunteer, Donation messages, Donor report, and Beneficiary report.

Actors:

Donor: Person donating goods or funds.

Beneficiary: Person or group receiving donations.

Volunteer: Person coordinating logistics or deliveries.

Use Cases (System Functionalities):

Locate Donation Centers (Map-based)

Send Donation Messages

Submit Donation

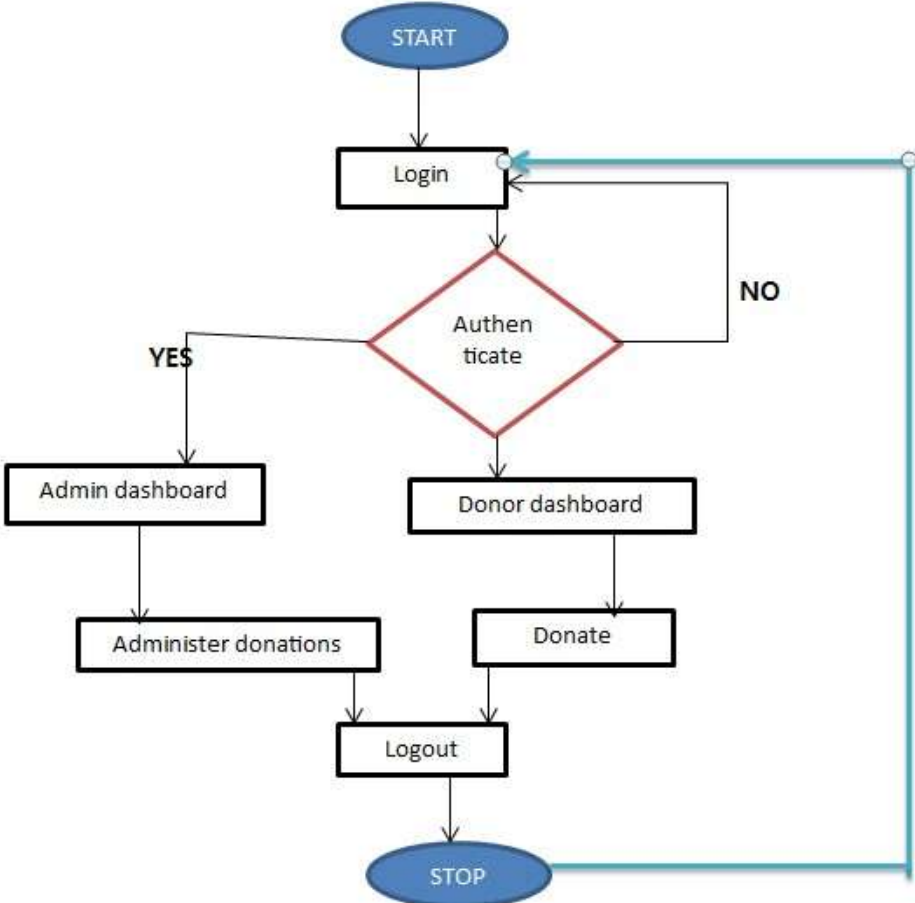
Receive Donation

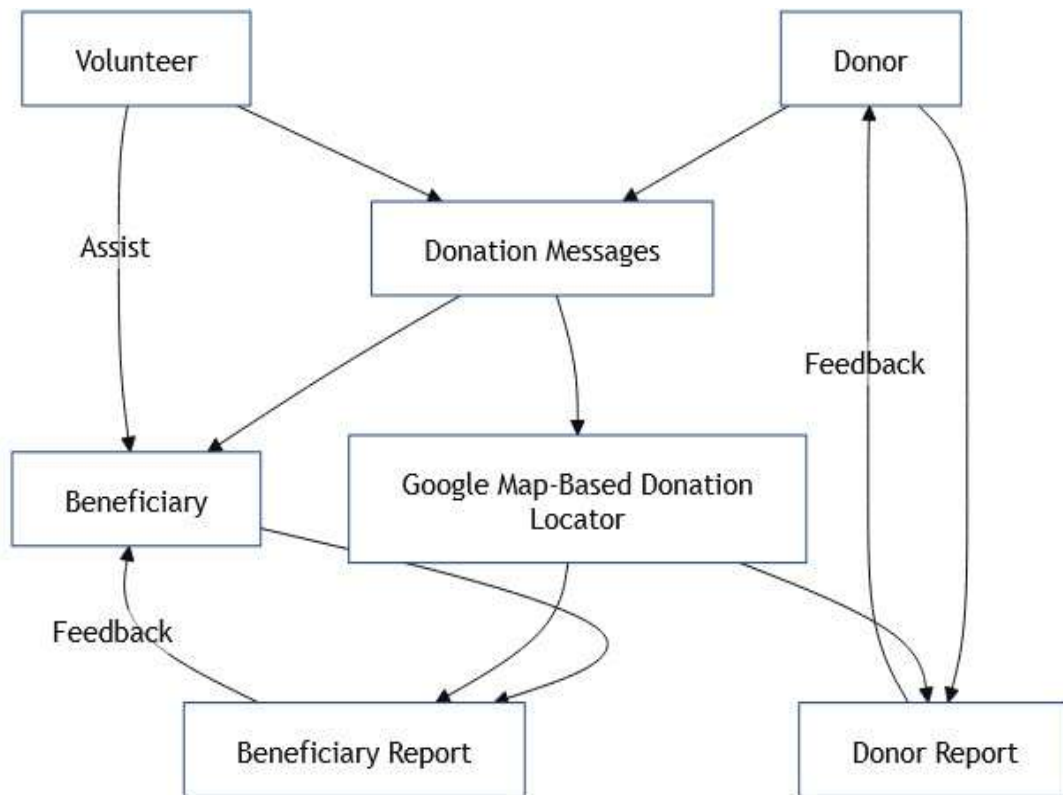
Generate Donor Report

Generate Beneficiary Report

Assign Delivery (Volunteer)

SYSTEM FLOW CHART





A system flow chart visually represents how data and processes flow within a system. For a Google Map-Based Donation Locator for an Effective Charity Donation System, the key actors—Donor, Beneficiary, Volunteer, along with Donation Messages, Donor Report, and Beneficiary Report—interact through a central platform that integrates with Google Maps to locate and manage donations effectively. Here’s a detailed explanation of the System Flow Chart for these components:

Donor Flow

Start

Donor Logs into System

Enter Donation Details (Type, Quantity, Location)

Donation Saved in Database

Location Marked on Google Maps

Notification Sent to Admin & Volunteers

End

Beneficiary Flow

Start

Beneficiary Logs into System

Searches for Donations Nearby (via Google Maps)

Requests Donation (Sends Request Message)

Admin/Volunteer Validates and Approves Request

Beneficiary Gets Confirmation

End

Volunteer Flow

Start

Volunteer Logs in

View New Donations & Beneficiary Requests

Matches Donors with Beneficiaries Based on Location

Coordinates Pickup and Delivery

Updates Status in System

End

Donation Messages

Triggered when:

Donor submits donation

Beneficiary requests a donation

Volunteer coordinates delivery

Stored in Database

Viewed by the respective parties

Used for communication and logging

Donor Report Donor Logs in Views Past Donations System Generates: Donation Summary

Locations Donated To

Dates and Categories

Export Option (PDF/CSV)

End

Beneficiary Report

Beneficiary Logs in

Views Received Donations System Generates:

Donation History

Categories of Aid

Dates and Status

Export Option (PDF/CSV)

End

5.2 Development Tools and Technologies

The implementation of the Google Map-Based Donation Management System relies on a variety of software tools and technologies. Each plays a vital role in the design, development, deployment, and functionality of the system. The development of the system was conducted using a set of modern tools and technologies suitable for both frontend and backend development. The system was developed with scalability, usability, and efficiency in mind. Technologies used are explained below;

Visual Studio Code (VS Code) was used as the primary source code editor. It offered a lightweight and flexible development environment with support for multiple languages such as HTML, CSS, JavaScript, PHP, and Node.js. Its built-in terminal and integration with Git made it easier to run, test, and manage the code base during development.

HTML, CSS, and JavaScript formed the core technologies used for building the frontend of the system. HTML was responsible for defining the structure of the web pages,

CSS styled those pages to create a user-friendly and attractive interface, while JavaScript introduced interactivity, particularly for form validations and integration with external services like Google Maps.

To make the frontend more responsive and visually appealing, Bootstrap was incorporated into the design. Bootstrap contributed a lot of reusable UI components like buttons, cards, navigation bars, and grid templates, which helped diminish design time a lot and maintained consistency on varying devices as well as varying screen sizes.

For server-side scripting, PHP was used for backend logic processing. Form submissions, user login, database interactions, and third-party services integration, like Google Maps API, fell

into this category. The reason for using PHP was simplicity, extensive support, and XAMPP support; Node.js might replace it for real-time features if anything goes wrong with PHP.

MySQL was chosen as the database management program based on its reliability, scalability, and ease of integration with PHP. MySQL was employed for the storage of crucial system information, such as donor information, details of donation, administrator information, and details for scheduling pickup. Relational database tables were defined and normalized for the maintenance of data integrity and to evading redundancy.

The Google Maps JavaScript API played a key role in enabling geolocation services for the system. It allowed donors to mention their location while submitting and enabled administrators to display those places of donation on a map, which could be interactive. This functionality lay at the core of connecting pickup coordination with donor locations for the system.

For local testing and development, XAMPP has been used to emulate a server environment hosted locally. XAMPP incorporates Apache, MySQL, and PHP all in a single bundle, allowing for easy installation of the application locally for debugging problems before deployment live.

For managing the notifications, Firebase Cloud Messaging or SMTP servers were integrated. Firebase provided real-time messaging services for push notifications, while email alerts were managed using SMTP. These technologies ensured that donors received timely alerts when the donation status had changed or when a pickup had been scheduled.

5.3 Modules Implemented

The Google Map-Based Donation Management System was developed using the iterative software development model, which involves building the system incrementally through cycles of design, development, testing, and refinement. This allowed for close collaboration with stakeholders from the Uganda Red Cross Kabale Center, who actively participated in reviewing and validating the functionality of each module during each iteration. Each module serves a distinct purpose while interacting seamlessly with others to achieve the system's overall functionality. Below is a detailed explanation of each module implemented.

5.3.1 User Authentication Module

In the initial iteration, the user authentication module was implemented to secure access for both donors and administrators. The Uganda Red Cross team emphasized the importance of role-based access, which led to refining this module to ensure that administrators have access to operational features, while donors interact only with donation functionalities. Continuous feedback helped in improving usability, such as enhancing form validation and integrating a password reset feature.

5.3.2 Donation Submission Module

This module was iteratively improved based on usability tests conducted with Red Cross volunteers. Initially, a basic form was created to submit donation details. Through feedback, the Google Maps API was integrated to allow donors to pinpoint their exact location. Volunteers at the Red Cross suggested adding item categorization, which was later included in the second cycle to help in sorting and managing donations.

5.3.3 Mapping and Location Tracking Module

The map module was a core feature identified by the Red Cross Kabale team. During the first implementation, markers were displayed for each donor. However, further iterations included clustering, real-time updates, and clickable markers with donation summaries. The iterative feedback process ensured that the map interface remained user-friendly for administrators to plan pickups efficiently.

5.3.4 Pickup Management Module

After a basic pickup scheduler was developed, the Red Cross administrators requested additional features like assigning status levels to each donation (e.g., "pending", "picked", "canceled") and setting pickup dates. This feedback was incorporated into the next development cycle. The iterative model allowed frequent modifications until a satisfactory level of detail and usability was achieved.

5.3.5 Notification Module

Email and SMS alerts were added gradually. Initially, donors only received email confirmations. Based on stakeholder recommendations, push notifications were proposed for future versions using Firebase. The iterative nature of development allowed testing these notifications with real users from the Red Cross team, improving message clarity and timing.

5.3.6 Report Generation Module

The reporting module was implemented in the final iteration, as administrators needed insights into donation volumes and trends. Basic tabular reports were generated, followed by the inclusion of visual summaries (e.g., location-based statistics and bar charts) based on Red Cross feedback. This module empowered decision-making and logistics planning.

5.4 Integration and Testing

5.4.1 Iterative Integration Approach

Given that the system was developed using the iterative model, integration and testing occurred in multiple cycles, not as a single final stage. After each module or feature was developed, it was integrated into the existing system and tested in collaboration with stakeholders from Uganda Red Cross - Kabale Center. This approach allowed for early detection of issues, continuous improvements, and increased stakeholder satisfaction.

5.4.2 Unit Testing

Each module (such as login, donation form, and map interface) underwent independent unit testing during its respective iteration. Test cases were created to verify both successful and failed scenarios. For example, form validation was tested with both valid and invalid input to ensure data integrity.

5.4.3 Integration Testing

As modules were completed, they were integrated incrementally. For example, after the donation module was working, it was integrated with the map to ensure new submissions are seen on the map by system admins. Integration testing confirmed that data moved smoothly between the frontend, backend, and the donation database.

5.4.4 Stakeholder Validation & Feedback

In each cycle, a working prototype was demonstrated to the Uganda Red Cross Kabale Center team. Their feedback played a vital role in refining the system. For instance, they helped identify areas where donation status needed better tracking or where the map interface needed simplification. Their participation ensured that the system met actual field needs.

5.4.5 User Acceptance Testing (UAT)

After the final iteration, complete end-to-end user testing was performed. Red Cross staff acted as administrators, while simulated donors submitted test data. The system was evaluated based on usability, performance, and correctness. The feedback confirmed that the system was practical, user-friendly, and well-suited for real-life deployment.

5.5 Deployment

5.5.1 Local Deployment

Initially, the system was deployed on a local server using XAMPP. This allowed for complete offline testing of the frontend, backend, and database components.

5.5.2 Online Deployment (Planned)

A cloud server or shared hosting service may be used for live deployment. If needed, the Google Maps API key would be restricted to that domain, and the database would be migrated to a remote MySQL server.

5.5.3 Database Setup

All necessary tables were created and normalized to reduce redundancy. Sample data was inserted for testing purposes, and database relationships were validated to ensure consistency.

5.6 System data outputs

The Google Map-Based Donation Management System was developed to enhance the donation process by connecting willing donors with charity organizations through real-time mapping and intelligent coordination. The system produces several important outputs which support administrators and donors by providing confirmation, direction, and logistical insights in the form of bar graphs and generate reports. Each output has been designed with usability, clarity, and actionability in mind, refined through feedback from the Uganda Red Cross Kabale Center during iterative development cycles.

5.6.1 Web Home Page (System Entry Interface)

The landing page of the Google Map-Based Donation Management System serves as the public-facing entry point for both donors and administrators. Designed with simplicity, accessibility, and responsiveness in mind, the page ensures that users can quickly access the relevant functions without unnecessary navigation.

For donors, a prominently displayed "Donate Now" button allows them to instantly access the donation form, making the process of giving quick and intuitive.

For administrators, a "Admin Login" button is also presented, redirecting them to the secure login interface where they can authenticate and access the system backend.

This design caters to both user groups while maintaining a clean and welcoming layout.

Key Features of the Home Page

Clear Call-to-Action: The "Donate Now" button is strategically placed at the bottom of the page and highlighted to immediately attract donor attention. On click, it directs the user to the

donation form page where they can fill in the type of items, quantity, contact info, and share their pickup location via Google Maps.

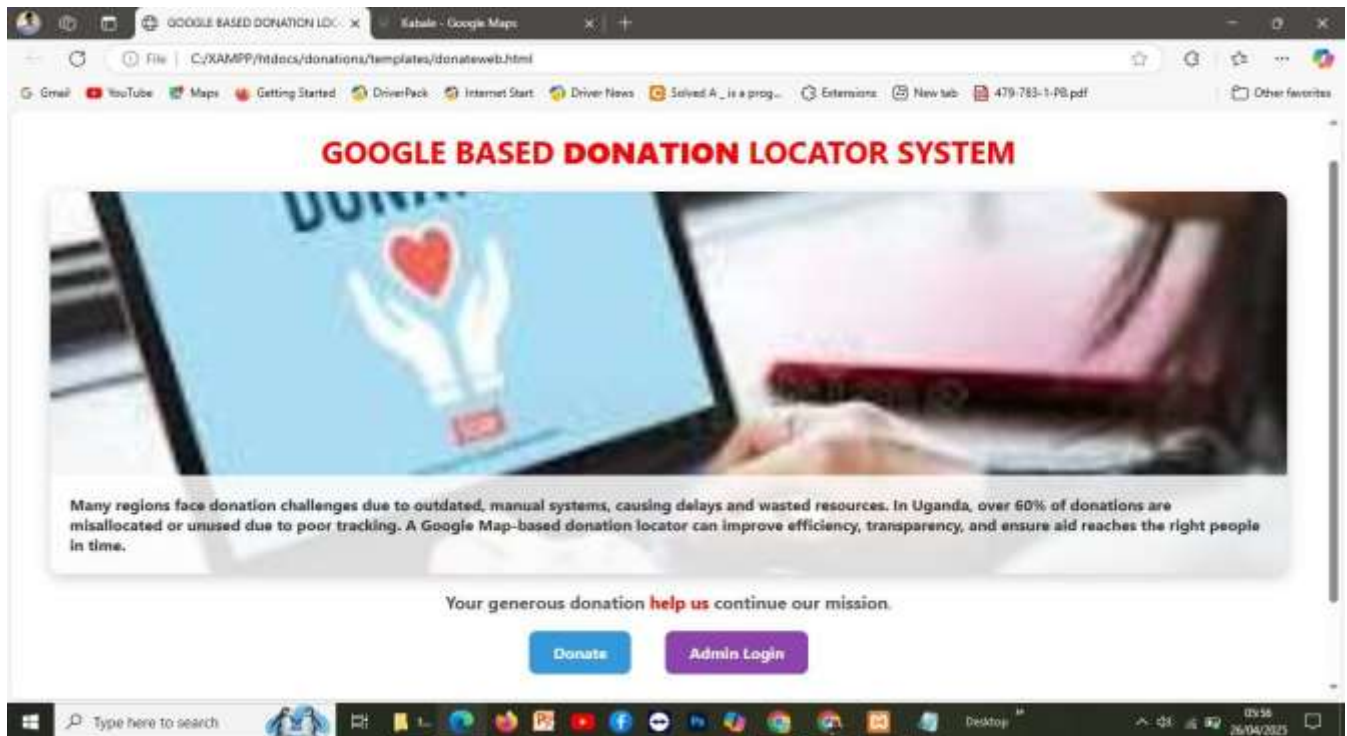
Administrator Access: The "Admin Login" link or button is styled professionally and located either on the top navigation bar or footer, ensuring that staff can easily access the system backend, which leads to the secure admin login interface.

Responsive and Mobile-Friendly: The page is responsive and adjusts gracefully to different screen sizes and devices, ensuring accessibility from desktops, tablets, or mobile smartphones.

Branding and Trust Elements: The landing page features the Uganda Red Cross Kabale Center logo, background imagery that represents humanitarian work, and short welcome text to explain the purpose of the system and encourage donations. Footer sections may include contact information, mission statements, or partner links.

Fast Load Time: Minimal design elements were used to ensure that the page loads quickly, even in low-bandwidth settings, supporting wider accessibility.

User Experience Consideration: This home page was built with the end-user experience as a priority. Donors do not need to create accounts or navigate through multiple menus; a single click on "Donate Now" takes them to a pre-integrated Google Map donation form. This quick-access design encourages more donations and lowers the barrier to participation. For administrators, direct login access saves time and reduces the chance of misnavigation.



5.6.2 Admin Login Page for Access and Security Control

The login page serves as the first line of defense for the Google Map-Based Donation Locator System, specifically controlling access to the administrative interface. Given the sensitive nature of the data handled, such as donor locations, contact information, and logistical planning details, the login mechanism was implemented with a focus on security, authentication, and usability.

Design and Functionality

The admin login page is presented as a clean and minimal interface with fields for entering a username and password. When they are entered, the credentials are securely compared with hashed values on the backend database. Only authorized users, who are administrators, have access through the dashboard, through which they can view locations on the map that have donations, run reports, and schedule pick-ups.

To polish the user experience and avert repeated errors when logging in, the page is also integrated with feedback mechanisms. For example, when the user keys in a wrong password or username, the system will directly display a message like "Invalid login credentials. Please try again."



Figure 3: Login page

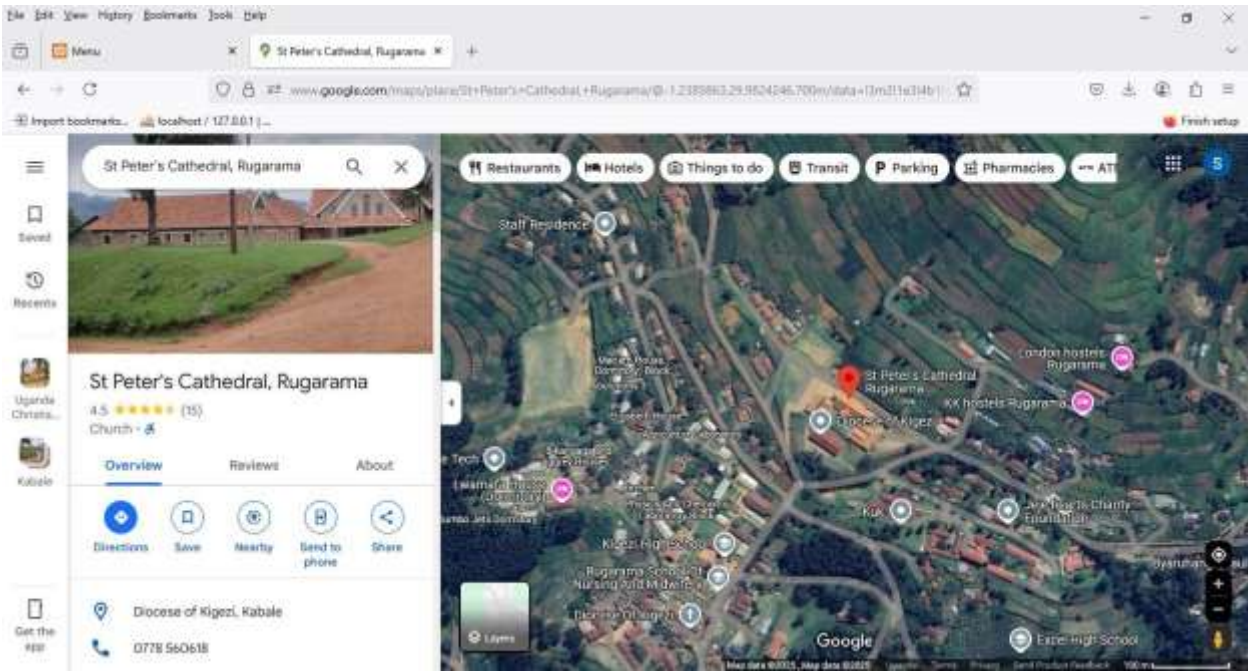


Figure 4: Interactive Donation Map

One of the key outputs of the system is the interactive donations map, which is built into the admin dashboard. This map displays locations of donations that are coming in through dynamically positioned markers, which is equivalent to the geographical addresses of the donors entered on the donations form. All the markers provide a pop-up with concise but meaningful information, such as the name of the donator, contacts, type of item donated, quantity, and time submitted. This user interface functions like a plan-of-operations center in that Uganda Red Cross employees can visualize sources of donations in real-time. Administrators are enabled to click on a marker for the purpose of extracting detailed individual profile donations and then plan pick-ups through communication via phone or email from the interface map. It ensures that there is single access of the full map by the admin account, thus protecting the privacy of the donators while enabling transparency of the full operational snapshot. To facilitate strategic decision-making, the system produces the donation summary reports, which are mostly for the use of the administrators in the Uganda Red Cross. Donation summary reports contain summarized statistical information on the performance of at the given time.

	<input type="checkbox"/>	ID	First Name	Last Name	Donation Type	Phone Contact	Address Location	Email	Amount	Payment Me
	<input type="checkbox"/>	18	gguiufe	fstidgf	clothings	0775234564	kk	dku4tcasa@gmail.com	3.00	
	<input type="checkbox"/>	19	Sam	Sams	school supplies	0775234568	Wbale	kkatlasdandadg@gmail.com	5.00	Cheque

Figure 5 Donor List

The outputs that have been developed include the general donations received, the most popular groupings of items, as well as the geographical distribution of the donations. Data visualization involves the utilization of bar graphs and collated documentation that is in the admin dashboard, thus providing an integrated picture of the performance indicators. Such outputs guide the Red Cross on ascertaining the success of the donation drives, identifying areas that contain active donations, and designing special outreach programs.

ID	First Name	Last Name	Donation	Amount	Address/Location	Date
39	GLORIA	NINSHAA	food	0	akeubi	4/1/2025
40	JOHN	KATI/SIME	food	0	kabile university	4/14/2025
41	LYNE	NATUGONZA	CLOTHES	30000	kabile near active super market	4/15/2025
42	Niwanyanya	Livi	food	5000	kigongi	10/18/2024
43	ivan	tumukunde	clothes	500000	kitumba	5/18/2022
44	Muegi	Robert	Cow	30000	Kabile University	5/3/2025
45	Donors	Kabile Donor	Milk	60000	Kabile	5/2/2025
46	Ipsil	Wasa	books	50000	kabile university	5/2/2025
47	ssoddsdsdtds	dsdsdsdsd	Money	1	Mbarara	5/2/2025

Figure 6 Donor Report



Figure 7: Donor report Bar chart

CHAPTER SIX: DISCUSSION, CONCLUSION, RECOMMENDATION, AND FUTURE

WORK

6.1 Achievements of the Project as per the objectives

The Google Map-Based Donation Management System achieved several design, operation, stakeholder satisfaction, and development approach goals. Those goals indicate the achievement of applying the use of the iterative model and co-operation with the Uganda Red Cross Kabale branch stakeholders.

The integration of Google Maps is a technical success par excellence. The work enabling easy determination of stem sites and visualization on a web-based User interface mapping. It was particularly helpful in terms of planning logistics, especially when planning collections in areas with higher levels of giving. The

integration provided a modern, real-time functionality in humanitarian resource management.

User-friendly Donor Interface: A user-friendly and fast web interface is also built,

via which donors are enabled to converse with the system, on submission of donation information.

Label object categories and mark their respective locations. The user's experience was made primary during

The process was designed so that it required minimal effort and time on behalf of the donor. This aspect

was designed to enhance the degree of engagement by individuals who had previously deemed donation

processes difficult or time-consuming.

Role-Based Access for Increased Security: To guard important information and stop

unauthorized use, the software included a password-protected login module for administrators. Administrative users

were permitted to view donation records, monitor donation geographic distributions, and produce summary

reports; however, other members were at liberty to simply contribute. Such strict demarcation of usage responsibility enabled

Enhanced program integrity and complied with key cybersecurity principles.

Real-Time Data Management and Centralized Repository: All aspects of donations were

then documented and saved in a central database. Data management was done on a real-time basis, allowing for instant availability for administrators. This method eliminated the need for

manual processes, eradicated errors, and provided a better means for managing the logistics of humanitarian aid.

Visual Analytics and Reporting: The system supported auto-generated bar charts and data summaries showing the number of items donated, categorized by type. This helped administrators and Red Cross management to make data-driven decisions, for instance, by identifying which donation categories needed more attention during relief campaigns.

Field Validation with Uganda Red Cross, Kabale Center: The system was piloted with actual field users from the Uganda Red Cross Society in Kabale. Their feedback affirmed the system's practical value, especially in terms of visibility, ease of accessing donor data, and using maps to reduce time wasted during pickups. This confirmed the system's alignment with real-world humanitarian needs.

6.2 Problems encountered when doing project research

While the system was successful overall, several technical, logistical, and practical challenges arose during different stages of development, testing, and implementation.

Internet Connectivity Issues in Testing Areas: During field testing in parts of Kabale, weak internet connections caused delays in accessing or loading the map interface. Since the system is web-based and relies heavily on live Google Maps rendering, any interruption in connectivity impacts performance, particularly when submitting donation forms or viewing donor locations.

API Usage Limitations and Costs: Google Maps API provides a free tier, but this comes with a limit on the number of map loads and geolocation requests. During intense testing periods, these limits were exceeded, resulting in temporary blocks or degraded performance. While manageable during development, this presents a scalability concern for future deployment unless billing or an alternative mapping service is considered.

Limited Real Donor Testing Participation: Due to ethical considerations and data privacy concerns, real donors were hesitant to share actual location data during the test phase. This

limited the ability to simulate real-life donation distribution patterns, forcing reliance on test data. While helpful, such simulations don't fully capture field complexity.

Administrator Learning Curve: Though the admin dashboard was designed with clarity, some of the Red Cross staff needed training to understand features like map filtering, report downloading, and bar chart interpretation. This exposed the need for documentation or onboarding guides, which had to be created during the late stages, as the project report to always act as a manual guide in using the system.

The project was tireless due to the lack of knowledge about PHP since it was not part of the programming languages, we were taught within the curriculum we covered. The time provided to come up with a complete system was limited since we had other course units to cover, along with developing the system. This slowed down the whole process.

The project was costly in that a lot of money was spent on buying tools to use, like APIs, and the internet for testing.

Therefore, having encountered several challenges during our research project, we humbly report that even if the system has accomplished its requirements to a greater extent, there are some limitations it bears;

The system requires an internet connection to operate.

The system currently lacks a notification function.

6.3 Future work

The system can still be improved upon as discussed below;

Integration of notification functions into the system.

The backup module should also be incorporated to ensure that the information that is kept is safe and ensure that there is ready backup information in case the original information gets corrupted or lost.

6.4 Recommendations

As information structure designers and IT experts, we make the following recommendations;

To the system administrators

For the system to succeed, users have to be trained about how the works and it's all its functionality, so that it becomes easy for the users to get the motivation to use the system.

The system should be maintained accurately and protected from people who pretend to be administrators but are not, by creating strong passwords that cannot be broken down easily by hackers.

Any upgrading needed on the system should be done unless otherwise specified by the system developer.

The system supporting the machine, specifically the server machine, requires routine servicing and cleaning.

Suggestions for Implementation

Scale the system across the Red Cross chapters and relief NGOs in the rest of Uganda, with capacities scaled down according to local demand.

Set up comprehensive training academies for users and provide frequent tech assistance for improved system use and productivity.

To the university stakeholders

We would like programming languages such as PHP and Flutter to be the core as a unit course because this will allow the existing and future students to build on their programming skills,

especially the ones who might be aspiring to take a major in software and system administration and development.

The university curriculum should also prioritize practical lessons more than theoretical ones as it is now. This will shape the skill boosting amongst students and pave the a path for them to increase their innovativeness and be set to compete in problem solving in the IT industry.

Directions towards More Research

Perform longitudinal surveys on tracing the general influence from the system on patterns of donation, beneficiary satisfaction, and organisational success.

Explain data analytics and integration of artificial intelligence (AI) in the identification of peak demand points and resource distribution optimization.

See opportunities for interface with other humanitarian sites as well as government databases towards the achievement of a favorable national donation management system.

6.5 Conclusion

This program sought to match donors with charities using a tech-centric platform, with special interest in the Uganda Red Cross Society, Kabale Center. The overall objective was to simplify and make donations electronic through a web-based program that includes Google Maps, such that donors could specify locations and details of donation, and administrators could manage pickups efficiently and monitor them centrally.

It was developed based on the iterative model of software engineering, enabling a sequential process of design, testing, user input, and upgrades. The evolutionary cycle comprised:

- ✓ Collecting requirements from the stakeholders at Uganda Red Cross,
- ✓ Development of user interfaces for both donors and administrators,

Implementing main modules, such as Google Maps APIs,

✓ Testing for usability, responsiveness, and security, ✓ and deployment for pilot use.

The outcome was a fully functional prototype capable of acquiring donor information, tracking donor locations, managing contributions, scheduling pickup, and creating reports. The system enhanced donor-administrative interactions, provided accurate spatial data for planning on the ground, and facilitated openness and accountability in the management of donations.

6.6 Conclusions

The study research has led to the successful implementation of the assigned objectives for the first chapter of this report.

Based on the findings and analysis, the Google-based donation locator system is a venture worth investing in because it is an independent and cost-saving platform for both donors and donation admins. Once taken seriously and embraced, the delivery of donations to the people in need can be eased.

REFERENCES

- Brown, M., & Green, T. (2023). *Technology and Philanthropy: Innovations in Giving*. Oxford University Press.
- Goodchild, M. F. (2018). *GIS and Public Policy: Advancing Geographic Information Science*. Springer.
- Jones, P., & MacDonald, S. (2019). *Digital Donations: Enhancing Engagement Through Technology*. Cambridge University Press.
- Liu, Y., Wang, H., & Zhang, P. (2021). *Cloud Computing for Social Good: Applications in Disaster Relief and Philanthropy*. Elsevier.
- Mwangi, J., & Wanjiru, K. (2021). Challenges and Opportunities in Digital Philanthropy in Africa. *African Journal of Technology*.
- Natarajan, R., Singh, A., & Rao, P. (2022). *Mobile Technologies for Social Impact: Case Studies in Developing Nations*. Taylor & Francis.
- Sargeant, A., & Shang, J. (2017). *Fundraising Principles and Practice*. Wiley.
- Sharma, R., & Gupta, V. (2020). *Food Donations and Technology: A Case Study of India's Hunger Relief Efforts*. Springer.
- Smith, L., Brown, K., & Williams, J. (2020). *GIS for Nonprofits: Strategies for Effective Charitable Outreach*. MIT Press.
- Zhang, X., Li, M., & Chen, J. (2020). Artificial Intelligence in Social Good: Data-Driven Solutions for Humanitarian Aid. *IEEE Transactions on Social Computing*.
- Kasozi, K., & Okello, T. (2020). "Digital platforms and charitable giving in Uganda:

Trends and challenges." *Journal of Ugandan Social Research*, 15(2), 123-135.

Google. (2021). "Google Maps for non-profits: Empowering organizations with mapping solutions." *Google for Nonprofits*.

Mugisha, L. (2019). "Integrating technology in charitable organizations: A review of mobile donation systems in Uganda." *Uganda Journal of Information Technology*, 12(4), 210-220.

Ntale, M., Nkalubo, D., & Asimwe, J. (2018). "Leveraging geospatial technologies for efficient charity donation systems in Uganda." *Ugandan Journal of Development Studies*, 11(1), 55-70.

APPENDICES

Appendix A

S/N	Date	Activity
1	5th Sept 2024 - 13th Sept 2024	Concept paper writing and topic crafting
2	14th Sept 2024 - 13th Nov 2024	Document Proposal writing
3	20th Nov 2024	Presenting the proposal
5	01st Jan 2025 - 17th Jan 2025	Literature review to refine our proposal
6	20th Jan 2025 - 10th Feb 2025	Data collection
7	15th Feb 2025 - 21st Feb 2025	Analyzing the collected requirements
8	25th Feb 2025 - 26th Mar 2025	Designing and implementing the project
9	15th Mar 2025 - 10th April 2025	Testing our project

10	10th April 2025 - 30th April 2025	Project Report writing
11	7th May 2025	Project Defense
12	01st June 2025 onwards	Deployment process

Appendix B Log in source code

```

global_login - Notepad
File Edit Format View Help
<!doctype html>
<html {html_attrs}>
  <head>
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>{pagetitle}</title>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8">
    <base href="{projectPath}">
    <link REL="stylesheet" href="styles/default.css?{wizardBuildKey}" type="text/css">
    {BEGIN rtlCSS}
    <link REL="stylesheet" href="styles/defaultRTL.css?{wizardBuildKey}" type="text/css">
    {END rtlCSS}
    {BEGIN styleCSSFiles}
    <link REL="stylesheet" href="{stylepath}" type="text/css">
    {END styleCSSFiles}
  </head>
  <body class="{styleName} function-login" >
    {BEGIN body}
    {header}
    <style>
      {containerCss}
      .r-pretty-login-page > .r-controls {
        background: white;
      }
      .r-pretty-login-page > .r-sideImage {
        background: #F2F2F2;
      }
    </style>
    <div class="r-pretty-login-page"
      data-image-fullsize
      <div class="r-controls">
        <div class="r-mainform">
          {BEGIN top block}

```

Appendix C: Main menu source code

```
global_menu - Notepad
File Edit Format View Help
<!doctype html>
<html {html_attrs}>
  <head>
    <meta http-equiv="X-UA-Compatible" content="IE-Edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>{pagetitle}</title>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8">
    <base href="{projectPath}">
    <link REL="stylesheet" href="styles/default.css">{WizardBuildKey}" type="text/css">
    {BEGIN rtiCSS}
    <link REL="stylesheet" href="styles/defaultRTL.css">{WizardBuildKey}" type="text/css">
    {END rtiCSS}
    {BEGIN styleCSSFiles}
    <link REL="stylesheet" href="{stylepath}" type="text/css">
    {END styleCSSFiles}
  </head>
  <body class="{styleName} function-menu" >
    {BEGIN body}
      {Header}
      <style>
        {containercss}
      </style>
      <div class="r-topbar-page">
        <div data-menu-width="full"
          class="r-topheader"
          data-resize-name="topbar"
          data-body-align="left"
        >
          <div style="float: right; text-align: right;">
            {BEGIN supertop_block}
          </div>
          <nav class="navbar navbar-default"
            data-location="supertop" id="form_supertop_{pageid}" data-makeup="topbar" {form_supertop} data-pageid="{pageid}" >
            <span data-cellid="supertop_c1" data-pageid="{pageid}" class="r-align-left navbar-header" data-itemid="logo" {SiteLogo}>
          </div>
        </div>
      </div>
    </body>
  </html>
```

Appendix D System database

The screenshot shows the phpMyAdmin interface for a MySQL database named 'db2'. The left sidebar displays a tree view of the database structure, including tables like 'beneficiaries', 'broadcast_message', 'donation', and 'volunteer'. The main area shows the 'Structure' tab for the 'db2' database. A search filter is applied: 'Containing the word:'. Below the filter is a table listing the database's tables and their properties.

Table	Action	Rows	Type	Collation	Size	Overhead
beneficiaries	[Icons]	1	InnoDB	utf8_general_ci	32.4 Kib	-
broadcast_message	[Icons]	1	InnoDB	latin1_swedish_ci	36.4 Kib	-
donation	[Icons]	1	InnoDB	utf8mb4_general_ci	38.4 Kib	-
google_based_donation_locator_system_gblsuggroups	[Icons]	1	InnoDB	utf8_general_ci	38.4 Kib	-
google_based_donation_locator_system_gblsugmembers	[Icons]	1	InnoDB	utf8_general_ci	38.4 Kib	-
google_based_donation_locator_system_gblsugrights	[Icons]	21	InnoDB	utf8_general_ci	38.4 Kib	-
location	[Icons]	8	InnoDB	utf8_general_ci	36.4 Kib	-
tbl_user	[Icons]	11	InnoDB	latin1_swedish_ci	48.4 Kib	-
volunteer	[Icons]	1	InnoDB	latin1_swedish_ci	36.4 Kib	-
3 tables	Sum	47	InnoDB	utf8mb4_general_ci	392.0 Kib	0 B