INFORMATION SYSTEM FOR ENHANCING COMMUNICATION BETWEEN MEMBERS OF PARLIAMENT AND CITIZENS: A STUDY OF DODOMA, TANZANIA

Mary S. Mtoi

A Project Report Submitted in Partial Fulfilment of the Requirements for the Degree of Master of Science in Embedded and Mobile Systems of the Nelson Mandela African Institution of Science and Technology

Arusha, Tanzania

August, 2025

ABSTRACT

The evolution of information systems, including the internet and smart devices, has transformed the way we communicate, access information, and connect with others. Communication between members of parliament (MPs) and citizens in Tanzania remains ineffective due to the reliance on mainly formal traditional channels such as public meetings, physical visits, local government leaders, opinion boxes, visitor books, letters, broadcast media, and social media. These methods are often hindered by poor attendance, delays, unavailability of members of parliament, high costs, and limited access to smart devices and the internet. Findings revealed that 42.9% of citizens took more than three days to submit their concerns, 30.3% had never submitted, and 69% cited MP unavailability as the main challenge, highlighting agreement from both citizens and MPs that existing methods create serious obstacles. A literature review was conducted to identify technological gaps, revealing that many proposed solutions are inaccessible to users without internet-connected devices. This study developed the Public Participation Information System (PPIS). This hybrid platform combines a web application for online users with a two-way messaging system to include those without internet access or smart devices. The two-way messaging feature ensures inclusivity and timely, interactive communication for all citizens and includes Swahili and English support, with simple SMS interactions designed to accommodate users with limited internet access and low literacy levels. Furthermore, a mixed research method was used to gather system requirements from 177 participants, including both members of parliament and citizens. Findings showed that 89.1% of citizens and 98.3% of MPs were willing to adopt the system. The PPIS improved message delivery accuracy, reduced response time, and enabled citizens to track their concerns. PPIS uniquely bridges digital divides by offering inclusive two-way communication, enhancing accessibility, accountability, and citizen participation in governance, which demonstrates readiness for pilot deployment.

DECLARATION

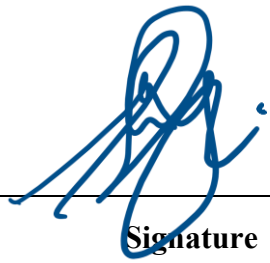
I, Mary Samwel Mtoi, do hereby declare to the Senate of The Nelson Mandela African Institution of Science and Technology that this project report is my original work and that it has neither been submitted nor been concurrently submitted for a degree award in any other institution.

Mary Samwel Mtoi

Name of Candidate	**Signature**	**Date**

The above declaration is confirmed by:

Dr. Musa Ally Dida



31/07/2025

Name of Supervisor 1	**Signature**	**Date**

Prof. Anael Sam

31/July/2025

Name of Supervisor 2	**Signature**	**Date**

COPYRIGHT

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by The Nelson Mandela African Institution of Science and Technology, a project report titled *"***Information System for Enhancing Communication between Members of Parliament and Citizens: A Study of Dodoma, Tanzania"** in partial fulfillment of the requirements for the degree of Master of Science in Embedded and Mobile Systems of the Nelson Mandela African Institution of Science and Technology.

Dr. Musa Ally Dida

Name of Supervisor 1	**Signature**	**Date**

Prof. Anael Sam 31/07/2025

Name of Supervisor 2	**Signature**	**Date**

ACKNOWLEDGEMENTS

From the bottom of my heart, I express my deepest gratitude to Almighty God for being my guide, support, and comfort; without Him, I would not have been able to complete my project. I thank God for His infinite love, protection, and kindness throughout my studies and for giving me the strength from the beginning to the end of the project.

I would like to express my gratitude to the Centre of Excellence for ICT in East Africa (CENIT@EA) for their financial support throughout my master's studies.

I take immense pleasure in expressing my sincere gratitude to my supervisors, Dr. Mussa Ally, Prof. Anael Sam, and Ms. Hope Mbelwa, for their time, support, and guidance during this project study. Their advice, assistance, and knowledge motivated me to work hard throughout the project. I would like to express my gratitude to all the school's lecturers for their tireless efforts. Words alone are insufficient to express my heartfelt appreciation for the ways in which you have expanded my capacity.

Furthermore, I would like to extend my heartfelt appreciation to Madam Lily Mraba, Mr. Munubi Kajobi, Ms. Anna Dareda, Mr. Peter Mtoi, Ms. Janeth Ruzegama, and Mr. Saidi Mawenje for their great support in my project during requirement gathering.

This would be incomplete without expressing my deepest love and gratitude to my family, especially my mother, for their continuous encouragement, support, and love during this long journey.

May God bless you all!

DEDICATION

With a thankful heart, I dedicate this project work to my mother, who encourages and supports me during this long journey.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

MPs	Members of Parliament
SMS	Short Message Service
XML	Extensible Markup Language
OTP	One-Time Password
UAT	User Acceptance Testing
ICT	Information and Communications Technology
TCRA	Tanzania Communications Regulatory Authority
XP	Extreme Programming
DFD	Data Flow Diagram
NBS	National Bureau of Statistics
GSM	Global System for Mobile Communications
PPIS	Public Participation Information System
API	Application Programming Interface
ERD	Entity Relationship Diagram
SQL	Structured Query Language
DC	District Council
CC	City Council
IDE	Integrated Development Environment
ER	Entity Relationship
MEP	Members of the European Parliament
TTCL	Tanzania Telecommunication Company
NIDA	National Identification Authority
IEEE	Institute of Electrical and Electronics Engineers
CSV	Comma Separated Values

PHP	Hypertext Preprocessor
MVC	Model-View-Controller
HTML	Hypertext Markup Language
RDBMS	Relational Database Management System
CPANEL	Control Panel
USSD	Unstructured Supplementary Service Data
UI	User Interface
NLP	Natural Language Processing
BERT	Bidirectional Encoder Representations from Transformers
TF-IDF	Term Frequency-Inverse Document Frequency
NVDA	Non-Visual Desktop Access

CHAPTER ONE

INTRODUCTION

1.1 Background of the problem

Tanzania is an East African country with over 61 million people (NBS, 2022). Tanzania has a multi-party political system, with members of parliament (MPs) chosen every five years to represent their constituents in the National Assembly of Tanzania. Citizen involvement in decision-making is a core principle of liberal democracy (Nissen, 2021). Citizen engagement is an important aspect of participatory governance (Poncian, 2020). The Constitution of the United Republic of Tanzania, adopted in 2016, grants citizens the right to seek, obtain, and disseminate information. Although Tanzanian residents have constitutional rights to access information and participate in decision-making, many find it challenging to contact their representatives directly due to the limitations of the available communication channels.

In Tanzania, citizens can communicate with their members of parliament (MPs) through various means, such as public meetings, local government leaders, telephone calls, letters, emails, physical meetings, and social media (Griffith & Leston-Bandeira, 2020). Additionally, other broadcast media, such as conventional ICT media that the government has frequently utilized to engage with citizens on extractive resource governance issues, include radio and television broadcasts, as well as newspapers and magazines (Poncian, 2020). However, the effectiveness of these channels is limited by several factors. For instance, public meetings are often poorly attended, and the unavailability of members of parliament (Twaweza, 2021). Although MPs have secretaries who assist with communication, the unavailability of MPs themselves was still reported as a major challenge by 69% of citizens. This suggests that relying solely on secretaries does not fully address communication delays or obstacles experienced by citizens. Telephone calls and letters may not be effective in reaching MPs, especially if they are not in their offices, while emails and social media may be more effective, but many Tanzanians lack smartphones or laptops required to use these platforms. Broadcast media, such as radio and television, are commonly used but only support one-way communication, preventing citizens from responding or engaging directly with their representatives (Neprytskyi *et al.,* 2021).

Using local government leaders to collect citizens' issues can be effective, but it often results in delays because it aggregates concerns from multiple individuals before delivering them all at once. This approach also limits transparency between MPs and citizens. Furthermore, physical meetings with MPs at their offices remain a challenge for citizens living far away, and sometimes, citizens travel to MPs' offices only to find that they are unavailable. In response, several ICT-based platforms have been introduced to enhance citizen engagement, typically through web and mobile applications. However, most of these solutions require reliable internet and access to smartphones, tablets, or computers, making them inaccessible to people without such devices.

This project implements an Information System that enables direct, timely, and two-way communication between members of parliament and citizens. It allows citizens to submit concerns via a web application or SMS in English or Swahili, track their progress, and receive responses. The system categorizes concerns based on sectors and filters duplicates to avoid repetition. MPs can reply directly or delegate issues to relevant ministries. It also provides MPs with tools to share their availability and assign tasks to assistants. This system contributes to improving governance by enhancing inclusivity, transparency, and responsiveness in communication between citizens and their elected representatives.

1.2 Statement of the problem

Effective communication between citizens and their elected representatives is a cornerstone of participatory governance. However, in Tanzania, there is no inclusive and reliable digital communication system that enables citizens to directly engage with their members of parliament (MPs) without relying on internet access or smart devices. Currently, Tanzanians use traditional channels such as public meetings, local leaders, physical visits, emails, phone calls, social media, and letters, which face limitations like poor attendance at public meetings, delayed delivery of concerns, high costs, one-way communication, technological barriers and MPs' unavailability caused by attend parliamentary sessions which collectively total seven months annually.

Although some studies have proposed digital solutions, such as mobile and web applications, these primarily serve users with internet access and smart devices, excluding many citizens who rely on feature phones or lack internet connectivity.

To address these challenges, this study aims to develop an information platform that supports both offline communication via SMS on feature phones and online communication through a web application. This dual-access design ensures that all citizens can engage directly with their MPs regardless of device or connectivity. The project aims to improve communication between citizens and their representatives, regardless of device type or internet connectivity.

1.3 Justification of the study

Based on communication statistics made available by the Tanzania Communications Regulatory Authority (TCRA) by the end of the quarter, which ended in March 2025, the device is a significant factor in encouraging the use of ICT or telecommunication services (TCRA, 2024). Table 1 depicts the status of devices connected to the operator's network.

Table 1: TCRA Communication statistics quarter ending March 2025

S/N	Device Type	Number of devices	Penetration
1.	Mobile Phones/Feature phone	56 318 379	82.64%
2.	Smartphone	24 051 837	35.29%
3.	Handheld	1 606 481	2.36%
4.	Modem	686 911	1.01%
5.	Personal Digital Assistant (PDA)	51 530	0.08%
6.	Tablet	523 354	0.77%
7.	Module	55 954	0.08%
8.	WLAN Router	239 739	0.35%
9.	Dongle	92 804	0.14%
10.	Internet of Things (IoT) Devices	152 285	0.22%
11.	Vehicle	9731	0.01%
12.	Connected Computer	12 431	0.02%
13.	Wearable	8584	0.01%
14.	Device for the Automatic Processing of Data (APD)	4061	0.01%

Recent communication statistics from the Tanzania Communications Regulatory Authority (TCRA) for the quarter ending March 2025 reveal a significant disparity in device usage among Tanzanians. Featured phones dominate device usage in Tanzania, accounting for 82.64% penetration (56 318 379 users), while smartphones account for 35.29% (24 051 837 users), and tablets and computers represent less than 1% of users (TCRA, 2024). This significant gap in device ownership highlights the limited accessibility of ICT solutions that rely solely on smartphones, tablets, or computers.

Given the widespread use of feature phones, which are more affordable and accessible to the majority of Tanzanians, there is a clear need for a communication system that caters to all device types. Therefore, this project proposes the development of both a web application and a two-way SMS messaging system. This dual approach ensures broader accessibility, enabling citizens, including those without smartphones, computers, tablets, or internet access, to submit concerns and communicate directly with their members of parliament, thereby addressing the digital divide and enhancing citizen engagement.

1.4 Project objectives

1.4 1 Main objective

To develop an Information system for enhancing communication between members of parliament and citizens.

1.4.2 Specific objectives

(i) To identify the requirements for developing an information system for enhancing communication between members of parliament and citizens.

(ii) To develop an information system for enhancing communication between members of parliament and citizens.

(iii) To validate the functionality of the developed information system for enhancing communication between members of parliament and citizens.

1.5 Research questions

(i) What are the key requirements for developing an information system for enhancing communication between members of parliament and citizens?

(ii) How an information system for enhancing communication between members of parliament and citizens will be implemented?

(iii) Is an information system for enhancing communication between members of parliament and citizens valid?

1.6 Significance of the project

The importance of this study lies in its potential to enhance communication between Members of Parliament (MPs) and the public through a web application and two-way messaging system. Citizens can use this platform to voice their concerns to their elected representatives anytime and anywhere, whether online or offline, and track the progress of their submissions until they receive a response. Additionally, MPs can share their schedules with citizens, helping them avoid visits on days when they are unavailable and keeping them informed about various issues.

The system also analyzes citizen concerns by sector, enabling MPs to prioritize challenges and address them more effectively. Automated acknowledgments provide immediate confirmation that citizens' concerns have been received, alleviating feelings of being ignored. Furthermore, automated reminders alert MPs to pending issues, ensuring timely responses and facilitating task delegation to assistants. This approach significantly improves communication efficiency and facilitates ongoing communication between MPs and citizens.

1.7 Delineation of the project

The study developed an Information System to enhance communication between members of parliament (MPs) and citizens. The system enables citizens to submit their concerns to their representatives at any time, from anywhere, either online through a web application or offline via a two-way messaging system. It also allows them to track the progress of their submissions until a response is received. Notably, citizens using feature phones receive notifications when their concerns are addressed and can check the status by sending a reference number through a short code, enabling real-time updates.

However, users of the two-way messaging system can only submit concerns, receive responses, and track the status of their submissions, but cannot view concerns raised by others. All concerns are categorized by sectors for easy access. Additionally, MPs can transfer concerns to the relevant ministry to facilitate the resolution of citizens' issues.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides overviews of the existing communication system between members of parliament and citizens in Tanzania, along with insights from various researchers' studies. Literature works of other researchers have been included in the related works section. Mainly, the sources of these literature works are articles from scholarly journals, websites, and reports. Further, technical gaps between the existing information systems and the proposed system were discussed.

2.2 Current system for communication between members of parliament and citizens in Tanzania

Tanzanians want their voices to be heard and expect their members of parliament (MPs) to listen to them and represent their views in parliament according to the principles of popular sovereignty. Members of parliament in Tanzania currently communicate with the public using traditional channels, such as public meetings, local government leaders, telephone calls, letters, physical meetings, and social media (Griffith & Leston-Bandeira, 2020). Additionally, the government frequently utilizes other media, such as conventional ICT channels, to engage with citizens on extractive resource governance issues, including radio broadcasts, television broadcasts, newspapers, and magazines (Poncian, 2020). The methods may change based on the preferences of each member of parliament. However, these methods have some limitations, such as:

First, Members of Parliament who use public meetings to communicate with their citizens face several challenges. These include poor attendance, high costs, and difficulties in organizing meetings during the rainy season. As a result, MPs can only hold a limited number of public meetings each year. Additionally, many citizens are unable to attend these meetings due to work commitments or a lack of information about the meeting times.

Secondly, Members of Parliament also rely on local government leaders to collect citizens' issues for resolution (Xu & Tang, 2020). However, there are often delays in addressing citizens' concerns, as local leaders can't address individual concerns; instead, they collect concerns from

multiple sources and address them collectively.

Thirdly, Members of Parliament designate specific days for citizens to visit their offices, but this approach can be challenging for those living far away. While letters can also be an effective way to voice concerns, MPs may not always be present in their offices to receive them, leading to delays in providing timely feedback to citizens.

Fourth, Members of Parliament use social media and email platforms to share updates, news, and engage with their electorate (Babeiya & Magoti, 2023). However, the effectiveness of these communication channels is limited as not all citizens have access to the Internet or social media, and many do not own smartphones.

Lastly, conventional ICT media such as radio, television, newspapers, and magazines are effective for communication between MPs and citizens. However, these methods only provide one-way communication.

2.3 Related works

A significant effort has been made to address communication challenges between MPs and citizens worldwide. In this section, several related works have been critically reviewed. Below is a summary of some of the selected subsets of the related literature on the subject.

Saud and Margono (2021) proposed utilizing social media to motivate Indonesian youth to engage in political affairs, enabling them to discuss and learn about their shared values in the public domain. This approach is beneficial in terms of encouraging broader public involvement. However, through social media, there is no system for filtering those common questions. Furthermore, it overlooks those who do not have access to smartphones or computers.

Widodo and Kristiyono (2025) the study examined how digital platforms like WhatsApp, Facebook, and TikTok have transformed political communication between MPs and citizens in Indonesia. These tools have enabled faster, more direct engagement, especially during campaigns. However, their effectiveness is limited by digital inequality, misinformation, and shallow interaction. Many citizens, particularly in rural areas, are excluded due to poor access or digital literacy, and most communication remains symbolic rather than genuinely participatory or integrated with formal political processes.

Agarwal *et al.* (2019) suggested that Twitter could enhance communication between members of parliament (MPs) and citizens. They noted that MPs strategically manage their interactions on Twitter by selectively replying to citizens, fulfilling their duties as elected representatives, and using retweets to disseminate their party's message. However, through social media, there is no system in place for filtering common questions. Further, citizens can't track the progress of their queries, so MPs may decide not to respond to them. Additionally, social media data can't be analyzed and categorized, which still makes it difficult for MPs to make decisions on them.

Neihouser (2022) the literature review examined how digital communication tools such as websites, social media, and email, mainly used in election contexts across developed countries. It highlighted four key research areas: digital strategy, citizen engagement, political impact, and media normalization. Most studies focus on what politicians post online, often using content analysis, but overlook how strategies are developed, how citizens respond, and how online communication compares with offline communication. Additionally, the review revealed a gap in research on inclusive, low-tech communication methods and noted that studies rarely cover low-income countries like Tanzania.

Beutelspacher *et al.* (2022) explore how smartphone apps support M-participation in German municipalities. It proposes gamification to boost citizen engagement but is limited by a lack of real-world testing, a narrow focus, and limited inclusivity for those without digital access.

Asimakopoulos *et al.* (2025) this study systematically reviews how ICTs influence democratic participation through tools like e-voting, social media, and e-government platforms. It finds that ICTs improve transparency, citizen engagement, and service delivery. However, the digital divide disproportionately affects rural and low-income groups due to limited internet access and inadequate digital literacy. Social media also introduces algorithmic bias and spreads misinformation, undermining democratic trust. The study recommends the development of inclusive, secure, and regulated ICT systems to ensure equitable participation.

Dube (2019) suggested developing a mobile application called "My Parliament" to enable South African citizens to participate in parliamentary processes actively and have their opinions heard. This app would provide MPs with relevant, accurate, and timely information through their mobile devices, allowing them to publish their public meeting schedules.

However, it should be noted that the application is only accessible to those who use smartphones, and it does not filter frequently asked questions, and citizens can't track the progress of their queries.

Poncian (2020) examines the use of ICT for active citizen engagement in extractive decision-making and governance processes. The study focuses on new information and communication technologies that include government agencies' websites and social media platforms. It has been determined that the government has taken advantage of modern ICT to increasingly make its activities open through websites and social media. However, they are only limited to websites and social media, and people with no internet access and a smartphone or computer can't access them.

Odeyemi and Abioro (2019) explore the pivotal role of parliament in democratic societies, emphasizing its responsibility to represent citizens and ensure accountability. It specifically investigates the impact of digital technologies, such as the Internet and social media, on parliament–citizen relations in Nigeria and South Africa. The analysis focuses on how these technologies enhance responsiveness and communication between elected representatives and constituents. The study, based on online resource measurements, contributes to frameworks for leveraging digital tools to improve governance in sub-Saharan Africa.

Ng'uni *et al*. (2019) propose a system to bridge the communication and information gap between members of parliament and the public. They proposed and developed a cloud-based mobile application for facilitating seamless interaction between Zambian parliamentarians and their constituents. However, it's worth noting that the proposed solution has a limitation, as it relies on mobile applications, potentially excluding individuals without smartphones from accessing the system.

Koryzis *et al.* (2021) this study proposes a transformation framework to guide parliaments toward digital maturity, utilizing emerging technologies such as social media analytics, legal informatics, and virtual platforms. Based on expert surveys from 25 parliaments, the framework prioritizes inclusiveness, transparency, and citizen engagement in digital strategy. A key solution is the integration of user-centered design and interoperable systems to support open communication with citizens. However, resistance to change and a lack of technical capacity limit implementation. The study recommends digital skills development and cross-sector collaboration to ensure an inclusive and adaptive digital transformation.

Tomažič and Mišič (2019) examine the role of the Parliament and citizen participation using social media, finding that most parliaments of the member states of the European Union incorporate social media for communication between members of parliament and citizens. However, the study was limited to social media, and it did not consider other technologies.

Schürmann and Stier (2023) this study introduces a comprehensive database analyzing Twitter adoption and activity among MPs in 32 European countries. It finds that MPs in Western democracies are more likely to adopt and actively use Twitter, particularly in countries with higher public Twitter usage. The platform enables direct communication with voters, enhancing transparency and political visibility. However, engagement remains one-way primarily, with limited evidence of genuine interaction between MPs and citizens. Methodological limitations include incomplete identification of Twitter accounts and offline communication channels.

Haman and Školník (2021) present a cross-national database analyzing Twitter use by MPs in 32 European countries, showing patterns in digital presence across political systems. While Twitter is noted for enabling direct outreach, the study focuses on usage frequency, not communication quality or engagement. It overlooks interactivity and citizen feedback. No low-tech or offline channels are considered. This limits its relevance for inclusive MP citizen communication in low-access settings.

Table 2: Summary of related works

Paper	Technique	Objective	Limitation
Dube (2019)	Mobile application	To develop the "My Parliament" app, enabling South African citizens to participate in parliamentary processes	Limited to smartphones; no query tracking, and inaccessible to citizens without mobile internet
Saud and Margono (2021)	Social media	To motivate Indonesian youth to engage in political discussions and learn about shared values	excludes non-digital users and lacks data security
Agarwal *et al*. (2019)	Twitter	To enhance MP–citizen communication via social media	Limited engagement tracking and excludes non-Twitter users
Widodo and Kristiyono (2025)	Social media (WhatsApp, Facebook, Tok-tok)	To examine how digital platforms transform MP–citizen communication in Indonesia	It excludes rural, low-literate users.
Neihouser (2022)	Literature Review (Web/social media/Email)	To review digital communication by MPs during election periods	excludes low-tech tools; lacks empirical data on citizen responses and relevance to low-income countries
Beutelspacher *et al.* (2022)	Mobile Apps and Gamification	To improve M-participation through gamified applications in German municipalities	Do not include off-line users
Asimakopoulos *et al.* (2025)	Systematic Review (ICTs)	To review the impact of ICT on democratic participation	Digital divide limits reach, biases in social media, and lacks offline channels

Paper	Technique	Objective	Limitation
Poncian (2020)	Website, social media	To assess ICT use in extractive resource governance in Tanzania	Excludes citizens without smartphones or internet access; limited to online platforms only
Ng'uni *et al*. (2019)	Cloud-Based Mobile App	To bridge communication gaps between MPs and the public in Zambia	Limited to smartphones with internet; excludes citizens without smart devices
Koryzis *et al.* (2021)	Framework (ParlTech)	To guide the digital transformation of parliaments with inclusive ICT strategies	Low-tech capacity, and resistance to change; it lacks SMS or hybrid tools for offline populations
Tomažič and Mišič (2019)	Social media	To examine the EU parliaments' use of social media for MP–citizen interaction	Limited to social media only; ignores other technologies and digital divides
Haman and Školník (2021)	Cross-National Twitter Database	To analyze MPs' digital presence across 32 European countries	Lacks interaction quality or inclusive tech like SMS; no citizen feedback mechanisms.
Schürmann and Stier (2023)	Text Analysis of Social Media Posts	To examine how electoral mandate affects MPs' regional communication online	Focuses on symbolic communication; does not assess interaction, feedback, or support for low-access populations

Paper	Technique	Objective	Limitation
Odeyemi and Abioro (2019)	Social Media	To explore digital tech's role in parliament, citizen relations in Nigeria, and South Africa	Limited to online tools; lacks authentication and secure feedback structures

2.4 Technical gap

Various studies and project initiatives have proposed systems aimed at improving communication between members of parliament (MPs) and citizens. However, the majority of these solutions are built as mobile applications or web-based platforms, which depend heavily on internet connectivity and the use of smartphones, tablets, or computers. This reliance limits accessibility, particularly in rural areas of Tanzania, where many citizens lack smart devices and reliable internet access. As a result, these systems are ineffective in low-resource environments and exclude a large segment of the population due to limited access to internet-connected devices such as smartphones, tablets, and computers. Therefore, without offline access options such as SMS, many citizens are unable to engage directly with their representatives, which undermines inclusiveness and equitable participation.

Furthermore, existing systems do not categorize concerns by sector, making it difficult for MPs to identify, prioritize, and respond to issues efficiently. They also lack mechanisms to automatically link citizen concerns to constituencies, causing confusion and response delays.

2.5 Proposed system

The proposed system is designed to enhance communication between citizens and Members of Parliament (MPs) in Tanzania, supporting both internet-based and SMS-based interactions. It addresses the technical gaps in existing systems by enabling inclusive, two-way communication that is accessible even in rural areas with limited or no reliable internet or smartphone access.

As shown in Fig. 1, the system comprises multiple user types, including web application users, two-way message users, Members of Parliament, parliamentary assistants, and the ministry. Also, it has SMS and PPIS Server. The architecture illustrates the interaction between citizens and their elected representatives, outlining how concerns are submitted, categorized, tracked, and responded to. Citizens can submit concerns through a web application or a two-way messaging system, while MPs and their assistants use a web platform to forward or respond to these issues. The system supports real-time updates and notifications to ensure transparency and accountability. All data transmitted across the network is encrypted to safeguard users' information.

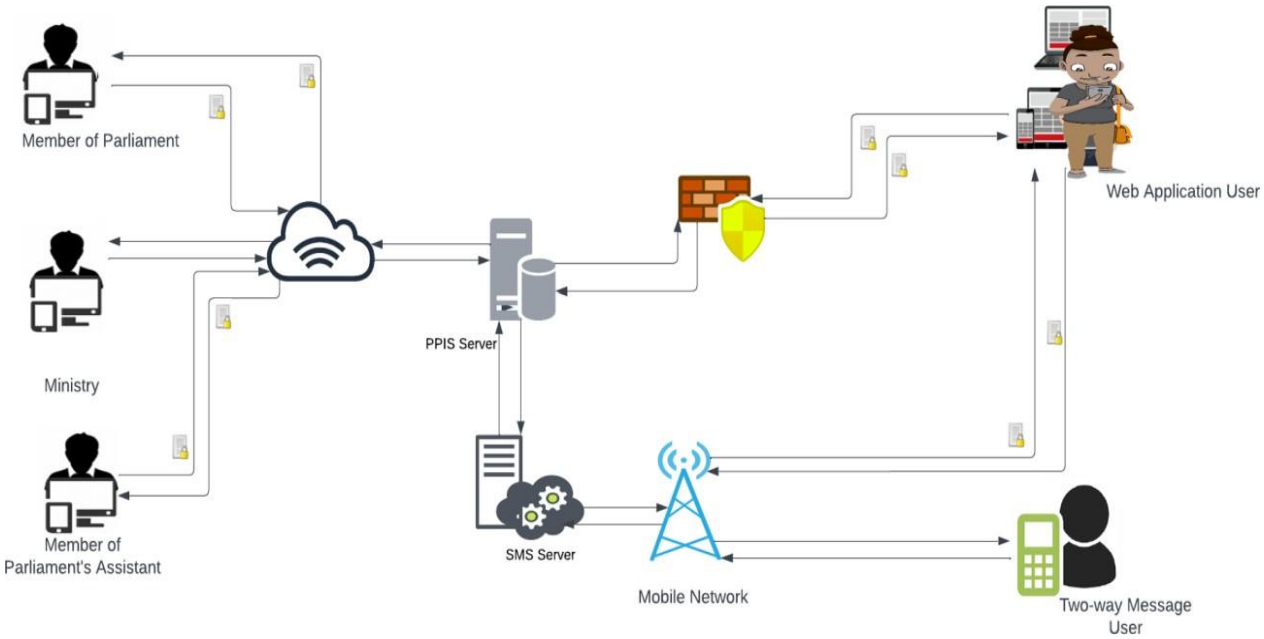


Figure 1: Proposed system of information systems

(i) Web application user

To log in to the web application, users must provide their unique phone number or email, which they registered with. Before a user logs in, they activate their email or verify their phone

number using a one-time password (OTP), which allows them to access the system and submit their concern. Upon submission, citizens can track the progress of their concerns. Additionally, web application users can view concerns submitted by others within their specific province and add comments. This feature helps keep them informed about ongoing issues in their area.

(ii) Two-way message user

Users of the two-way messaging system are provided with short code numbers and clear instructions for how to submit concerns. Internet access is not required; all they need is a standard SMS bundle. The system supports SMS from any service provider, including Airtel, Tigo, Vodacom, TTCL, and others that are available in Tanzania. To begin, citizens must register by sending "Sajili" in Swahili or "Register" in English via the provided short code numbers. The system will then guide them through the process, asking for details such as their NIDA number, region, and province until registration is complete. After registration, citizens can submit their concerns, and the system will generate a unique reference number for each submission, which they can use to track progress. Additionally, they will receive notifications for every action taken regarding their submission. For instance, if the MP forwards their concern to a ministry, they will be informed of this update.

(iii) Members of parliament and the ministry

Furthermore, members of parliament and the ministry can view and respond to citizens' challenges. However, the Ministry can respond to the concerns only if the MP forwards them for further clarification. The system also categorizes submitted concerns by sector and analyzes them graphically for a straightforward interpretation of the data, helping Members of Parliament in their decision-making.

(iv) Members of parliament's assistants

Members of parliament assistants use web applications to attend to all work assigned by Members of Parliament, such as following up on issues that require clarification before the MP responds to their constituents and provides reports on those particular issues.

(v) Concerns management and filtering mechanism

The web application implements a real-time deduplication mechanism that uses string matching to detect similar concerns of a user type. If a match is found, the system displays

related concerns to the user. The user can view existing responses or select a “Notify Me” option to receive alerts when a response becomes available. This reduces duplicate entries and enhances system efficiency. However, this feature is not supported on the SMS interface due to platform limitations.

Additionally, all data transmitted over the network is encrypted to safeguard users’ information from third parties. Users are required to create a unique password containing uppercase and lowercase letters, special characters, and numbers.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Introduction

This chapter presents the materials and methods used in this project. It describes the project's case study location, the research methodology, targeted population, sampling techniques, sample size, system requirements, development approach, system design, and system testing procedures. The case study approach was chosen to allow for an in-depth exploration of MP-citizen communication within a real-life context, enabling the design, development, and testing of a practical information system tailored to the specific political and technological environment.

3.2 Project case study

The case study for this project was conducted in Dodoma, Tanzania. Dodoma is the capital city of Tanzania, located in central Tanzania. It is divided into eight districts: Kondoa DC, Kondoa TC, Chemba DC, Bahi DC, Dodoma CC, Chamwino DC, Kongwa DC, and Mpwapwa DC. According to the 2022 national census, the region had a population of 3 085 625 (NBS, 2022). The study was carried out in Kigwe ward in Bahi district, Miyuji ward of Dodoma city council, and Dabalo of Chamwino district council, as shown in Fig. 2. The population of Kigwe is approximately 7201, Dabalo has around 26 241, and Miyuji has approximately 36 588 (NBS, 2022), making the total population 70 030.

Dodoma was selected as the case study region because it serves as the political and administrative hub of Tanzania and is home to the National Assembly. This makes it highly relevant for studying communication between citizens and Members of Parliament (MPs). Furthermore, Dodoma features a diverse mix of urban and rural settings, allowing for the collection of representative data across different demographics and geographic areas. The selection was also facilitated by the researcher's internship at the National Assembly, which provided access to key stakeholders and practical insights into the communication environment between MPs and citizens. Figure 2 is the Tanzanian map that shows the study area districts, which were Dodoma urban, Bahi, and Chamwino.

Figure 2: The Tanzania map shows the study area districts

Source: https://shorturl.at/fZ1Mn

3.3 Target population and sampling technique

The study employed simple random sampling to select 177 participants, including 119 citizens and 58 members of parliament (MPs). Participants were drawn from key groups relevant to the study objectives, members of parliament and citizens, based on their ability to provide insights into communication challenges.

Citizens were randomly selected from three wards in Dodoma: Kigwe, Dabalo, and Miyuji. Questionnaires were distributed via WhatsApp, email, and printed copies to reach a broad demographic. To include those without internet access, focus group discussions supported by local government leaders were conducted, using guided discussions and paper questionnaires.

Members of parliament from different constituencies were randomly selected. Printed questionnaires were distributed during parliamentary sessions, and semi-structured interviews were conducted with selected MPs to gather in-depth, qualitative data. This approach ensured diverse perspectives from both urban and rural areas, combining quantitative breadth with qualitative depth to gain a comprehensive understanding of the communication barriers between citizens and their representatives.

3.4 Sample size

The Dodoma region had a total population of 3 085 625 individuals (NBS, 2022). The research took place specifically in the Kigwe ward of the Bahi district council, Miyuji ward of Dodoma City council, and Dabalo of Chamwino District Council, whereby the population of Kigwe is approximately 7201, while Dabalo has a population of approximately 26 241, and Miyuji ward has approximately 36 588 (NBS, 2022) Which makes the total population 70 030. Also, the study encompassed all 393 members of parliament in Tanzania (Bunge, 2020), which made the targeted population approximately 70 423.

The sample size was determined using the Taro Yamane formula, which is applied to calculate the optimum sample size for both continuous and categorical variables at a specific confidence level and margin of error (Adam, 2020). A sample size of 177 participants was determined from a target population of 70 423, using the Taro Yamane formula with a precision level of 0.075. Below is the mathematical illustration to determine the sample size of a given target population.

Taro Yamane Formula:

$$n = \frac{N}{1 + Ne^2}$$

Where: n = Sample size, N = Total population under study, e = Margin of error (level of precision)

Given:

$N = 70\,423$

$e = 0.075$

$Step\ 1: e^2 = (0.075)^2 = 0.005625$

$Step\ 2: N \cdot e^2 = 70{,}423 \times 0.005625 = 396.359375$

$Step\ 3: 1 + N \cdot e^2 = 1 + 396.359375 = 397.359375$

$Step\ 4: n = \frac{N}{1 + Ne^2} = 70{,}423 \,/\, 397.359375 \approx 177.23$

$Therefore, n \approx 177$

3.5 System requirements

3.5.1 Data collection methods and tools

The methods for gathering data were divided into two groups: secondary data and primary data.

(i) Primary data sources

Primary data was collected through face-to-face interviews, focus groups, and questionnaires. A set of closed questions was prepared and distributed via Google Forms and printed questionnaires to gather diverse information, as shown in Appendix 2. The questionnaires in Google Forms were shared with the target respondents through email, WhatsApp, and text messages. Also, an interview guide was prepared, as shown in Appendix 3, to collect qualitative data from members of parliament. A guideline for the focus group was also ready to cater to the population of people who have limited literacy skills, do not have a smartphone, and lack knowledge of technology, such as Google Forms, email, or WhatsApp, as shown in Appendix 4.

(ii) Secondary data sources

Secondary data were acquired from existing study papers, including journal articles, websites, and reports, and served as the source of secondary data. To gain a better understanding of the idea of information systems that are used for establishing communication between members of parliament and citizens and its significance in both the global and local settings, these data, which had already been collected and analyzed, were reviewed from a scientific database such as IEEE Xplore, ScienceDirect, Springer, Google Scholar, and others. The studies also helped identify gaps in existing systems.

3.6 Data analysis

In this study, quantitative data were analyzed using SPSS and Microsoft Excel. Statistical Package for the Social Sciences (SPSS) and Excel were chosen for their simplicity, accessibility, and suitability for descriptive analysis. Since the study focused on basic statistics, such as frequencies and percentages, unlike tools like R, Python, and MATLAB, which are powerful platforms typically used for complex data modelling, large datasets, or advanced statistical analyses, which were beyond the scope of this study. The collected data was obtained through a printed questionnaire and a Google form, which were stored as a CSV-delimited file.

Descriptive analysis was used to analyze the quantitative results, which were then visualized using a pie chart.

Qualitative data collected from members of parliament (MPs) and citizens in Dodoma, Tanzania, were analyzed using the content analysis method. Content analysis aims to structure and derive meaning from the collected data, allowing for the formulation of realistic conclusions (Lindgren *et al*., 2020). Data were obtained through interviews and focus group discussions. The process begins by transcribing data gathered through interviews and focus group discussions, followed by familiarization with the data, where the researcher reviews the transcribed data. The code framework was deployed, where segments of data were systematically coded based on recurring ideas, then the coded data were interpreted. Content analysis was chosen for its ability to organize complex qualitative data and generate meaningful conclusions. The findings reveal significant communication challenges and propose potential solutions to improve the interaction between members of parliament and citizens

3.7 System development approach

The methodology used for this project was an agile software development approach based on the Extreme Programming (XP) paradigm. The XP was selected because it supports rapid, iterative development and accommodates changes in requirements more effectively than traditional and even some agile methods. According to (Venkatesh *et al.,* 2020) XP is both time-saving and cost-efficient, making it suitable for projects with evolving user needs.

Compared to the waterfall model, which follows a linear and rigid structure that limits flexibility once development begins, XP encourages frequent iterations and continuous user feedback, allowing for adaptability throughout the development process. While Scrum also supports iterative development and emphasizes stakeholder involvement, it is more focused on project and team management. In contrast, XP provides specific technical practices, such as pair programming, test-driven development, and continuous integration, which were essential in this project to maintain code quality and ensure the system evolved reliably at each iteration.

Therefore, to develop a flexible and robust system that could meet the dynamic needs of users, the XP methodology was used. Figure 3 illustrates the Extreme Programming cycle, highlighting the key phases and practices applied.

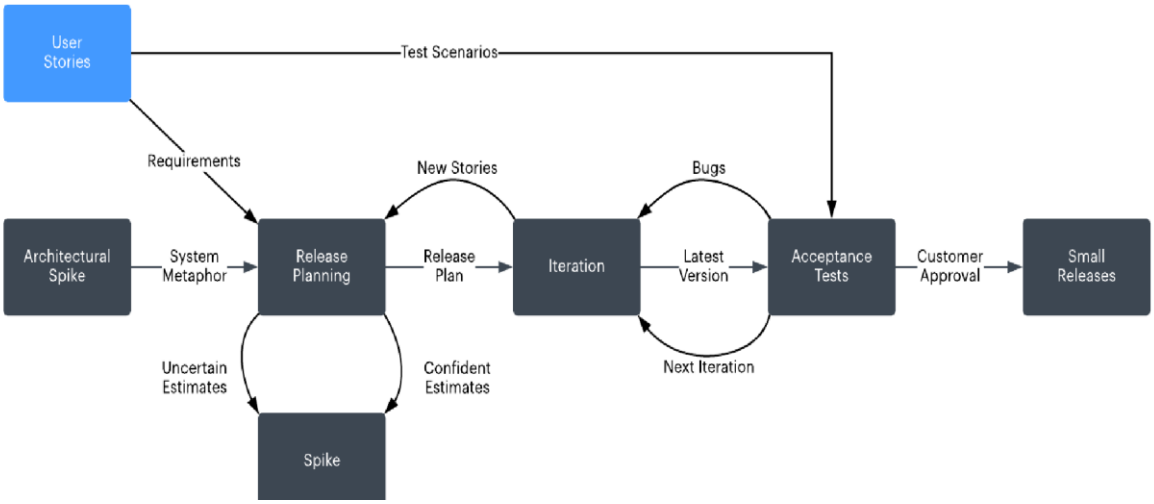


Figure 3: XP Programming methodology

Source: https://www.lucidchart.com/blog/what-is-extreme-programming

Table 3: Sprint report for system development activities

SN	Sprint Goal	Backlog Items	Tasks	Start Date	End Date
1.	Define project requirements	User story 1: As a product stakeholder, I needed to gather and document the project requirements.	Task 1: Conducted interviews with MPs Task 2: Distributed questionnaires to MPs and Citizens Task 3: focus group discussions with illiterate participants. Task 4: Documented requirements.	01/04/2023	14/04/2023
2.	UI/UX design	User story 2: As a user, I needed an intuitive and visually appealing user interface.	Task 1: Created wireframes and designed the Web application layout.	15/04/2023	05/05/2023
3.	Front-end development	User story 3: As a user, I needed to register and access the system securely.	Task 1: Developed registration and login interfaces. Task 2: Implemented input forms for sending and receiving citizen concerns.	06/05/2023	08/06/2023
4.	Back-end development	User story 4: As a user, I want my concerns to be stored securely and responses to be well-organized.	Task 1: Designed and implemented the database schema. Task 2: Developed secure storage for	09/06/2023	15/08/2023
5	Enable SMS integration and message routing	User story 5: As a citizen, I need to send concerns and receive a response through SMS.	Task 1: Integrated SMS API (Telerivet). Task 2: Configured message routing	1/08/2023	30/10/2023

SN	Sprint Goal	Backlog Items	Tasks	Start Date	End Date
			between citizens and respective MPs		
6	Test the system and collect user feedback	User Story 6: As a stakeholder, I needed to test the system and suggest improvements.	Task 1: Conducted comprehensive testing of web application and two-way messaging system (SMS). Task 2: Documented feedback for future refinement Task 3: Fixed any identified bug	01/11/2023	18/11/2023
7	Incorporate user feedback	User Story 7: As a user, I needed my feedback to be considered and incorporated into the system's	Task 1: Collected user feedback through surveys and interviews. Task 2: Analysed feedback	19/11/2023	15/01/2024
8	Finalize system deployment	User Story 8: As a developer, I needed to prepare the system for deployment and public release.	Task 1: Conducted final testing and quality assurance.	16/01/2024	07/02/2024

3.8 System design

3.8.1 Conceptual diagram of the public participation information system

A conceptual diagram is a visual representation of the expected relationship between variables in a research process (Swaen & George, 2022). Public Participation Information System (PPIS) involves Citizens, members of parliament, the ministry, and a member of parliament's assistant, as shown in Fig. 4. It illustrates how citizens use the system to submit their concerns and receive responses from members of parliament. Furthermore, it demonstrates how MPs utilize the system to communicate with both relevant ministries and their assistants.

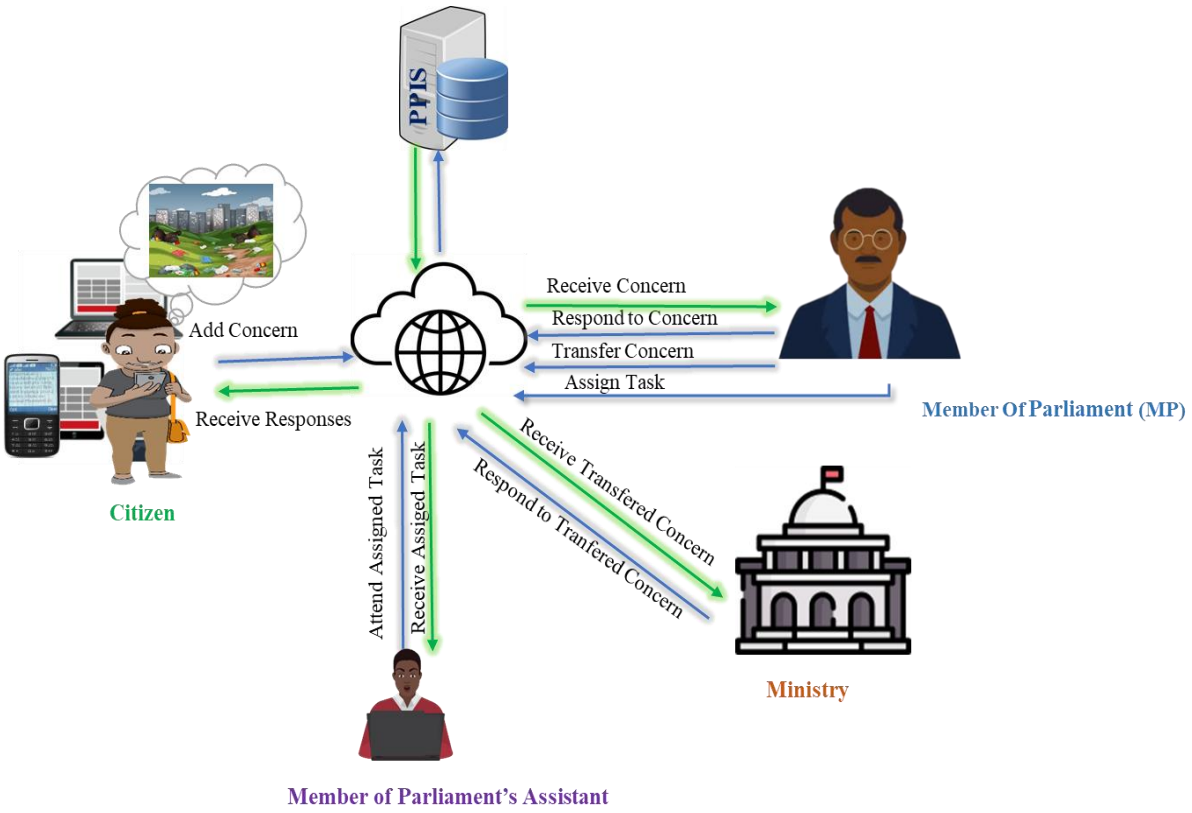


Figure 4: Conceptual diagram of the public participation information system

3.8.2 Context design of the public participation information system

A context diagram is a high-level view of a system that defines an entity based on its scope, boundaries, and relationships to external components, such as stakeholders. It provides a general overview of a process, focusing on its interaction with outside elements rather than its internal sub-processes (Alshareef *et al.,* 2022). The Public Participation Information System context diagram was created as a result of gathering and analyzing the system requirements. The suggested system explains the design idea, and the components demonstrate how they interact with one another within the system. Core functionalities were mapped to system actors as part of the system design, and the system process was represented, as illustrated in Fig. 5.

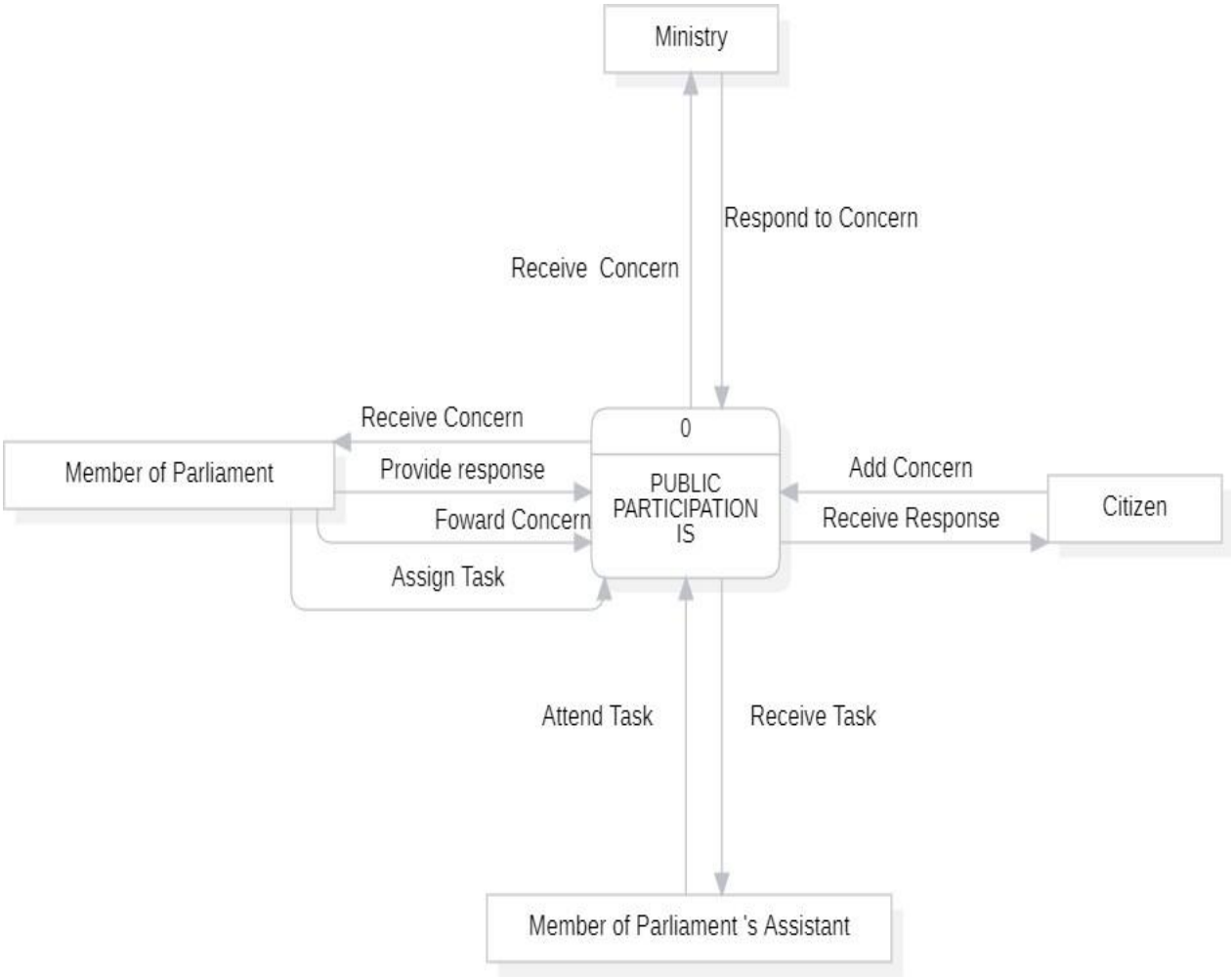


Figure 5: Context diagram of the public participation information system

3.8.3 Data flow diagram level 1 of the public participation information system

A data flow diagram (DFD) is a graphical representation used to model the flow of Information among software components (Alshareef *et al.,* 2022). The transformation of data from input to output, through the process, may be described logically and independently of physical components associated with the system. It clarifies the system requirements and identifies major transformations that become programs in system design. Figure 6 outlines the Public Participation Information System (PPIS) DFD Level 1, which shows the entire interaction between the Public Participation Information System (PPIS) user's requests to the system, the system's response to the user, and the system's interaction with the database.

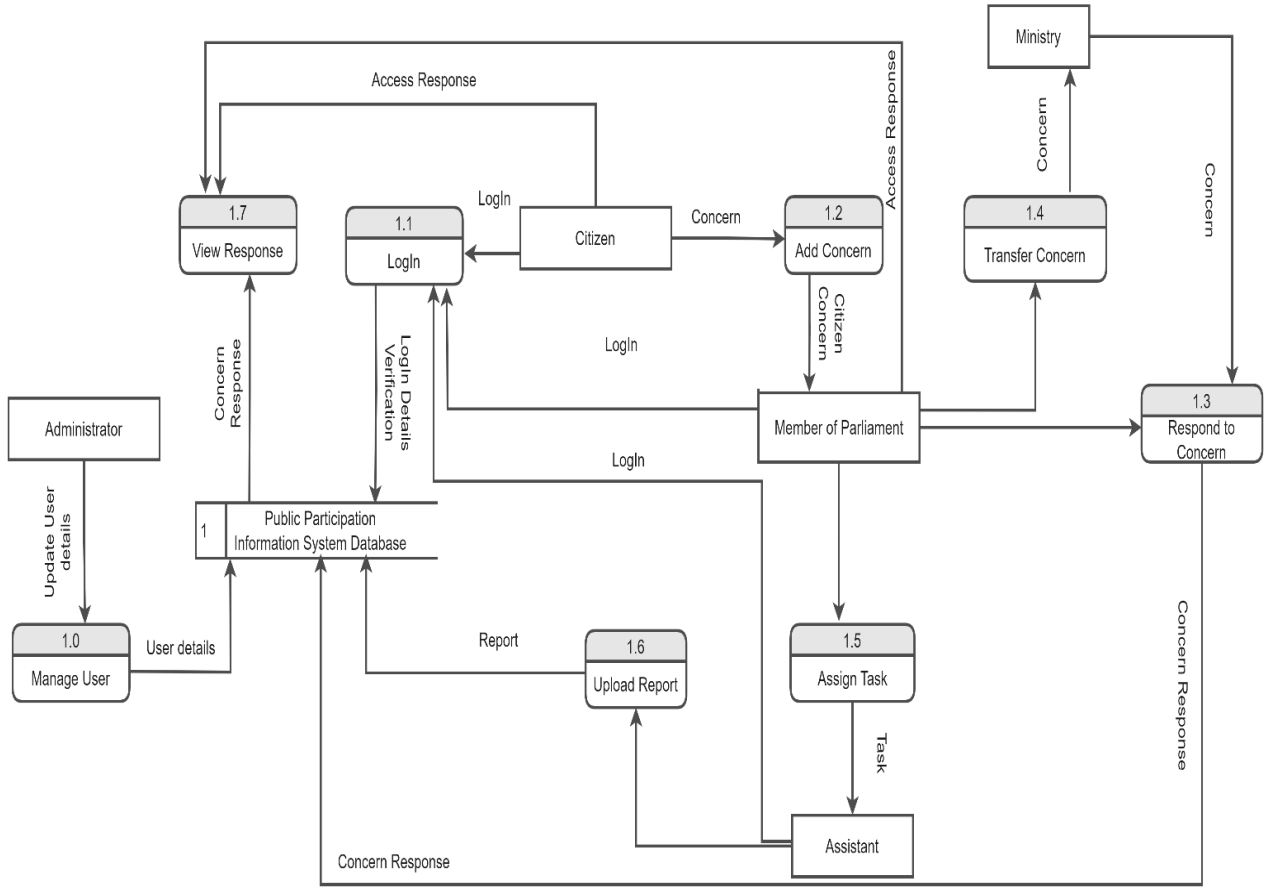


Figure 6: Data flow diagram level 1 of the public participation information system

3.8.4 Use case diagram of the public participation information system

The interaction between users and the system is shown in use case diagrams. It demonstrates how users engage with the system, their inputs and expectations, and the steps the system must take to accomplish its goals (Alshareef *et al.,* 2022). It illustrates how citizens, members of parliament, the ministry, the MP's assistant, and the administrator interact with the system, as seen in Fig. 7. Each of the use case descriptions shown is described in Appendix 1.

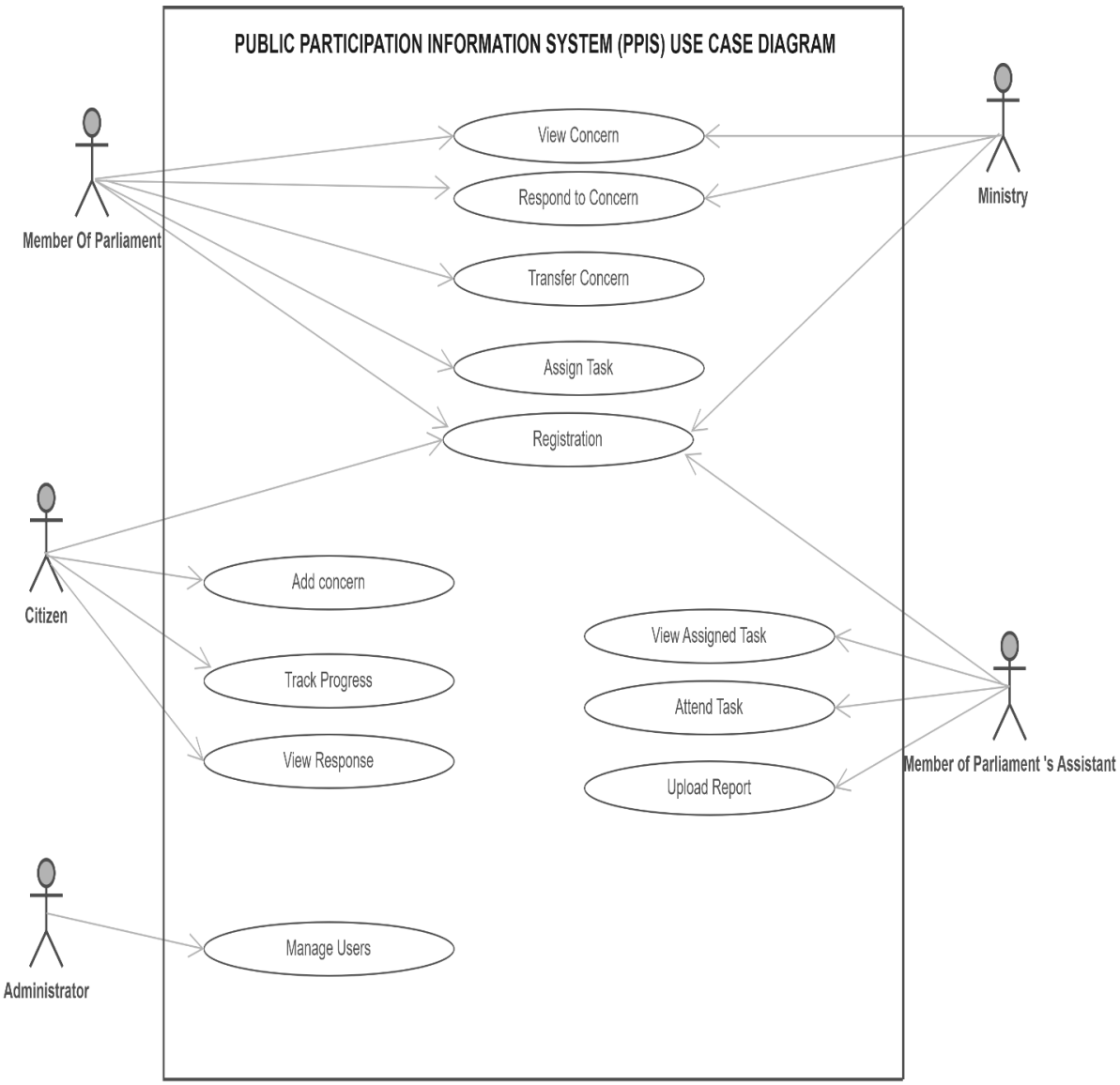


Figure 7: Use case diagram of the public participation information system

3.8.5 Flow chart diagram of the public participation information system

A flow chart is a graphical representation of a sequence of events, helping decision-makers understand the relationship between their decision and the given outcome(Allawi, 2020). Figure 8 shows the Public Participation Information System (PPIS) flow chart diagram. It illustrates how a system operates from start to finish, step by step. Different kinds of boxes and rows represent the activities and their order of linkage.

The system operates in three main stages: submission of concerns, processing of worries, and transferring concerns for higher-level intervention, as illustrated in Fig. 8. The flow begins with citizens submitting their concerns, which are automatically captured by the system and

displayed on a web-based dashboard for the respective Member of Parliament (MP). The MP reviews each situation and can either respond directly to the citizen or forward the issue to the relevant ministry if it requires action beyond their mandate.

Additionally, MPs have the option to delegate tasks to their assistants, especially when supporting evidence is required before issuing a response. Once the assistant completes the assigned task, they can upload a report through the system, allowing the MP to review the findings and formulate an appropriate response, which the citizen can then view. This process ensures transparency, accountability, and efficient handling of concerns.

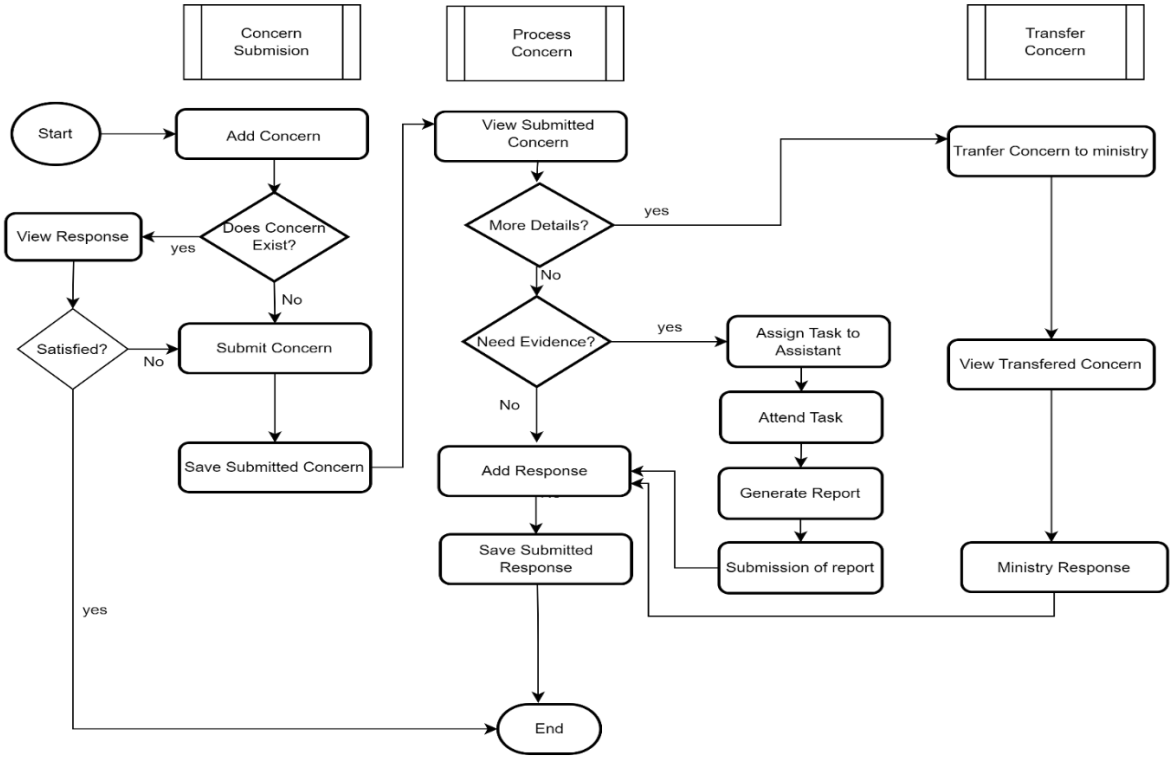


Figure 8: Flow chart diagram of the public participation information system

3.8.6 Entity relationship diagram of the public participation information system

An entity-relationship diagram (ERD) is a visual representation of entities and their relationships within a database. It serves as a framework created with specialized symbols to define the relationships between database entities. The ERD is created based on three principal components: entities, attributes, and relationships. Figure 9 presents the ERD for the Public Participation Information System (PPIS), illustrating the main entities, citizen, Member of Parliament (MP), Concern, Response, Ministry, and Assistant, and how they are related within the system.

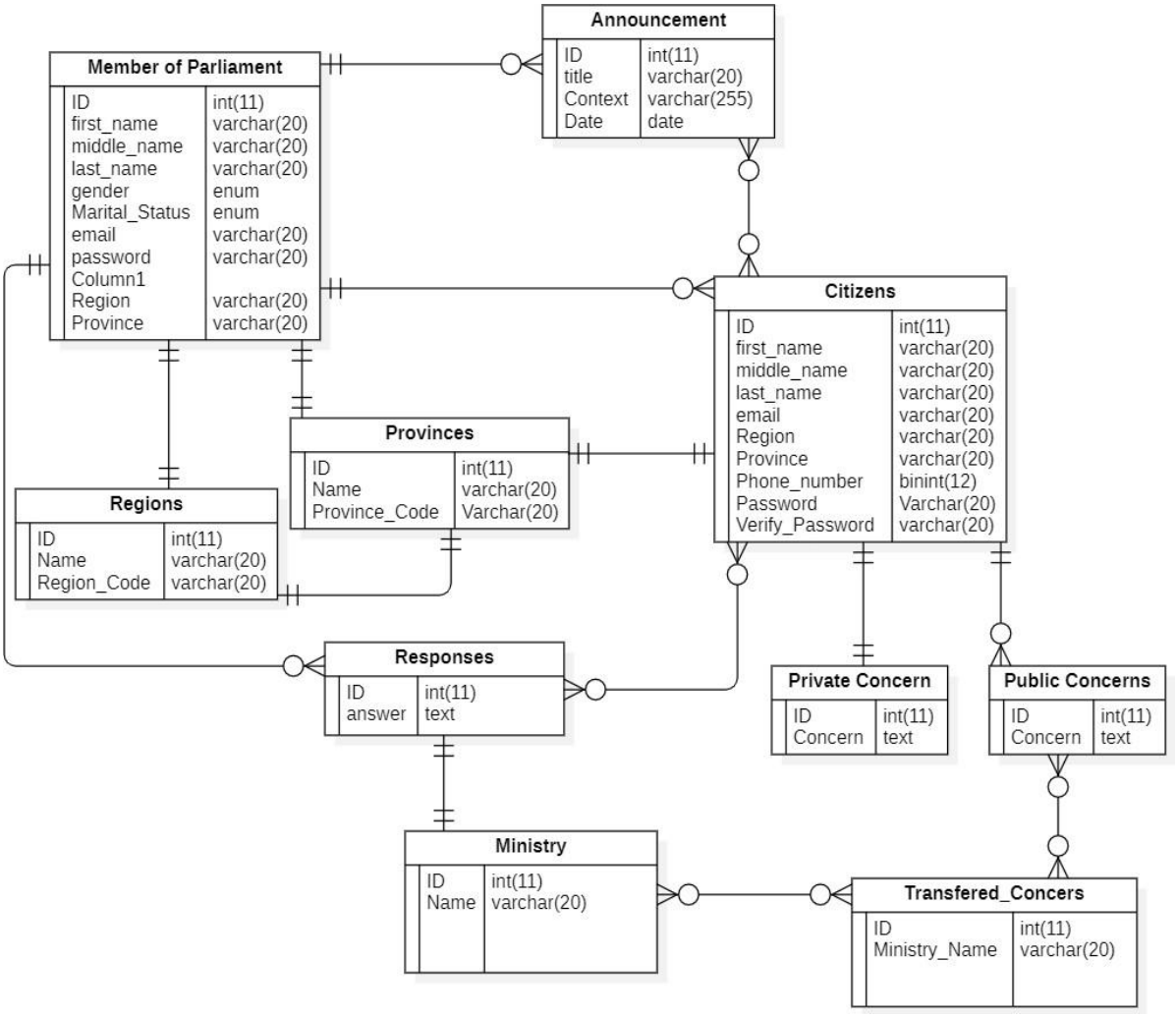


Figure 9: Entity relationship diagram of the public participation information system

3.9 System development tools and technologies

3.9.1 Software requirements

The Software used for the development of this system includes programming IDEs, an Operating System, a Database, the Laravel framework, Bootstrap, PHP, MySQL, SMS gateway, and cPanel, described as follows:

(i) Programming IDEs

Sublime four (4) was used for the development of this project. Sublime is a fast, lightweight text editor designed for coding, scripting, and general text editing(Sublime, 2023). It was used because it is incredibly responsive with large code, supports multiple platforms, and ensures a

consistent workflow across devices. Its extensibility allows for customization of the editor with a wide range of plugins, enhancing productivity (Sublime, 2023).

(ii) Tools and frameworks

Laravel 10 was used in the development of this project. Laravel is one of the PHP frameworks that has the MVC (Model-View-Controller) concept in the PHP language, which is used in website creation and is designed with a precise and time-saving syntax. It is a free and open-source web framework for creating sophisticated online applications, and is based on PHP. It was used to speed up development and ensure clean, maintainable code (Yadav *et al.,* 2019).

(iii) Front-End

Bootstrap 4 was used, which is an open-source front-end framework that simplifies web development by offering pre-designed components and a responsive grid system(Krause, 2020). It was used to ensure consistency across web projects and support efficient adaptability to various screen sizes.

(iv) Back-End

The PHP version 8.2.4 was used in the development of this project. PHP is a widely used server-side scripting language that is easy to learn and integrates well with HTML. It has extensive community support, runs on various platforms, and offers numerous frameworks, such as Laravel, for streamlined development. The PHP was used because it is cost-effective and compatible with most web servers and databases, making it a versatile choice for web development (Sotnik *et al.,* 2023).

In terms of data management, the MySQL database server was used, specifically version 15.1. The MySQL database server is a multi-platform, open-source database platform. Oracle developed this relational database management system (RDBMS) based on Structured Query Language (Wahyudi *et al.,* 2022). MySQL was chosen in this study because it is popular among web programmers. Its popularity stems from its ability to conveniently and quickly search for records and perform data manipulation tasks such as adding, deleting, and sorting data. Additionally, MySQL offers a simple and reliable security system, along with a free license.

For hosting, cPanel version 110.0.33 was employed. cPanel is a popular web hosting control panel that provides a graphical interface and automation tools designed to simplify the process

of hosting web applications. By using cPanel, web management was easy and could be done in one place, allowing for the easy management of multiple tasks in the same location (Anastasha & Zakaria, 2022).

(v) SMS API

Telerivet is a robust cloud-based platform designed for enterprise-grade messaging, enabling organizations to engage customers, streamline business operations, and facilitate communication via SMS, voice, USSD, and other channels (Telerivet, 2025). Telerivet was chosen for its ease of integration and scalability, although it incurs ongoing SMS costs based on message volume. Telerivet 1.2.0 was used to implement two-way messaging systems, allowing citizens to voice their concerns offline.

(vi) SMS fallback mechanisms: logging, alerting, and automatic retries

To ensure reliable message delivery in the Public Participation Information System (PPIS), the system employs multiple fallback mechanisms centered on monitoring, retrying, and alerting.

Telerivet, the primary SMS gateway, handles message failures by automatically retrying to send failed SMS messages. Failures may result from temporary issues, such as network interruptions, the recipient's phone being switched off, or weak signal strength. Telerivet's Android Gateway or cloud SMS service attempts up to five retries per failed message, spacing these retries with increasing delays to avoid network congestion. This approach maximizes the chance of successful delivery without overwhelming system resources.

The system systematically logs all SMS sending attempts, failures, and fallback actions. This comprehensive logging captures details such as the time of failure, error type, and retry status. When repeated failures or fallback triggers occur, the system automatically sends alerts to system administrators. These notifications enable timely troubleshooting and maintenance, minimizing downtime and improving system reliability.

By combining automatic retries with robust logging and alerting, the PPIS maintains high message delivery reliability and ensures administrators are promptly informed of any issues requiring intervention.

3.9.2 Hardware requirements

Table 4: Public participation information system hardware requirements

Component	Specification	Justification
Compute (CPU)	Minimum 2 v CPU	To provide sufficient computational power to handle multiple concurrent user requests and background processing.
Memory	Minimum 4 GB RAM	To support the smooth operation of the system, ensure efficient handling of multitasking and concurrent processes.
Storage	Minimum 500 GB SSD	To provide high-speed data read and write capabilities, improving system performance and responsiveness.
Network Bandwidth	1 TB/month data transfer	To ensure high-speed network connectivity for handling multiple simultaneous user requests and large data transfers.
Backup and Recovery	Cloud Backups	To ensure that data is regularly saved and can be restored in case of failure.
Basic Mobile Phone	Any phone with SMS capability	Enables citizens in rural or low-connectivity areas to communicate with MPs without internet.

3.9.3 System security and data protection

(i) Encryption

In the web application, data is secured using HTTPS (SSL/TLS), ensuring encrypted communication between users and the server. Passwords are stored using the bcrypt hashing algorithm for added protection. For the SMS system, messages rely on the telecom provider's GSM encryption (A5/1 or A5/3), while server-side message content is additionally encrypted using AES-256, protecting sensitive data even if intercepted.

(ii) Role-based authentication

To prevent unauthorized access, the system uses role authentication. User credentials are validated by matching the entered username and bcrypt-hashed password with database records. Access is granted based on predefined user roles.

(iii) Anti-forgery tokens (CSRF tokens).

Another security measure implemented is the use of anti-forgery tokens (CSRF tokens). These tokens help protect the system from Cross-Site Request Forgery attacks by verifying that each request made to the server originates from an authenticated user and trusted source. This prevents malicious actors from performing unauthorized actions on behalf of legitimate users.

(iv) Unique password

To ensure strong security, the system requires users to create unique passwords that meet the following criteria: a minimum of 8 characters, including at least one uppercase letter, one lowercase letter, one number, and one special character. This complexity helps protect against common password attacks.

3.10 System testing

System testing was conducted to ensure the developed system met the specified requirements and functioned as intended. Using the extreme programming (XP) approach, the testing process involved unit testing, integration testing, and system testing. Unit tests verified the correctness of individual components, while integration testing ensured smooth interaction between modules such as messaging, user authentication, and data storage. System testing evaluated the overall functionality, performance, scalability, and compatibility of the application. This approach confirmed that the system was stable, reliable, and ready for deployment.

(i) Unit testing

Unit testing is a type of test performed on a code section to ensure that it is functional. This is accomplished on a practical level. This refers to testing the accuracy of individual modules and integrating numerous system modules as part of the unit test (Asakawa & Tanaka, 2022). The unit test was run to verify that each module of the Public Participation Information System was functioning correctly. Additionally, it prioritizes ensuring that loading times are minimal.

(ii) Integration testing

Any software testing that aims to check the interfaces between components against a program design is known as integration testing (Trautsch *et al.,* 2020). During this testing, several approaches were employed to evaluate the entire system, including the simultaneous testing of

multiple software components. In addition, the data flow between modules was monitored and tested during the integration testing process. The web application and two-way message system were tested to ensure they can communicate accordingly.

(iii) System testing

In this study, system testing was conducted on the developed Public Participation Information System (PPIS). The system underwent comprehensive testing to ensure its functionality, performance, compatibility, and usability. Functional testing was conducted using structured test cases to verify that each feature operated as intended.

Performance testing was conducted using the Grafana K6 library, which was utilized to simulate multiple virtual users over a defined duration. Key performance indicators, including average response time, success rate, failure rate, and request throughput, were captured during the test. This helped assess the system's stability and responsiveness under realistic user loads.

Compatibility testing was performed to ensure the system operated consistently across various platforms and environments. It was tested on multiple web browsers (e.g., Chrome, Firefox, Edge, Opera) and on different device sizes, including desktop, tablet, and mobile views, to ensure responsive behavior and a uniform user experience.

Usability testing was conducted using the System Usability Scale (SUS), a widely validated tool (Lewis, 2018). SUS was selected due to its simplicity, speed of administration, and ability to generate a standardized usability score out of 100. It effectively captures user perceptions regarding system complexity, ease of use, user confidence, and satisfaction, while supporting benchmarking against established usability standards. Importantly, SUS supports benchmarking, where a score of ≥ 68 is considered acceptable based on established industry standards.

(iv) Scalability testing

To assess the system's scalability, performance testing was conducted by gradually increasing the number of virtual users (VUs) simulating concurrent access to the Public Participation Information System (PPIS). Load and stress tests were conducted to assess the system's ability to handle increasing demand, with a focus on key metrics including response time, success rate, and failure rate. These tests aimed to ensure that the system could maintain reliable and efficient

performance when scaled to support larger user populations. The results from these tests informed potential optimizations needed to accommodate future growth in user load and data volume.

3.11 System validation

System validation was conducted to ensure that the developed system met both technical requirements and user expectations. The process involved members of the target population who evaluated whether the implemented features aligned with the system's intended objectives. Participants interacted with the system and provided structured feedback through a structured questionnaire, focusing on functionality, usability, responsiveness, performance, and user-friendliness. Furthermore, to complement user feedback, technical validation involved assessing key performance metrics, including latency (response time)**,** system load capacity**,** and success rate. These metrics were used to evaluate the system's efficiency and reliability under typical operating conditions.

3.12 Ethical consideration

Before commencing data collection, official approval to conduct the project was obtained from the Nelson Mandela African Institution of Science and Technology (NM-AIST) to ensure compliance with institutional research ethics. In addition, permission was granted by the Parliament of Tanzania to collect data from Members of Parliament and parliamentary staff. All participants were informed about the purpose and nature of the study, and their participation was entirely voluntary. Informed consent was obtained from those who filled out questionnaires and took part in focus group discussions or interviews. To maintain confidentiality, all personal information collected was kept private and used solely for academic purposes. The data was securely stored, and no identifying details were disclosed in any part of the report. Furthermore, in the interpretation and reporting of findings, ethical standards were strictly observed, and respondents' identities were anonymized to ensure privacy and protect the integrity of the data.

3.13 Policy and strategic alignment

(i) Tanzania National ICT policy 2016

This policy emphasizes enhancing transparency, accountability, and citizen participation through ICT. Specifically, it aligns with the policy's objective to enhance good governance

through the strategic use of ICT tools (MWTC, 2016). The PPIS supports this by enabling direct digital communication between citizens and Members of Parliament via SMS and web platforms, thereby promoting active public participation as envisioned in the policy's emphasis on ICT literacy and engagement. Additionally, the platform reflects the government's commitment to using ICT to improve service delivery and transparency in governance.

(ii) e-Government strategy

The e-Government authority's strategic plan directly supports systems like PPIS under its objective to enhance and sustain e-Government service provision by public institutions and to ensure compliance with e-Government policies and standards. It emphasizes improved citizen access to digital public services, transparency, and accountability in service delivery. It also highlights the use of platforms that foster public participation and feedback mechanisms (e-GA, 2021). These priorities position PPIS as a practical tool aligned with national e-Government objectives.

(iii) Tanzania digital economic strategic framework

The Tanzania digital economy strategic framework supports systems like PPIS through pillar 5, which nurtures digital inclusion and accessibility, and pillar 4, which emphasizes digital innovation culture and enabling technologies (MWTH, 2024).

Pillar 5 emphasizes extending digital infrastructure to underserved communities, enabling inclusive participation in governance. The PPIS aligns with this by providing accessible communication between citizens and MPs, while pillar 4 encourages the development of local digital solutions that enhance transparency and service delivery. These pillars position PPIS as a key tool for inclusive and accountable digital governance.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Findings from the respondents

In this chapter, a comprehensive exploration of the results obtained through various stages of research unfolds. The discussion begins with the results obtained from questionnaires, which explore the demographic characteristics of respondents, current communication channels used by citizens to reach Members of Parliament (MPs), the challenges associated with these channels, and the willingness to adopt digital solutions to enhance communication.

This is followed by insights derived from interviews and focus group discussions, which helped identify key system requirements based on the research questions and specific objectives. The chapter then presents the design, development, testing, and validation of an information system designed to enhance communication between members of parliament and citizens, which includes both a web application and a two-way messaging platform. Finally, the outcomes and performance of both system components are discussed in detail.

4.1.1 Demographic characteristics of participants

This part comprises the analysis of the demographic characteristics of the citizens and members of parliament, which deals with the gender and age of the citizens. This ensures that the developed system is inclusive and caters to all users. Additionally, it helps to identify potential biases and ensures that the results are representative of the entire population, leading to a more effective and user-friendly system.

(i) Gender

The researcher was interested in knowing the gender of participants. Their response is summarized in Table 5. The findings revealed that 58% of the respondents were male, while 42% were female, among the 177 respondents who participated in the survey. The findings indicate that the majority of the surveyed citizens were males. As shown in Fig. 10 and Table 5.

Table 5: The respondents of the gender

Gender	Frequency	Percent (%)
Male	102	58
Female	75	42
Total	**177**	**100**

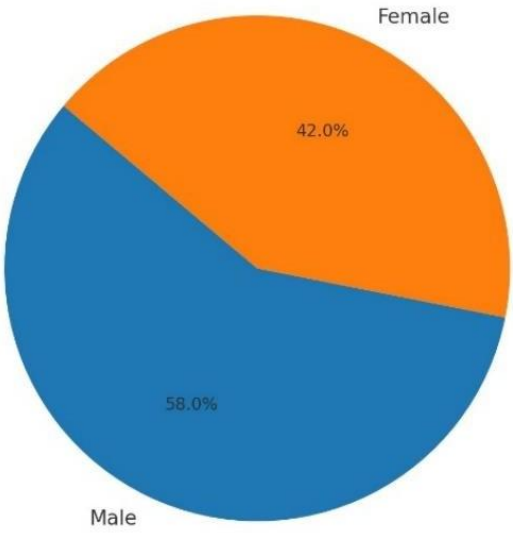


Figure 10: The respondents of the gender

(ii) Age

The age of the individual is among the key determinants of study requirements for developing the information system. Their response is summarized in Table 6. In the study, the age range of respondents varied from 18 years to 45 years and above. The findings revealed that a majority of respondents were in the range of 14-25 years, with 43%, also 32% of the respondents were in the range of 26 - 44. Only 25% of the respondents were above 45 years old. The finding indicates that the majority of respondents in this study were from the younger generation, who are primarily involved in social media. This implies that because the young generation engages in social media, they are likely to be aware of the requirements for developing an information system, as shown in Fig. 11.

Table 6: The respondents of the age

Age	Frequency	Percent (%)
18 to 25	76	43
26 to 44	57	32
45 and above	44	25
Total	**177**	**100**

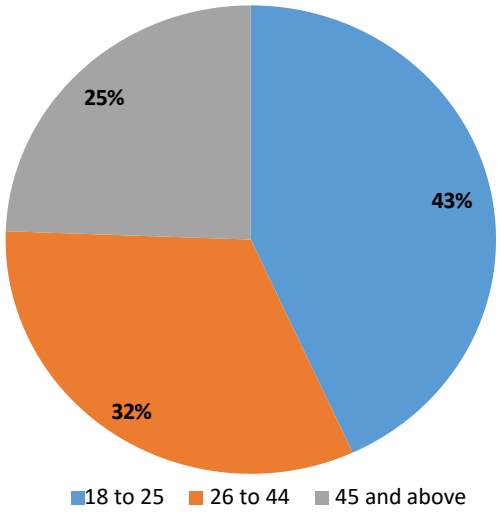


Figure 11: Age of the respondents

The demographic data shows that most respondents are young (18–25), who are generally comfortable with digital communication, supporting the adoption of both the SMS-based system and the web application. Older respondents highlight the need for a simple, accessible platform via SMS to ensure inclusivity for those without internet or smartphones. This dual approach accommodates diverse user capabilities, enhancing overall system usability and satisfaction.

4.2 Results from the questionnaire

4.2.1 Findings on methods used by citizens and MPs to communicate

The focus here was to discover how people submit their challenges to their representatives, and learn how MPs communicate with their citizens to discuss the difficulties submitted. The findings are categorized based on data collected from citizens and representatives.

(i) Communication channels used by citizens to submit their concerns

Respondents were asked which methods or channels they use the most to communicate with their Member of Parliament. Their response is summarized in Table 7. The results show that 39% submit their challenges through local government leaders or the assistants of Members of Parliament, 38% submit their challenges through public meetings, 18% use the Telephone, and 5% use the face-to-face method to submit their challenges. From the result, we see that a large percentage depend on local government leaders and public meetings to represent their needs or challenges to their representative, as shown in Fig. 12.

Table 7: Communication channels used by citizens to submit their concerns

Methods/channels	Frequency	Percent (%)
Telephone	21	18
Face to face	6	5
Local leaders	47	39
Public meeting	45	38
Total	**119**	**100.0**

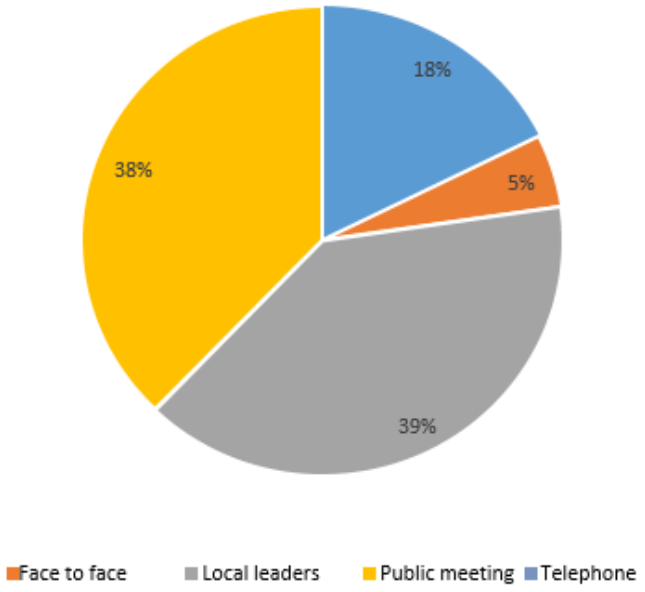


Figure 12: Communication channels used by citizens to submit their concerns

(ii) Communication channels used by members of parliament to gather concerns from their citizens

Members of Parliament were asked which primary channel they currently use to gather concerns from citizens in their constituency. Their response was summarized in Table 8. The result shows that the majority of 86% responded that they use public meetings to gather concerns from their citizens. Also, 7% revealed that they gather concerns through physical meetings, while 3.5% responded to gathering concerns through telephone and local leaders, as shown in Fig. 13.

Table 8: Communication channels used by MPs to gather concerns

Channel	Frequency	Percent (%)
Public Meeting	49	86.0
Physical meeting	4	7.0
Telephone	2	3.5
local leaders	3	3.5
Total	**58**	**100.0**

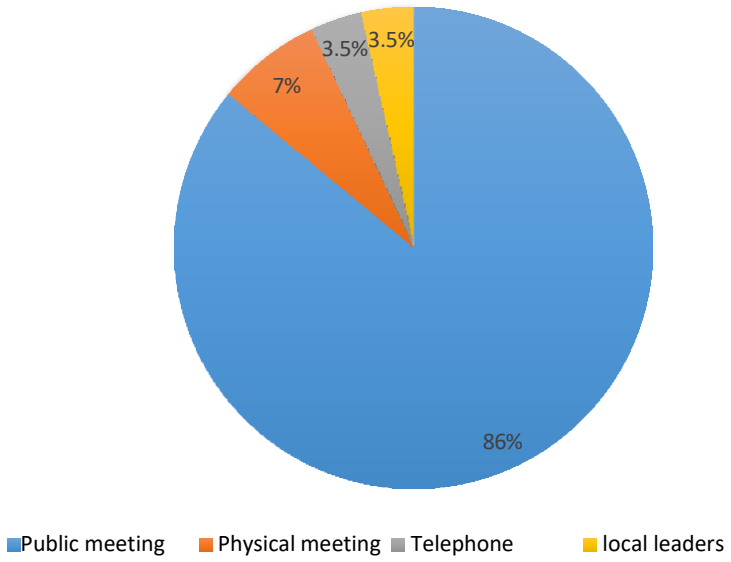


Figure 13: Communication channels used by MPs to gather concerns

Furthermore, members of parliament were asked about channels of communication that their constituents mostly use to communicate with them. They were asked to list all channels used by their constituent; their findings are summarized in Table 9. The findings indicate that 82.5% of the citizens communicate with their representatives through local leaders. Also, 75.4% of MPs revealed that citizens communicate through public meetings, 57.9% communicate through telephone, and 52.6% communicate through physical meetings.

Table 9: Communication channels citizens used to communicate with MPs

Channel	Frequency	Percent (%)
Public meeting	43	75.4
Physical meeting	30	52.6
Telephone	33	57.9
local leaders	47	82.5

4.2.2 Findings on limitation of existing communication channels

The focus was to know what challenges or limitations people face when using existing channels to represent their challenges to their representatives.

(i) Time taken by citizens to submit concerns

Citizens were asked how long it took to submit their concerns to members of parliament in their constituency. Their findings are summarized in Table 10. The results indicated that the majority, 42.9% of the respondents, used more than 3 days to submit the concerns to the member of parliament. Also, the findings revealed that 30.3% of the respondents never submitted their concerns. On the other hand, 18.5% of the respondents used less than 3 days, while only 8.4% used exactly 3 days to submit their concerns to a member of parliament, as shown in Fig. 14.

Table 10: The time citizens take to submit their concerns

Days	Frequency	Percent
3 days	10	8.4
More than 3 days	51	42.9
Less than 3 days	22	18.5
Never submitted challenges	36	30.3
Total	**119**	**100.0**

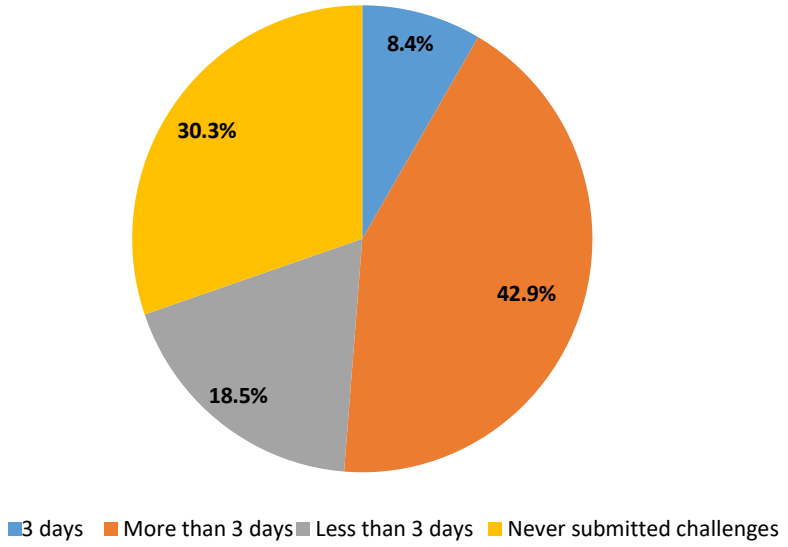


Figure 14: The time citizens take to submit their concerns

(ii) Challenges citizens face when they want to communicate with members of parliament

Citizens were asked about the challenges they faced in the process of submitting their concerns to their representatives. Their findings are summarized in Table 11. Findings in Fig. 15 revealed that the majority, 82% of the respondents, said the unavailability of a member of parliament is the challenge they face. Also, 17% of the respondent revealed that distance is another challenge they face in submitting their challenges, 9% revealed that traveling costs are also limiting them from submitting their challenges. 4% have never communicated with an MP, and for those who didn't have any issues, it was 1%. The results entail that a large number fail to represent their challenges to MP because of their availability, and it takes more than three days for others to be able to submit their challenges to their representative.

Table 11: Communication challenges between MPs and citizens

Challenges	Frequency	Percent (%)
Unavailability of a Member of Parliament	82	69
Distance	20	17
Travelling Costs	11	9
I have never been able to communicate with MP	5	4
None	1	1
Total	**119**	**100**

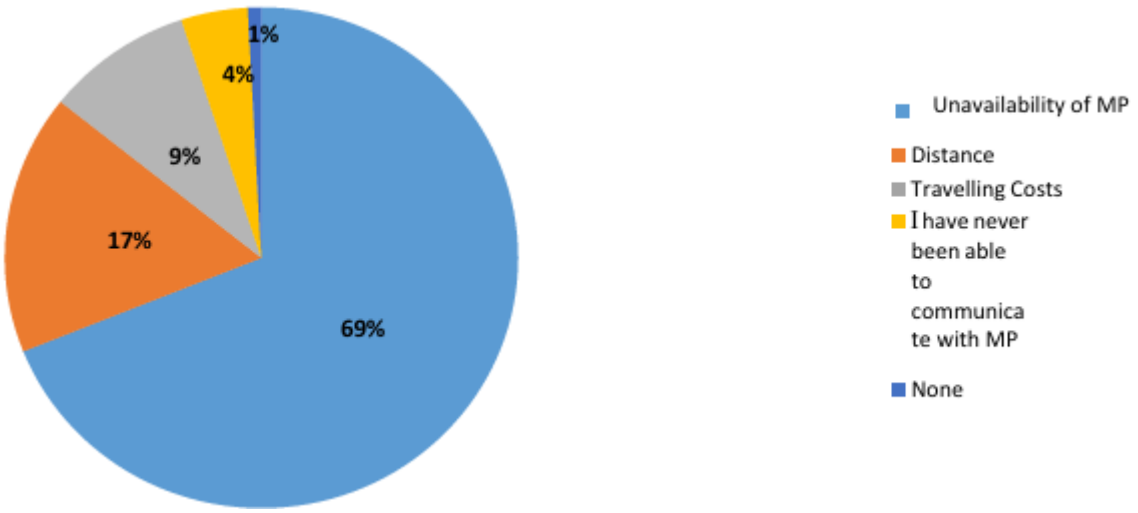


Figure 15: Communication challenges between MPs and citizens

(iii) Citizens' participation in public meetings

Citizens were asked how often they attended public meetings. The findings in Table 12 revealed that the majority, 56.3% of the respondents, rarely participated in the public meetings, and 21% never attended any meetings conducted in their area. Furthermore, 17.6% of the respondents frequently attended meetings held in their area, while 8.4% of the respondents preferred not to disclose their attendance at public meetings, as shown in Fig. 16.

Table 12: Citizens' participation in public meetings

Occurrence	Frequency	Percent (%)
Never	21	17.6
Rarely	67	56.3
Frequently	21	17.6
I prefer not to say	10	8.4
Total	**119**	**100**

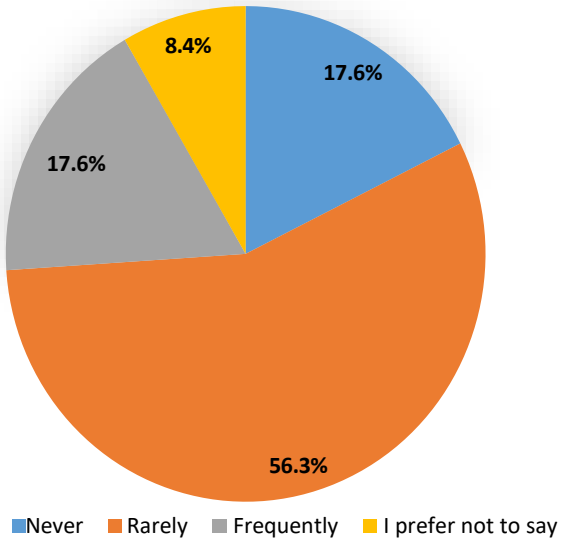


Figure 16: Citizens' participation in public meetings

4.2.3 Willingness to adopt technology for communication

The focus here was to determine how willing people are to adopt new information systems to improve communication between them and members of parliament. Findings in this section are presented based on data obtained from the citizens and data from members of parliament.

(i) Willingness of citizens to adopt technology systems to improve communication

Citizens were asked if the information system would help them to reach members of parliament easily. Their findings are summarized in Table 13. The results indicate that 61.4% agree that the information system will help them to reach their representative easily, 27.7% strongly agree that the system helps them, and only 10.90% of people disagree that the information system helps them to reach their representative easily, as shown in Fig. 17.

Table 13: Citizens' perceptions of ease in reaching MPs via the information system

Response	Frequency	Percent (%)
Strongly Agree	33	27.7
Agree	73	61.4
Disagree	13	10.9
Total	**119**	**100**

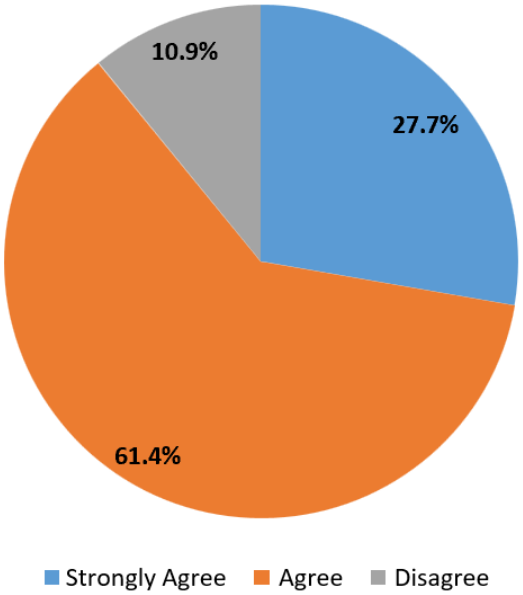


Figure 17: Citizens' perceptions of ease in reaching MPs via the information system

(ii) Willingness of members of parliament to adopt technology systems to improve communication between them and citizens

Additionally, members of parliament were asked if information and communication technology can enhance the efficiency of gathering citizens' concerns. The results in Table 14 and Fig. 18 show that the majority, 54.4% strongly agree, and 43.9% agree that information and communication technology can enhance the efficiency of gathering citizens' concerns, while only 1.8% disagreed.

Table 14: MPs' perceptions of ease in reaching MPs via the information system

Response	Frequency	Percent (%)
Strongly Agree	31	54.4
Agree	25	43.9
Disagree	2	1.8
Total	**58**	**100**

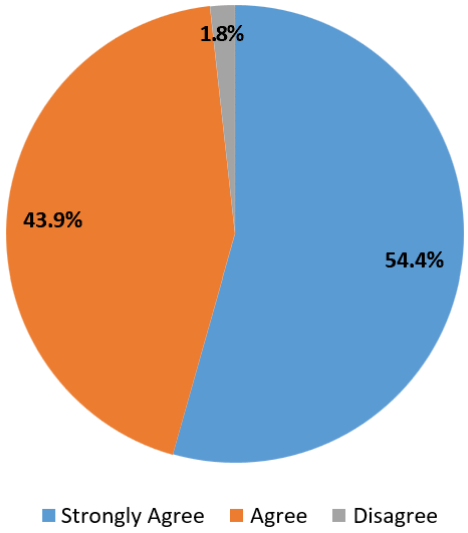


Figure 18: MPs' perceptions of ease in reaching MPs via the information system

4.2.4 Findings on acceptance of proposed technical features

The focus here was to determine the acceptance of some features included in the system. Respondents were asked if this system can submit challenges openly or confidentially.

(i) Citizens' acceptance of some technical features to be included in the system

The results in Table 15 revealed that the majority, 39.5% of the respondents, said that the system can submit concerns both openly and confidentially. On the other hand, 29.4% said confidentially, and 23.5% revealed they can submit openly. Only 7.6% were not sure if the system can submit challenges openly or confidentially, as shown in Fig. 19.

Table 15: Preferred mode of concerns submission

Response	Frequency	Percent (%)
Openly	28	23.5
Confidentially	35	29.4
Both openly and confidentially	47	39.5
I don't know or Not Sure	9	7.6
Total	**119**	**100**

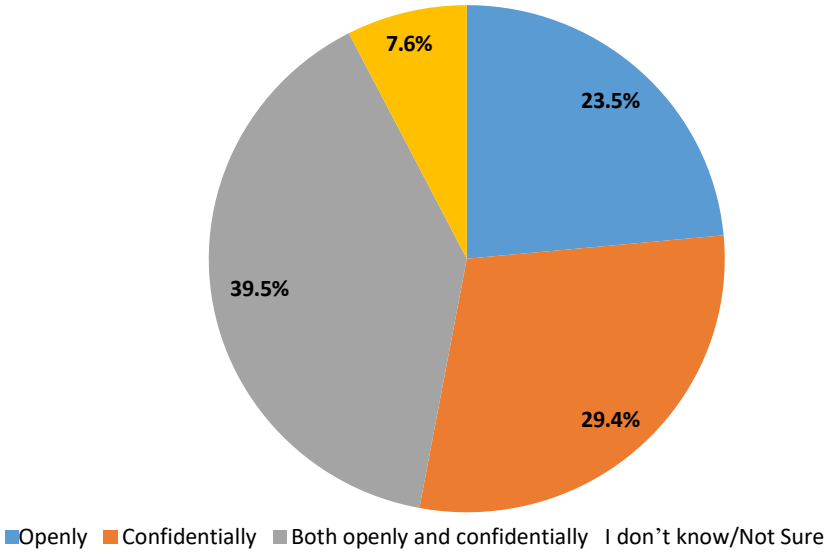


Figure 19: Preferred mode of concerns submission

(ii) Citizens' acceptance of the tracking of their submission

Citizens were asked if they would like to track the progress of their submitted concerns. The results in Table 16 revealed that 107 respondents agreed that they would like to track the progress. Only 4% of the respondents do not want to track their progress, while 6% are unsure whether they want to track it or not, as shown in Fig. 20.

Table 16: Citizens' interest in monitoring concerns feedback

Responses	Frequency	Percent (%)
Yes	107	90
No	5	4
I am not Sure	7	6
Total	**119**	**100**

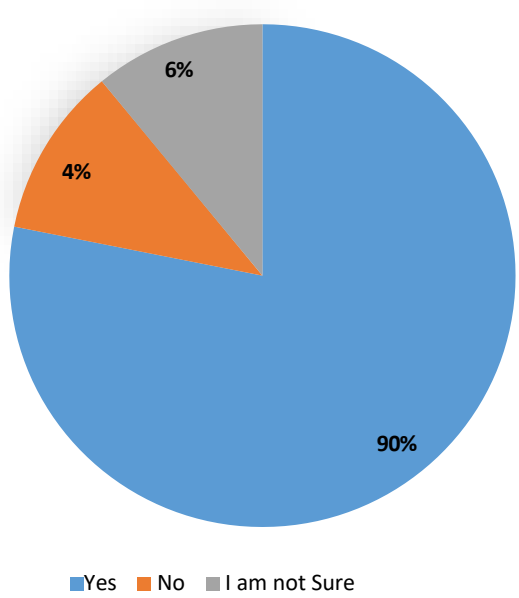


Figure 20: Citizens' interest in monitoring concerns feedback

(iii) Members of parliament's acceptance of some technical features to be included in the system

Members of parliament were asked if they were ready to adopt new technologies and systems to improve their communication with constituents. Figure 21 shows that the majority 88% of the members of parliaments are ready to accept some of the technical features to be included in the system, and 12% of them are not ready.

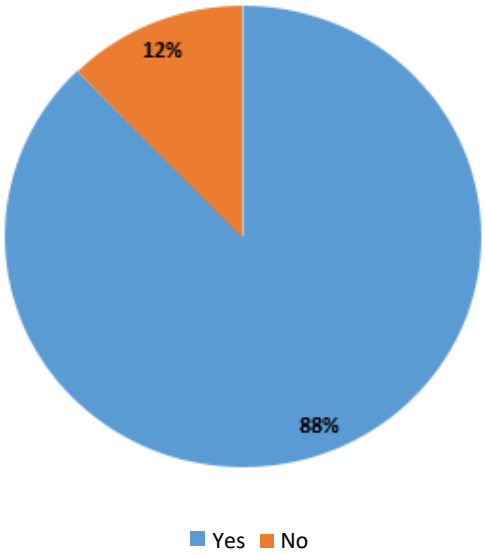


Figure 21: MPs' acceptance of some technical features

(iv) Privacy or security concerns MPs would like to address in the implementation of an ICT system for communication with citizens

Furthermore, members of parliament have indicated which specific privacy or security concerns they would like to address in the implementation of an ICT system for communication with citizens. Findings in Table 17 show that the majority, 50.9% of members of parliament, select secure user authentication to be addressed in the implementation of the ICT system for communication with citizens. End-to-end encryption was the most preferred security feature, selected by 28.1% of respondents, whereas 21% indicated no specific preference, as shown in Fig. 22.

Table 17: Specific privacy or security features to be implemented

Response	Frequency	Percent (%)
End-to-End Encryption	16	28.1
Secure user Authentication	29	50.9
No Specific preferences	13	21
Total	**58**	**100.0**

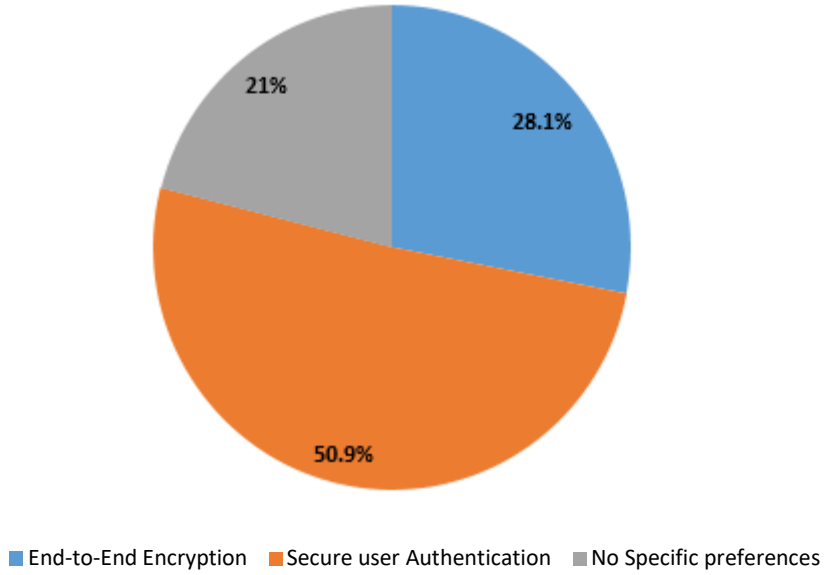


Figure 22: Specific privacy or security features to be implemented

Moreover, members of parliament were asked if there was anything they wanted to add or share regarding the requirements for the information system. A member of parliament revealed that communications should be extended to rural areas to broaden the scope of communication and enable citizens to voice their challenges through SMS. Education should be provided, especially to rural residents. Additionally, some prefer the system to display resolved issues to citizens so they know the government and parliament are addressing their problems. Additionally, the government should enable phone communication at the 4G and 5G levels in rural areas to enhance the system for addressing challenges faced by citizens.

4.3 Results from the interview and focus group discussion

During data collection from members of parliament and citizens, interviews were conducted with members of parliament, and focus group discussions were held with citizens who lacked literacy skills and were unfamiliar with technology, including WhatsApp, email, and Google Forms.

4.3.1 Communication channels between citizens and members of parliament

In this section, the focus was on identifying how people submit their concerns to their MPs. Also, to discover how MPs communicate with citizens to get to know their challenges. The findings are categorized based on data obtained from the citizens and MPs.

The findings revealed that Members of Parliament (MPs) use various methods, such as public and physical meetings, local government leaders, face-to-face, and telephones, to communicate and collect citizens' concerns. To them, these are the easiest and most accessible methods to use due to the coverage. When a public meeting is employed, it can involve a lot of citizens at once, rather than meeting each citizen individually to listen and gather their problems (Quick & Bryson, 2022). During the interview, the respondent revealed the following:

"I normally use the local government leaders as the main channel to gather information from the citizens. However, there are some situations where public meetings, face-to-face communication, and telephone are used."

Also, another respondent revealed the use of physical and public meetings to gather information from the citizens. Therefore, when employing this method, he can gather a significant amount of information in a short period at the lowest cost. Respondent had the following to say:

"The method I used to gather my citizens' concerns mainly is through public meetings, sometimes through local government leaders, and by telephone. And it depends on my schedule; it might be two or three times a year."

From the above, it is clear that most of the MPs generally prefer public and physical meetings and local government leader to gather concerns from their citizens due to their schedules, that is, they have busy schedules. Furthermore, from the focus group discussion, it was revealed that when citizens engage with their MPs, they mostly use public and physical meetings, local government leaders, and telephones. Most of the citizens preferred these methods because they are saving, accessible, and less costly. For instance, the respondent had the following to say:

"I mostly attend public meetings because it gives me a chance to express my concerns directly and hear from other people in the village. I find this method very effective, but when I have an urgent or private matter, I always visit the member of parliament physically so that I can get an immediate response."

Moreover, the respondent had the following to add:

"Most of the time, you might call MP, and they might not answer. They answer their phones very rarely, so I normally rely on public meetings and also local government leaders since they

can easily access MPs."

So, from the above assertions, it is clear that most of the citizens prefer public meetings since it is where they can meet with their MPs easily and air their problems. Nevertheless, it was found that public meetings were rarely held in the constituencies. Most of the respondents argued that these meetings were held once or twice a year or sometimes never. This can be seen as stated by the respondent:

"Public meetings are quite rare in our area, maybe once a year. I did attend one recently, and it was beneficial to voice community concerns."

Furthermore, other respondents had the following to append respectively:

"They are conducted twice or three times per year, and I used to attend all of them since I am a local leader."

From the above assertions, it is clear that due to busy schedules, the MPs rarely meet with the citizens. This has been caused by a considerable number of challenges.

4.3.2 Challenges of existing communication channels

Members of parliament were interviewed to reveal the challenges they face when using existing channels to communicate with their constituency. Members of Parliament state that due to busy schedules, it's very rare for them to meet with the citizens. Also, the high cost of organizing public meetings and Climate change. This can be seen when one of the Respondents said the following:

"A considerable number of residents live at a distance from the town, making it expensive and time-consuming for those wishing to meet in person and communicate their concerns. Furthermore, the lack of reliable means to notify them about my availability results in instances where they may visit my office only to find that I am not present."

Additionally, another respondent had the following to add:

"Due to my demanding schedule, I seldom have the opportunity to personally visit each village and directly address the citizens' concerns, leading to a lack of trust. I heavily depend on local government leaders, resulting in a missed chance to hear the concerns of my citizens firsthand; moreover, it is costly to organize public meetings."

Furthermore, it was found that citizens face a lot of challenges when employing various methods when submitting their concerns to their MPs. Challenges such as delay in feedback and cost. The citizen who employs public meetings to submit their concerns to the MPs faces challenges such as delays in feedback, and they are not conducted frequently. That is, a citizen may submit her/his concerns in January, but you may find that issues have not been worked on until May. This is seen as one of the respondents said:

"Submitting concerns during public meetings is easy, but it can take a while for them to be addressed. I once raised a road issue, and it took a couple of months for any action."

Moreover, the researcher found that citizens face different challenges when using local government leaders as their channel to communicate with their MPs, such as delays in addressing concerns and conflicts between local leaders and citizens. This can be seen as some of the respondents said:

"As I said, I usually go through my local leader, and the process is straightforward. However, the challenge is that it depends on when they can communicate the issues to the member of parliament, and sometimes they delay delivering our concerns to the representative."

Another respondent had said that:

"I have no problem with local leaders and they are helping a lot, but when we have issues that need immediate response it becomes challenging to use them because, even if they have processes to follow to be able to deliver these concerns to MP and they can't deliver these concerns individually, they normally collect concerns of citizens and submit them at once."

4.3.3 Acceptance of some technical features to be included in the system

It was further found out that most parliamentarians believe that the information system will help them overcome the challenges posed by the traditional methods that are currently used. They have confidence that the introduction of this system will help them gather concerns at any time they want. This can be seen as respondents said:

"Yes, it will help to improve communication and trust with my citizens. Also, it will ease the process of gathering my constituents' concerns back in my constituency."

"Yes, I will even be able to communicate with citizens who have busy schedules. Further, the system will help my citizens be aware of my schedules so that they can accommodate them. Not only that, but this system will solve a lot of the challenges that we faced before. So, through it, I will be able to analyze all of my citizens' concerns for a particular area based on a given sector."

From the above narrations, it is clear that the use of information systems will bring a revolution in terms of interaction between the citizens and their leaders. Also, through it, the MPs will be able to scrutinize all of their citizens' concerns for a precise area based on a part (sector) to prioritize a given challenge/concern and address them effectively.

Furthermore, it was found that citizens believe the introduction of a new information system would help them interact with their MPs more easily. The citizens believe that this information system will bond them with their leaders and provide them with an ongoing platform to air their concerns. Additionally, citizens appear to believe that this system will enable them to submit their concerns without relying on local government leaders, and it will also help them reduce the costs associated with traveling to the MP's offices to submit their issues. This can be proved as some of the respondents, respectively, said the following:

"Absolutely. The creation of an Information System could help in bridging the gap and providing a continuous platform for citizens to communicate their concerns/issues to their MPs."

"The information system will be very helpful, since we will be able to submit concerns to MPs directly rather than depending on local leaders, and we will be able to save costs for those who mostly prefer physical meetings."

From the narrations above, it is clear that citizens believe that the introduction of the new information system is a great help to them. They further add that if the information system is introduced, they want to be able to monitor their progress after they have submitted their issues. Monitoring increases MPs' responsibility and trust. Further, it was found that citizens preferred the system to contain both confidential and open features, depending on the nature of the issue, upon submitting their concerns to their MPs.

4.4 Summary of key findings

Most citizens and Members of Parliament rely on traditional and informal methods of communication, including public meetings, phone calls, handwritten letters, and intermediaries such as local government leaders. These methods are often inefficient, lack proper documentation, and provide little to no follow-up. Both groups expressed a strong willingness to adopt a technology-based solution, especially one that supports SMS, due to its accessibility, even in rural areas with limited internet or smartphone use. The developed system improved communication flow, enabled tracking of concerns, and allowed MPs to delegate tasks to assistants as needed. Pilot testing confirmed the system was user-friendly, effective, and well-received by both citizens and MPs. Additionally, the system was designed with scalability in mind, making it adaptable for future expansion to other constituencies, integration with local government structures, or enhancement with additional features such as voice interaction or analytics.

Table 18 : Summary of key findings

S/N	Key Finding	Supporting Evidence
1.	The majority of respondents were male	58% male, 42% female
2.	Youth are the largest participant group	43% aged 18–25
3.	Citizens mainly use intermediaries to submit concerns	39% use local leaders, 38% use public meetings
4.	MPs mainly gather concerns through public meetings	86% rely on public meetings, and a few use social media
5.	Delays in submitting concerns are common	42.9% take >3 days, and 30.3% never submitted at all
6.	MPs' unavailability is a top citizen challenge	69% said MPs are unavailable, as well as the distance and cost
7.	Citizens are willing to adopt the ICT system	89.1% agreed or strongly agreed
8.	MPs are willing to adopt the ICT system	98.3% agreed or strongly agreed
9.	Citizens want to track progress	90% said yes to tracking concerns

S/N	Key Finding	Supporting Evidence
10.	Preferred method of submission	Both open and confidential options are preferred by 39.5% of respondents
11.	MPs ready to adopt key features	88% of MPs are willing to adopt new features
12.	MPs' top privacy/security priorities	50.9% prioritize secure authentication, with 28.1% emphasizing encryption.

4.5 System requirements identification

The identified requirements are categorized into functional and non-functional requirements as shown in Tables 19 and 20:

4.5.1 Functional requirements

Table 19: Web application and two-way message requirements

S/N	Requirements
A. Smartphone Users	
A1	The system shall verify users through their phone number (OTP) and Email
A2	The system shall allow users to submit their concerns
A3	The system shall allow Users to submit their concerns to MPs privately
A4	The user shall be able to receive a response
A5	The user shall be able to change the language to either Swahili/English
A6	Users shall be able to track the status of the concern they submit
B. Non-Smartphone User	
B1	The system shall allow users to submit their concerns using a two-way messages
B2	The user shall be able to receive a response
C. Member of Parliament	
C1	Shall be able to view citizens' concerns
C2	Shall be able to respond to citizens' concerns
C3	Shall be able to forward citizens' queries to the ministry
C4	Shall be able to assign tasks to MP Assistants
C4	Shall be able to receive reports from their Assistants
D. Ministry	
D1	Shall be able to view forwarded concerns
D2	Shall be able to respond to the concerns

S/N	Requirements
E. Member of Parliament Assistant	
E1	Shall be able to view tasks
E2	Shall be able to attend to the task

4.5.2 Non-functional requirements

Table 20: Non-functional requirements of public participation information system

System Requirement	Requirement Description
Usability	The system is not compact, and it is easy to learn
Performance	The system's response to a user interaction is fast. If the connection is slow, it will take a long time to respond.
Reliability	The web application and two-way messages are reliable to use.
Security	The login credentials of the user are safely guarded.

4.6 System design results

Figure 23 presents the system architecture of the Public Participation Information System, structured into three key layers: the presentation layer, application layer, and data layer.

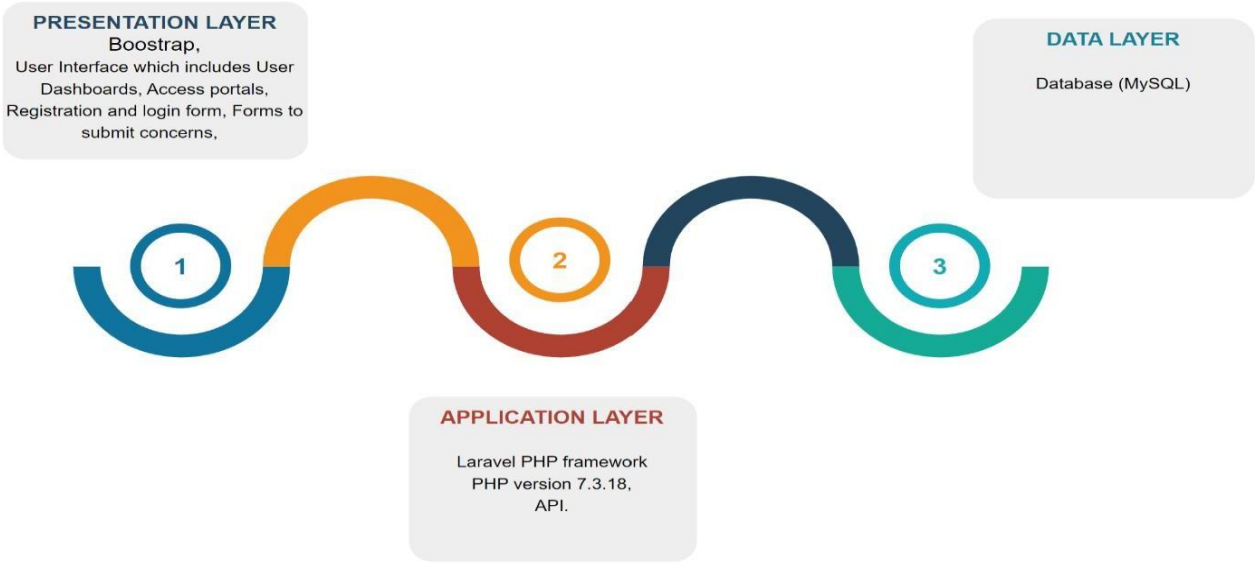


Figure 23: Public participation information system architectural diagram

4.6.1 Description of the elements of the system architecture

(i) Presentation layer

The presentation layer represents the user interface components developed using Bootstrap. It includes modules such as the user dashboards, registration and login forms, and concern submission forms. This layer is responsible for how users, citizens, members of parliament, the ministry, and assistants interact with the system.

(ii) Application layer

The application layer is built using the Laravel PHP framework and contains the system's business logic. It processes user inputs, handles routing, controls system behavior (e.g., how concerns are assigned, escalated, or responded to, and interacts with the database and SMS APIs.

(iii) Data layer

Data layer is implemented using a MySQL database, which stores all essential data, including user information, submitted concerns, responses, roles, and activity logs. This layer ensures secure storage and supports data retrieval for tracking and accountability.

4.7 System development results

4.7.1 A web application

A user-friendly web application named PPIS (Public Participation Information System) and a two-way Message system were developed to allow citizens and members of parliament to interact. The application can be accessed through a smartphone and computer, and those with a feature phone can submit their concerns through two-way messages using a special short code number provided.

(i) Registration page

Figure 24 illustrates the registration interface of the PPIS system, where new users are required to provide essential information, including NIDA number, email, password, phone number, region, province, and title. The inclusion of the NIDA number ensures that only Tanzanian citizens are

permitted to register, thereby enhancing the system's authenticity and security. By capturing this data, the platform verifies the user's identity and links them to their respective constituencies, ensuring that messages are routed to the appropriate Member of Parliament.

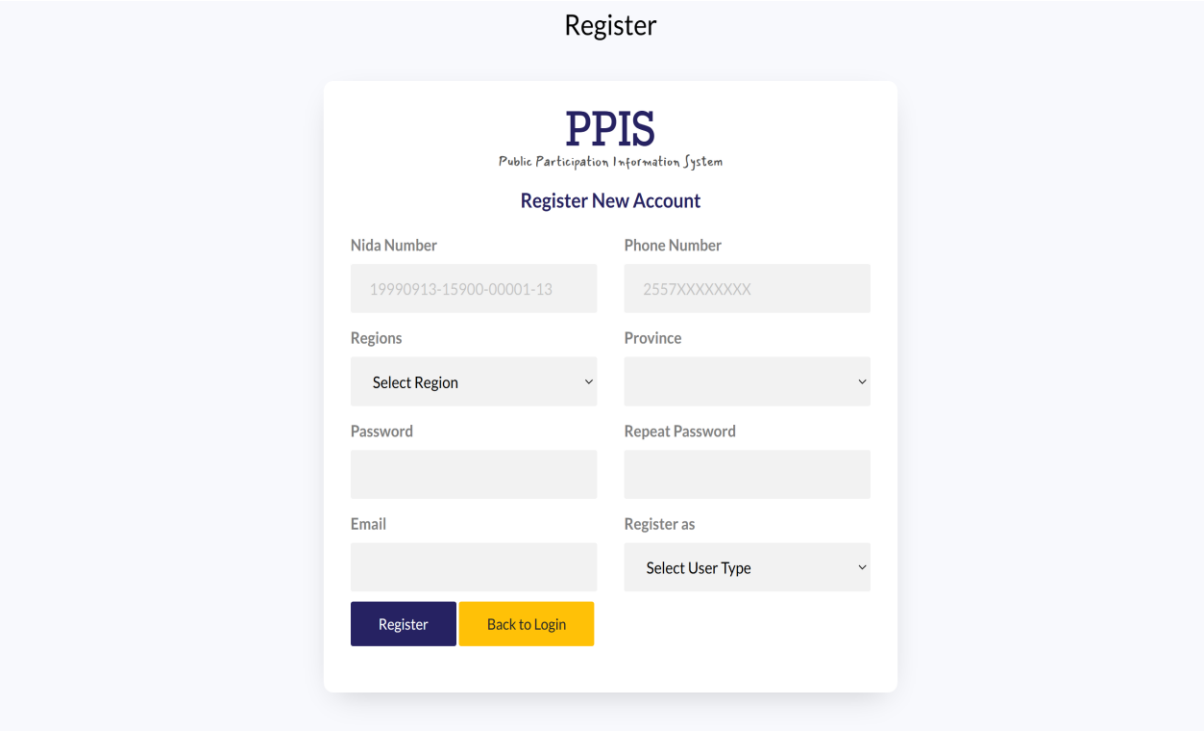


Figure 24: Public participation information system registration form

(ii) Login page

Figure 25 shows the login screen of the PPIS system, where registered users can access the platform using their credentials. This interface supports the system's core aim of enabling secure, authenticated communication between citizens and Members of Parliament. Its design ensures that only verified users can engage in the communication process, addressing concerns about identity, legitimacy, and trust in political participation platforms. The interface also includes a password recovery option, allowing users who forget their credentials to reset them easily.

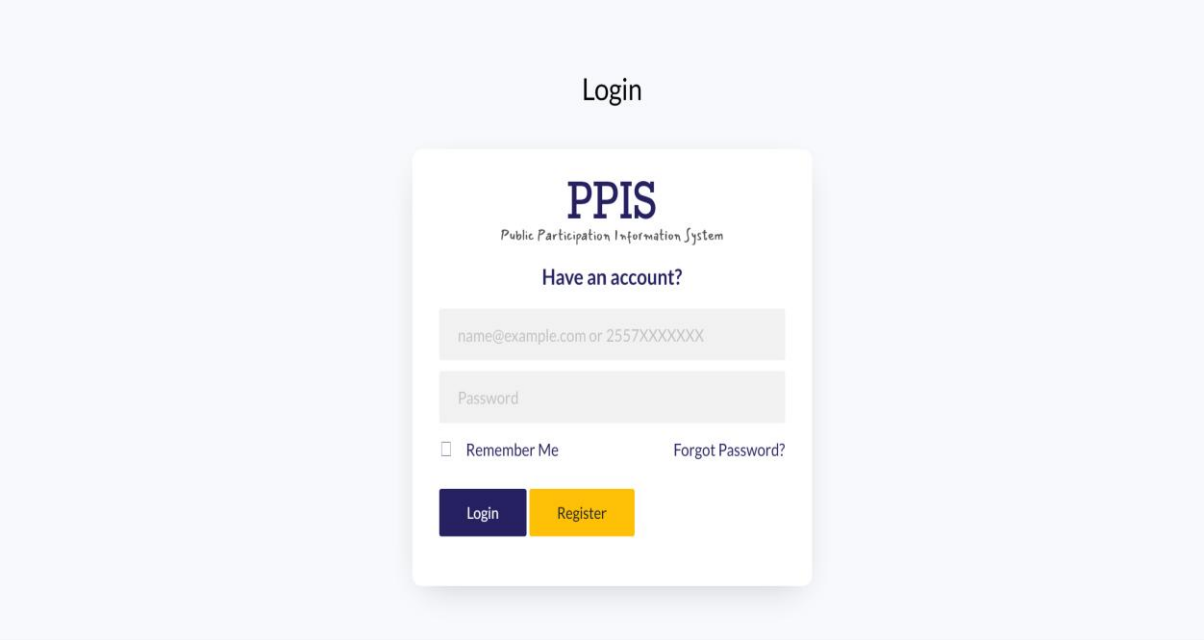


Figure 25: Public participation information system login page

(iii) Citizen dashboard

After the citizen logs in, they are directed to the dashboard, where they can view popular issues discussed in their province, categorized by sector or ministry. They can also view, like, and comment on these concerns. Furthermore, they can add concern either private or public concerns by clicking the concerns tab in the left side menu, as shown in Fig. 26. Private concerns can only be seen by a citizen who submitted it and member of parliament but for public concerns anyone can see it for as long you are registered as a citizen of that province. This figure demonstrates the user-friendly structure of the system and its alignment with the usability principle. It also encourages transparency and confidentiality of user information through private concerns.

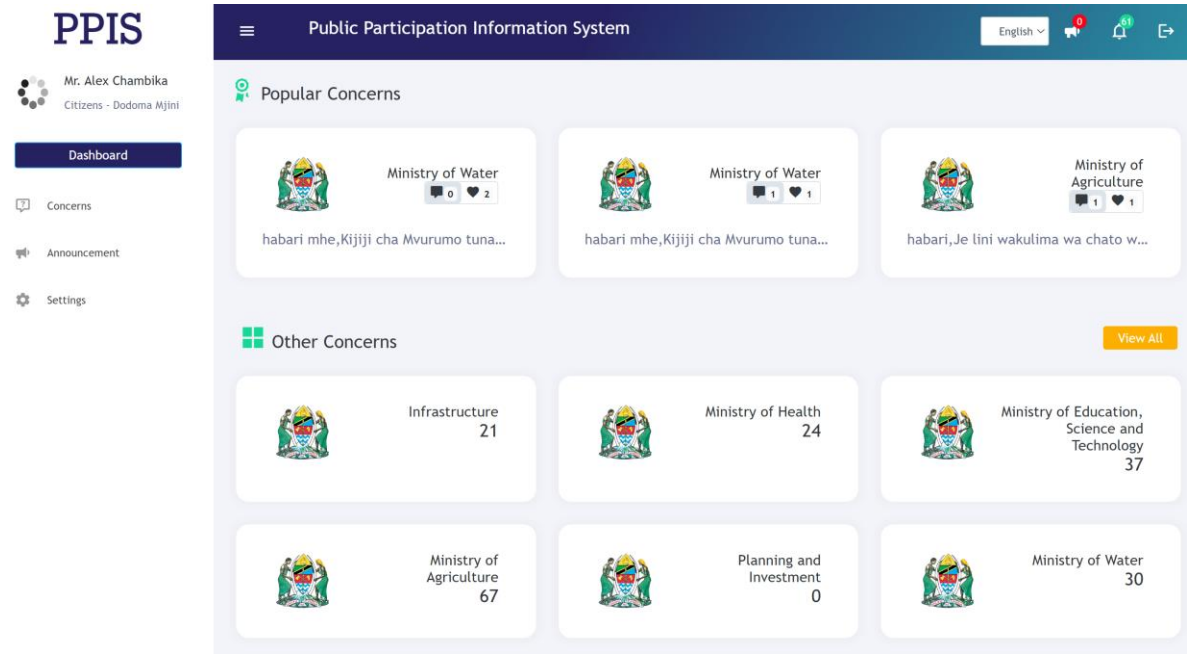


Figure 26: Public participation information system citizens dashboard.

(iv) Concern

From the concerns tab, you can choose either public or private, and add that you are a concern. If you select public concerns, everyone registered in that province will be able to see the concern you submit and even like or comment on it, and if you choose private concerns, then that conversation will be kept private between you and your representative.

(v) Public concern

Figure 27 shows the public concerns interface, where users can view their submitted concerns along with any responses from their MP. Concerns are visible to the MP and others in the same province. This mechanism strikes a balance between transparency and privacy, encouraging accountability by making resolved issues visible to a broader audience.

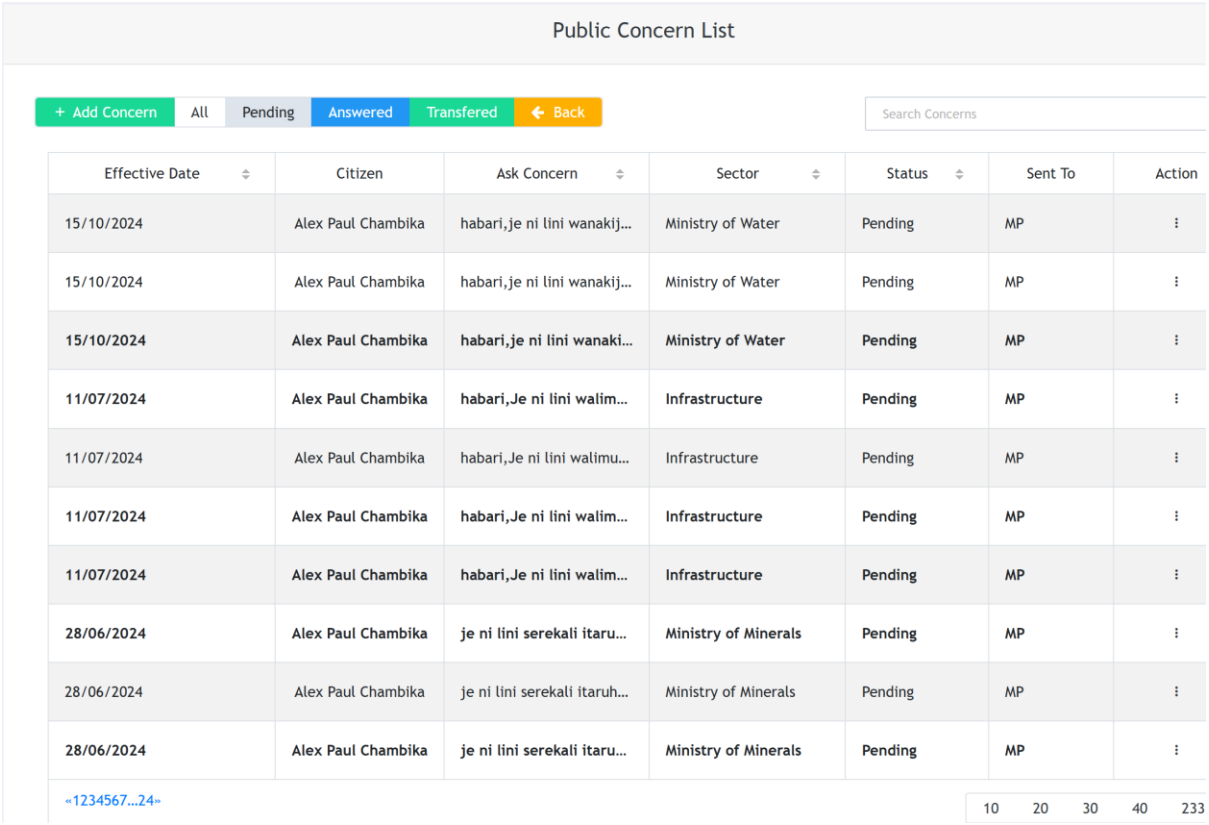


Figure 27: Public participation information system public concern list

(vi) Form to add your public concerns

This is the form for adding public concerns, whereby the citizen adds the concern. As shown in Fig. 28, Users can submit and close the interface if they do not have additional concerns by clicking post concern and close. In case of additional concerns, the user can submit and open an interface to write a new concern by clicking post concern and new or can cancel if there is no concern to submit.

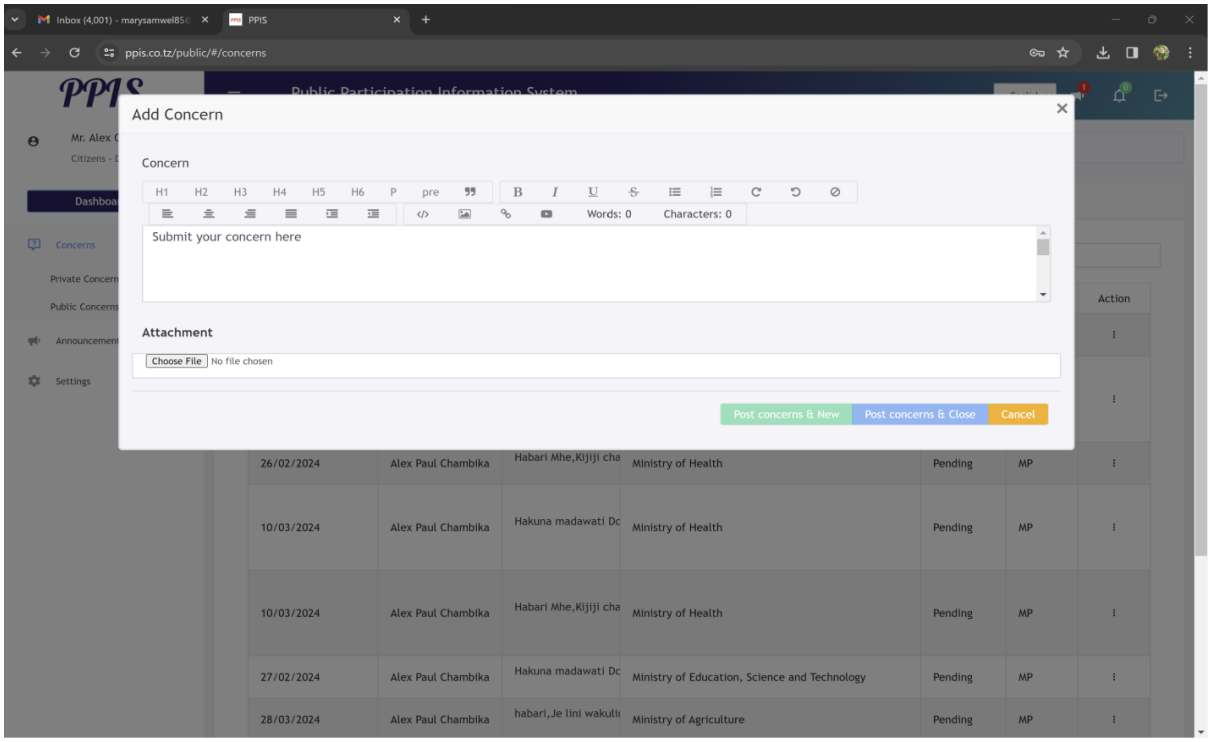


Figure 28: Form to add your public concern

(vii) Private concern

Figure 29 illustrates the private concerns section, where submitted concerns are accessible only to the respective citizen and their Member of Parliament. MPs can view all private concerns addressed to them and respond directly to each citizen. This feature ensures confidential communication for sensitive issues, supporting trust and personalized engagement between citizens and their representatives.

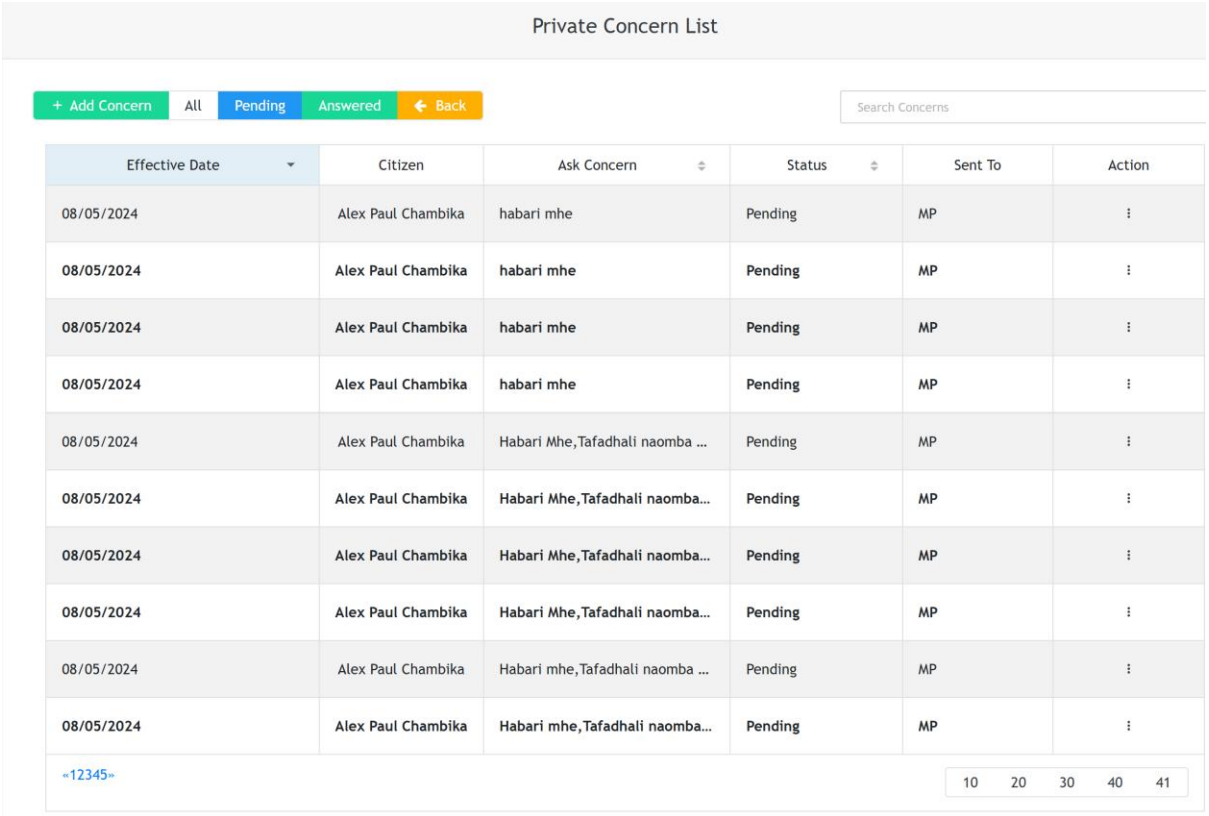


Figure 29: Private concern list

(viii) Member of the parliament dashboard

After logging in as a member of parliament, they will be able to see issues that are popular in their area in a graphical analysis. This will help them to make decisions and prioritize their task based on concerns that have a high percentage. Then, a member of parliament can view submitted concerns and reply to them or transfer them to a specific ministry for further explanation. See Fig. 30. This figure helps to achieve the goal of helping MPs to understand critical issues and work on them.

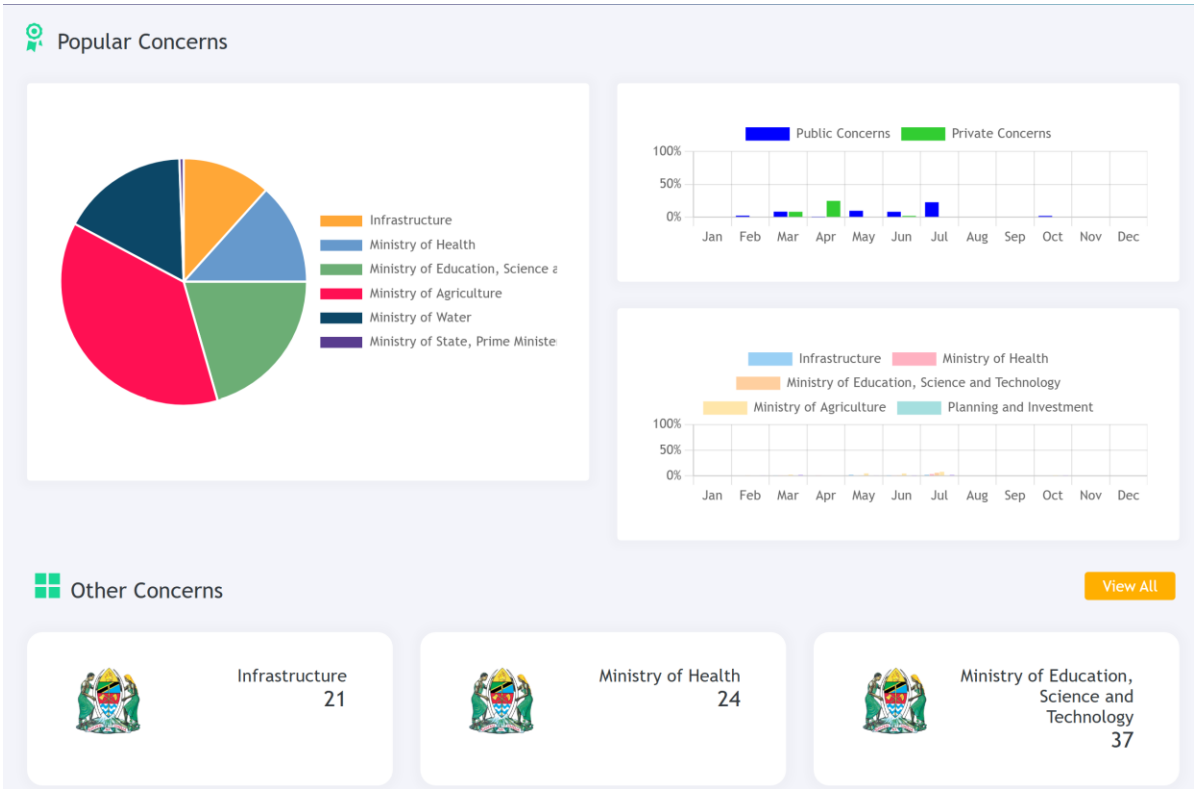


Figure 30: Member of parliament dashboard

(ix) Interface for reply to concern

From the form below, as seen in Fig. 31, a member of parliament adds a response and submits it to the citizen who submitted that concern.

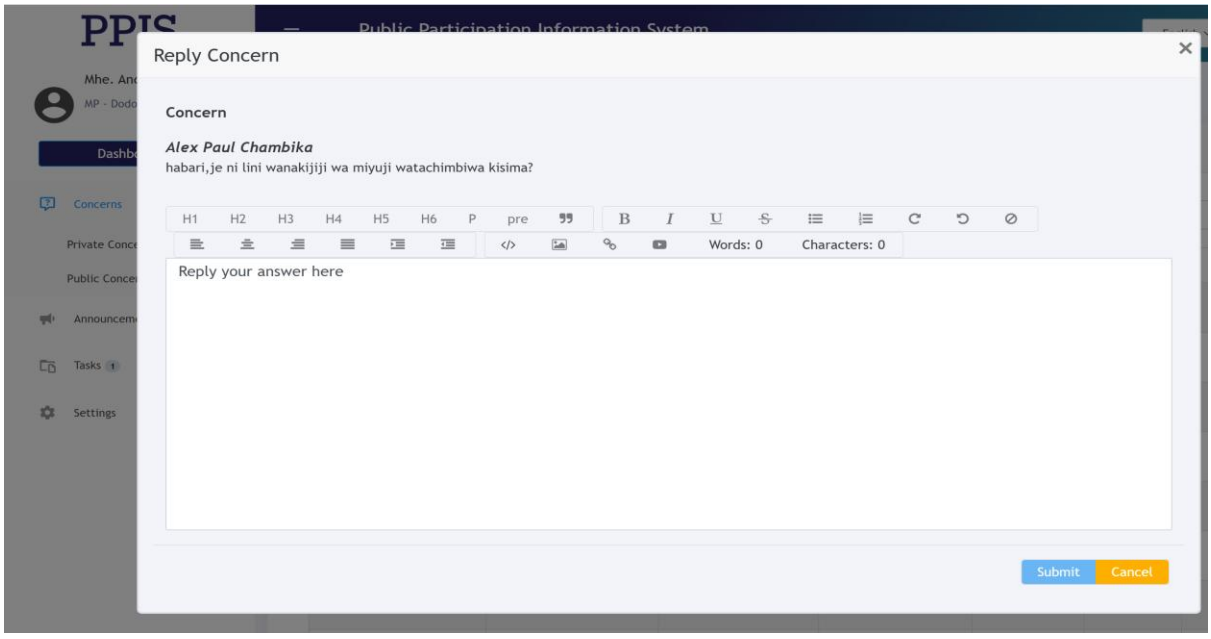


Figure 31: Public participation information system response form

(x) Transfer concern

Figure 32 displays the interface feature that allows a member of parliament to transfer a citizen's concern to the relevant ministry for further explanation. This function enhances coordination between elected representatives and government institutions, ensuring that concerns requiring specialized input receive appropriate attention. It also strengthens the feedback loop and accountability within the system.

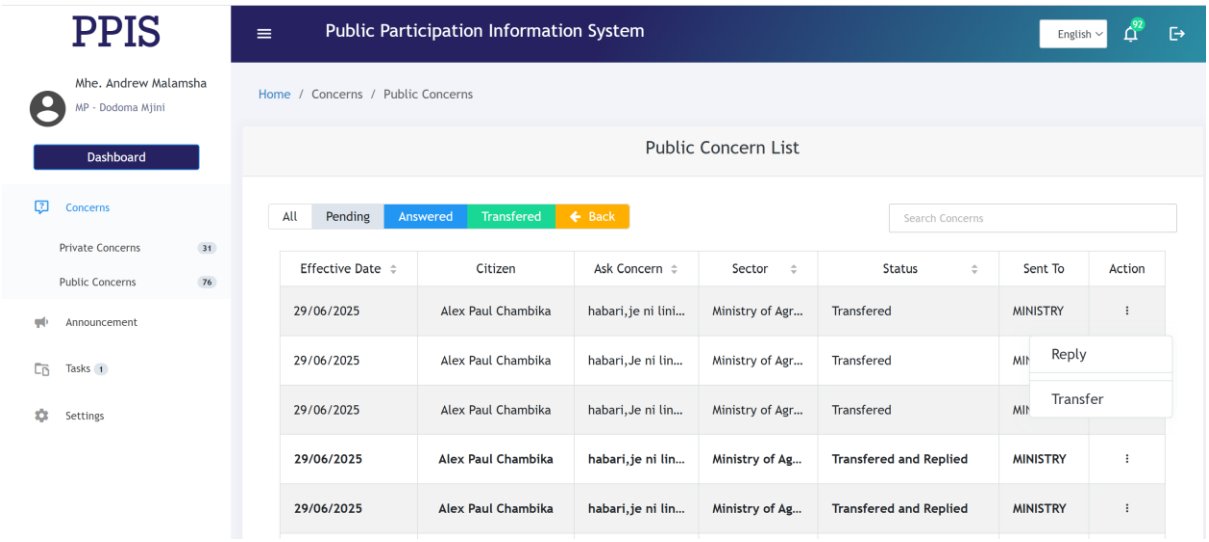


Figure 32: Public participation information system form that shows a button for transferring concerns

4.7.2 Two-Way messaging system (GSM Technology)

For users who utilize the two-way messaging system, registration is required by providing details such as the NIDA number, region, and province. Registration will be facilitated through a conversation, where the system prompts you to input your details and send them using the special number provided, as shown in Fig. 33. This conversational approach enables registration without requiring internet access, promoting inclusivity for citizens using basic mobile phones.

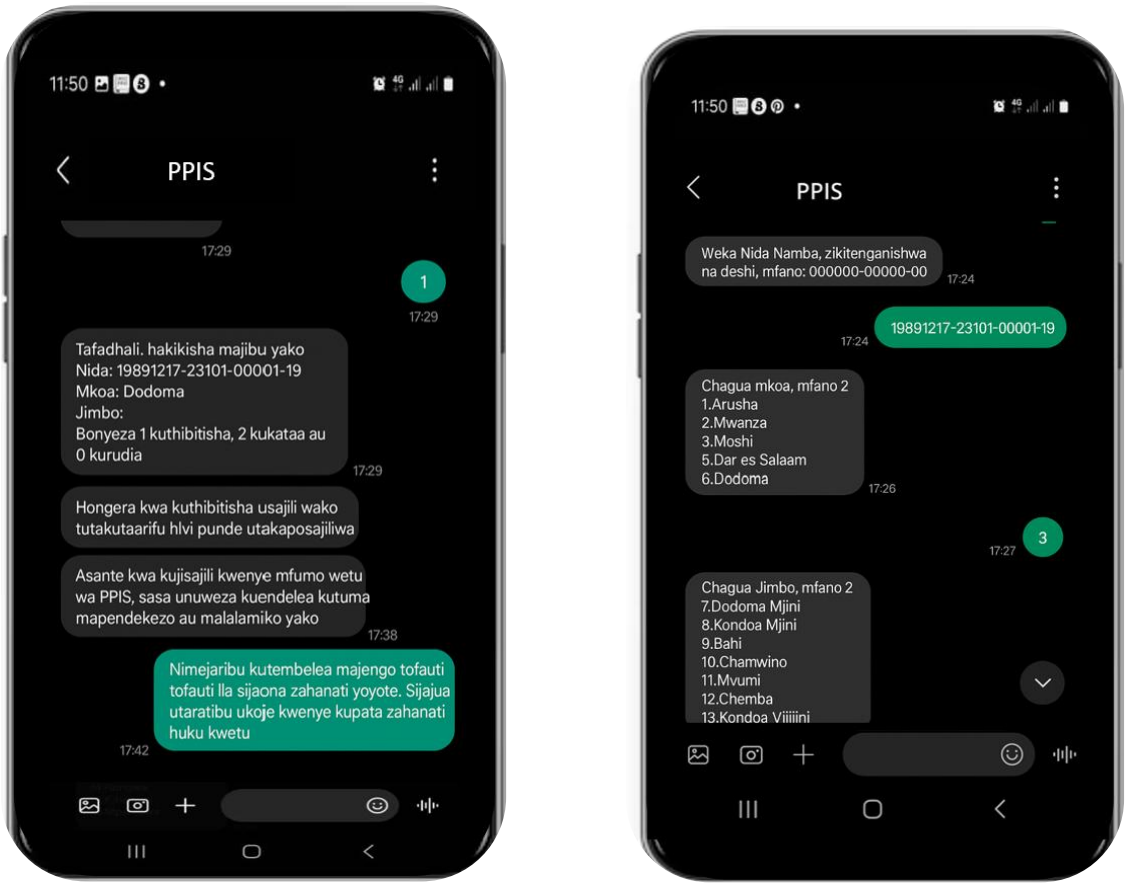


Figure 33: Registration through the two-way messaging system

After Registration, Citizens can submit their concerns to their representative using the special code number provided. As shown in Fig. 34.

Figure 34: Submission of concern through a two-way messaging system

4.8 System testing results

In this section, tests were performed on the Public Participation Information System for both the web application and the two-way messaging system. Including functionality (unit testing), compatibility, performance, and usability testing using the System Usability Scale (SUS) by Brooke Lewis. The System Usability Scale (SUS) is the most widely used standardized questionnaire for the assessment of perceived usability (Lewis, 2018). These tests were designed to test the system's compatibility across multiple platforms, overall performance, and functionality.

4.8.1 Unit testing

Unit testing was performed to verify that each component of the Public Participation Information System works as intended. It focused on core functions such as authentication, submission, responding to concerns, and uploading reports. Tests also ensured fast load times, proper delivery of OTPs for phone number verification, and confirmation of email.

4.8.2 Functionality testing results

Functionality testing verified that the system’s features operated as intended. All key functions were examined, and any issues encountered during the testing phase were addressed to enhance the system’s reliability. A comprehensive summary of the tested core functionalities is presented in Tables 21-32.

Table 21: Unit test scenarios for the registration process

Test Description:	**To verify the Registration process functionality in the Web Application**			**Test Written by:**	**Mary Mtoi**		
Module Name:	**Registration**			**Test Written date:**	**16/08/2023**		
				Test Performed by:	**Mary Mtoi**		
				Test Date:	**20/10/2023**		
Test No.	**Test Scenario**	**Steps Taken**	**Provided Data**	**Expected Output**	**Post-test Outcome**	**Actual Observation**	**Result**
TC_REG_01	Registration with all input fields left empty.	Click the "Register" Button.	a. Nida Number: none b. Phone Number: none c. Region: none d. Province: none e. Email: none f. User Type: none g. Password: none h. Repeat Password: none	Error messages are displayed for each mandatory field that is left blank.	No account is created, and errors appear beside the fields.	All input fields are attached to their respective error message.	**PASS**
TC_REG_02	Register with a valid input.	a. Enter Nida Number b. Phone Number c. Region d. Province e. Email f. User Type g. Password	a. Nida Number: 19970420- 23101-00001-28 b. Phone Number: 076930225 c. Region: Dodoma d. Province: Dodoma Mjini e. Email: marysamwel85@gmail.com f. User Type: Citizen g. Password: Griffin@2025**	A success message of “Registration successful! Check your email for verification.” is shown.	The account is successfully created, and the user can proceed to log in after verification of the email.	“Successful! You can Log In now.” message is shown.	**PASS**

Test Description:	**To verify the Registration process functionality in the Web Application**			**Test Written by:**	**Mary Mtoi**		
Module Name:	**Registration**			**Test Written date:**	**16/08/2023**		
				Test Performed by:	**Mary Mtoi**		
				Test Date:	**20/10/2023**		
Test No.	**Test Scenario**	**Steps Taken**	**Provided Data**	**Expected Output**	**Post-test Outcome**	**Actual Observation**	**Result**
		h. Repeat Password i. Click “Register.”	h. Repeat Password: Griffin@2025**				
TC_REG_03	Register with a mismatch between the Password and Confirm Password fields.	Enter: a. Nida Number b. Phone Number c. Region d. Province e. Email f. User Type g. Password h. Repeat Password Click “Register.”	a. Nida Number: 19970420-23101-00001-28 b. Phone Number: 076930225 c. Region: Dodoma d. Province: Dodoma Mjini e. Email: marysamwel85@gmail.com f. User Type: Citizen g. Password: Griffin@2025** h. Repeat Password: Griffin@2025*	An error message “Password and Confirm Password must match!” is shown.	Registration process failed	A message “Password mismatch!” is shown.	**PASS**
TC_REG_04	Register with an invalid Nida number	a. Enter Nida Number	a. Nida Number: 19970420-23101-08901-28 b. Phone Number: 076930225	An error message, “Invalid	Registration process failed	Message “Invalid	**PASS**

Test Description:	**To verify the Registration process functionality in the Web Application**			**Test Written by:**		**Mary Mtoi**	
Module Name:	**Registration**			**Test Written date:**		**16/08/2023**	
				Test Performed by:		**Mary Mtoi**	
				Test Date:		**20/10/2023**	
Test No.	**Test Scenario**	**Steps Taken**	**Provided Data**	**Expected Output**	**Post-test Outcome**	**Actual Observation**	**Result**
		b. Phone Number c. Region d. Province e. Email f. User type g. Password h. Repeat Password Click "Register"	c. Region: Dodoma d. Province: Dodoma Mjini e. Email: marysamwel85@gmail.com f. User Type: Citizen g. Password: Griffin@2025** h. Repeat Password: Griffin@2025*	Nida number!" is shown.		Nida Number"	
TC_REG_05	Register with a valid phone number and email, but a weak password	a. Enter Nida Number b. Phone Number c. Region d. Province e. Email f. User Type	a. Nida Number: 19970420-23101-00001-28 b. Phone Number: 076930225 c. Region: Dodoma d. Province: Dodoma Mjini e. Email: marysamwel85@gmail.com f. User Type: Citizen g. Password: griffin2025	A message "Password must be at least 8 characters long! Contain uppercase, lowercase, and special	Registration failed.	A message "Password must be at least 8 characters long! Contain uppercase, lowercase, and special	**PASS**

Test Description:	**To verify the Registration process functionality in the Web Application**			**Test Written by:**		**Mary Mtoi**	
Module Name:	**Registration**			**Test Written date:**		**16/08/2023**	
				Test Performed by:		**Mary Mtoi**	
				Test Date:		**20/10/2023**	
Test No.	**Test Scenario**	**Steps Taken**	**Provided Data**	**Expected Output**	**Post-test Outcome**	**Actual Observation**	**Result**
		g. Password h. Repeat Password Click "Register"	h. Repeat Password: griffin2025	characters" is shown.		characters" is displayed	
TC_REG_06	Register with an invalid phone number	Enter Nida Number b. Phone Number c. Region d. Province e. Email f. User Type g. Password h. Repeat Password Click "Register"	a. Nida Number: 19970420-23101-00001-28 b. Phone Number: 930225 c. Region: Dodoma d. Province: Dodoma Mjini e. Email: marysamwel85@gmail.com f. User Type: Citizen g. Password: Griffin@2025** h. Repeat Password: Griffin@2025**	A message "Please enter a valid phone number." is shown.	Registration failed.	A message "Please enter a correct phone number." is shown.	**PASS**

Table 22: Unit test scenarios for the two-way messaging system registration process

Test Description:	**To verify the Registration process functionality in the two-way messaging system**	**Test Written by:**	**Mary Mtoi**
Module Name:	**Registration**	**Test Written date:**	**16/08/2023**
Pre-conditions:	**-**	**Test Performed by:**	**Mary Mtoi**
		Test Date:	**20/10/2023**

Test No.	Test Scenario	Steps Taken	Provided Data	Expected Output	Post-test Outcome	Actual Observation	Result
TC_SMS_REG_01	Registration with an invalid NIDA number	a. Send "Register" b. Provide NIDA number c. Select your Region d. Select Province e. Confirm your f. details	a. Nida Number: 245679-5667-133 b. Region: Dodoma c. Province: Dodoma Mjini	Error messages are sent: "NIDA number provided is incorrect."	No account is created, and errors are sent.	"NIDA number provided is incorrect."	**PASS**
TC_SMS_REG_02	Registration with a valid input.	a. Send "Register" b. Provide NIDA number c. Select your Region d. Select Province e. Confirm your details	a. Nida Number: none b. Region: none c. Province: none	A success message of "Registration successful! You can submit your concern."	The account is successfully created, and the user can proceed with the submission	"Successful! You are registered successfully." message is shown.	**PASS**

Table 23: Unit test scenarios for the login process

Description:	**To verify the Login process functionality**			**Test Written by:**	**Mary Mtoi**		
Module Name:	**Login**			**Test Written date:**	**16/08/2023**		
				Test Performed by:	**Mary Mtoi**		
				Test Date:	**20/10/2023**		
Test No.	**Test Scenario**	**Steps Taken**	**Provided Data**	**Expected Output**	**Post-test Outcome**	**Actual Observation**	**Result**
TC_LOGIN_01	Log in with both fields, phone number/Email. and password, left empty.	Click the "Login" button	a. Phone no/Email: none b. Password: none	A message is shown under each respective input field: "Please fill out this Field."	Login was unsuccessful.	Both fields show their respective errors.	**PASS**
TC_LOGIN_02	Log in with a valid phone number or email and a valid password.	a. Enter the phone number or Email b. Enter the password Click the "Login" button	a. Phone number: 0769350225 b. Password: Griffin@2025** OR a. Email: mary85@gmail.com b. Password: Griffin@2025**	User successfully logged in and redirected to the dashboard.	User logged in and redirected to the appropriate dashboard.	User is successfully logged in and redirected.	**PASS**

Description:	**To verify the Login process functionality**			**Test Written by:**	**Mary Mtoi**		
Module Name:	**Login**			**Test Written date:**	**16/08/2023**		
				Test Performed by:	**Mary Mtoi**		
				Test Date:	**20/10/2023**		
Test No.	**Test Scenario**	**Steps Taken**	**Provided Data**	**Expected Output**	**Post-test Outcome**	**Actual Observation**	**Result**
TC_LOGIN_03	Log in with an invalid phone number/email (not registered).	a. Enter the phone number or Email. b. Enter the password. Click the "Login" button.	a. Phone number: 0769350225 b. Password: Griffin@2025**. OR a. Email: mary85@gmail.com b. Password: Griffin@2025**.	A message "phone number or email not found" is shown.	Logging in was unsuccessful, and the user was not logged in.	A message "Phone number or email not found" is shown.	**PASS**
TC_LOGIN_04	Log in with a valid phone /email and an incorrect password.	a. Enter the phone number or Email. b. Enter the password.	a. Phone number: 0769350225 b. Password: Griffin@2025**. OR a. Email:mary85@gmail.com b. Password: Griffin@205**.	A message "Incorrect username or Password" is displayed.	Logging in was unsuccessful, and the user was not logged in.	A message "Incorrect username or Password" is shown.	**PASS**

Description:	**To verify the Login process functionality**			**Test Written by:**	**Mary Mtoi**		
Module Name:	**Login**			**Test Written date:**	**16/08/2023**		
				Test Performed by:	**Mary Mtoi**		
				Test Date:	**20/10/2023**		
Test No.	**Test Scenario**	**Steps Taken**	**Provided Data**	**Expected Output**	**Post-test Outcome**	**Actual Observation**	**Result**
		Click the "Login" button.					
TC_LOGIN_05	Log in with a valid phone /email, but leave the password field blank.	a. Enter the phone number or Email. b. Enter the password. Click the "Login" button.	a. Phone number: 0769350225 b. Password: OR a. Email: mary85@gmail.com b. Password:	A message "Password cannot be blank" is displayed.	Logging in was unsuccessful, and the user was not logged in.	A message "Password cannot be blank" is shown.	**PASS**

Table 24: Unit test scenarios for the language support process

Test Description:	**To verify the Language support functionality**	**Test Written by:**	**Mary Mtoi**
		Test Written date:	**16/08/2023**
Module Name:	**Language support**	**Test Performed by:**	**Mary Mtoi**
		Test Date:	**20/10/2023**

Test No.	Test Scenario	Steps Taken	Provided Data	Expected Output	Post-test Outcome	Actual Observation	Result
TC_SW-ENG _01	Switch system language to Kiswahili.	a. The user signs in to the system. b. The user switches the language toggle icon from English to Swahili.	Language: Kiswahili	The system updates the interface to Kiswahili, and all labels, menus, and content are displayed in Kiswahili.	The system successfully switches to Kiswahili, and the interface reflects the new language.	The interface is updated to Kiswahili as expected.	**PASS**
TC_SW-ENG _02	Switch the system language back to English.	a. The user signs in to the system. b. The user switches the language toggle icon from Swahili to English.	Language: English	The system updates the interface back to English	The system successfully switches back to English,	The The interface is updated to English as expected.	**PASS**

Table 25: Unit test scenarios for the concerns submission process in the Web Application

Test Description:	**To verify the functionality of the concerns submission on the web**	**Test Written by:**	**Mary Mtoi**
Module Name:	**Concerns**	**Test Written date:**	**16/08/2023**
Pre-conditions:	**The user must log in to the system.**	**Test Performed by:**	**Mary Mtoi**
		Test Date:	**20/10/2023**

Test No.	Test Scenario	Steps Taken	Provided Data	Expected Output	Post-test Outcome	Actual Observation	Result
TC_CNC_01	Submit concerns	a. The citizen is logged in and navigates to the concern menu. b. The citizen selects either private/public concerns c. Citizen type concern d. Citizens submit concerns.	Citizen Concern	The system shows the submission was successful.	The Concern is submitted and stored in the database.	Concern is submitted successfully, and a success message is displayed.	**PASS**

Test Description:	**To verify the functionality of the concerns submission on the web**			**Test Written by:**	**Mary Mtoi**		
Module Name:	**Concerns**			**Test Written date:**	**16/08/2023**		
Pre-conditions:	**The user must log in to the system.**			**Test Performed by:**	**Mary Mtoi**		
				Test Date:	**20/10/2023**		
Test No.	**Test Scenario**	**Steps Taken**	**Provided Data**	**Expected Output**	**Post-test Outcome**	**Actual Observation**	**Result**
TC_CNC_02	Submit Existing Concerns	a. The citizen is logged in and navigates to the concern menu. b. The citizen selects either public concern c. Citizen type concern d. Citizens submit concerns	Citizen Concerns	The system prompts existing concerns. Citizens can click to view the response, if any, or click Notify me once MP responds, and they will be notified	System prompt existing Concern	Existing Concern	**PASS**

Table 26: Unit test scenarios for the concerns submission in a two-way message

Test Description:	**To verify the functionality of the concerns submission in the two-way messaging system**	**Test Written by:**	**Mary Mtoi**
		Test Written date:	**16/08/2023**
Module Name:	**Concerns**		
		Test Performed by:	**Mary Mtoi**
Pre-conditions:	**The user must log in to the system.**		
		Test Date:	**20/10/2023**

Test No.	Test Scenario	Steps Taken	Provided Data	Expected Output	Post-test Outcome	Actual Observation	Result
TC_SMS_CNC_01	Submit concerns through SMS	a. Citizen type concern b. Citizens submit concerns.	Citizen Concern	Acknowledge SMS receipt and provide a reference number for follow-up.	The Concern is submitted and stored in the database.	Concern is submitted successfully, and a success message is sent.	**PASS**

Table 27: Unit test scenarios for responding to the concerns

Test Description:	**To verify the response Functionality**	**Test Written by:**	**Mary Mtoi**
Module Name:	**Concerns**	**Test Written date:**	**16/08/2023**
Pre-conditions:	**The user must be signed in to the system.**	**Test Performed by:**	**Mary Mtoi**
		Test Date:	**20/10/2023**

Test No.	Test Scenario	Steps Taken	Provided Data	Expected Output	Post-test Outcome	Actual Observation	Result
TC_CRSP_01	Respond to submitted concerns	a. MP is logged and views the submitted concern b. Type Response. c. Click the Submit button	Concern Response	The system displays" Your response has been sent."	The system stores the response in the database.MP receives a notification of successful response submission.	Response is submitted successfully, and a success message is displayed.	**PASS**
TC_CRSP_02	Respond to concerns with an empty field	a. MP is logged and views the submitted concern b. Type Response. Click the Submit button	Concern Response: none	Inactive Submitted button	The system's submit button becomes inactive, and the user must fill in the field to proceed with submission	Inactive Submitted button	**PASS**

Test Description:	**To verify the response Functionality**	**Test Written by:**	**Mary Mtoi**
Module Name:	**Concerns**	**Test Written date:**	**16/08/2023**
Pre-conditions:	**The user must be signed in to the system.**	**Test Performed by:**	**Mary Mtoi**
		Test Date:	**20/10/2023**

Test No.	Test Scenario	Steps Taken	Provided Data	Expected Output	Post-test Outcome	Actual Observation	Result
TC_CRSP_03	System error while storing the data.	a. MP is logged and views the submitted concern b. Type Response. Click the Submit button c. The system encounters an error	Concern Response	The system displays a notification highlighting a problem with storing the response, with an option to attempt resubmitting it.	The system encounters an error, notifies the user, and the response is not stored.	An error is encountered while storing the response, and the user is notified.	**PASS**

Table 28: Unit test scenarios for the assigned task

Test Description:	**Assignment of tasks to MPs' Assistants**	**Test Written by:**	**Mary Mtoi**
Module Name:	**Task**	**Test Written date:**	**16/08/2023**
Pre-conditions:	**The user must be logged in to the system.**	**Test Performed by:**	**Mary Mtoi**
		Test Date:	**20/10/2023**

Test No.	Test Scenario	Steps Taken	Provided Data	Expected Output	Post-test Outcome	Actual Observation	Result
TC_TSK_01	Assign Task	a. The user logs in to the system. b. The user navigates to the task section c. Provide task details d. Click the assign task button	a. Task subject b. Task details c. Assign an assistant d. Start date e. End date	The message displays “Task assigned successfully.”	The user receives feedback and is informed about any necessary follow-up actions.	The message displays “Task assigned successfully.”	**PASS**
TC_TSK_02	Assign a task without filling in all the field (s) or some of the field(s)	a. The user logs in to the system. b. The user navigates to the task section c. Provide task details d. Click the assign task button.	a. Task subject: none b. Task details: none c. Assign an assistant: none d. Start date: 12/June/2025 e. End date: none	The submission button will be inactive.	The user is notified that the fields are empty	The message displays “Task details required.”	**PASS**

Table 29: Unit test scenarios for attend to task

Test Description:	**To verify the response to the assigned task from the member of parliament's assistant to the MPs**	**Test Written by:**	**Mary Mtoi**
Module Name:	**Task**	**Test Written date:**	**16/08/2023**
Pre-conditions:	**The user must be logged in to the system.**	**Test Performed by:**	**Mary Mtoi**
		Test Date:	**20/10/2023**

Test No.	Test Scenario	Steps Taken	Provided Data	Expected Output	Post-test Outcome	Actual Observation	Result
TC_TSKR_01	Attend Task	a. The user logs in to the system. b. The user navigates to the task section c. View assigned task d. Provide a task report and upload an attachment if any e. Status of task f. Click Submit	a. Report details b. Attachment, if any c. Status	The message displays "Successful Submission."	System store submitted a report	The message displays "Successful Submission."	**PASS**
TC_TSKR_02	Attend Task without filling in all the field (s) or some of the field(s)	a. The user logs in to the system. b. The user navigates to the task section		The submission button will be inactive.	The user is notified that the fields are empty	The message displays "Task details required."	**PASS**

Test Description:	**To verify the response to the assigned task from the member of parliament's assistant to the MPs**			**Test Written by:**	**Mary Mtoi**		
				Test Written date:	**16/08/2023**		
Module Name:	**Task**			**Test Performed by:**	**Mary Mtoi**		
Pre-conditions:	**The user must be logged in to the system.**			**Test Date:**	**20/10/2023**		
Test No.	**Test Scenario**	**Steps Taken**	**Provided Data**	**Expected Output**	**Post-test Outcome**	**Actual Observation**	**Result**
		c. View assigned task d. Provide a task report and upload an attachment if any e. Select the status of task f. Click the Submit button					

Table 30: Unit test scenarios for concerns transfer

Test Description:	**To verify the functionality of the transfer of the concerns from members of parliament to the Ministry**	**Test Written by:**	**Mary Mtoi**
Module Name:	**Concerns**	**Test Written date:**	**16/08/2023**
Pre-conditions:	**The user must be signed in to the system**	**Test Performed by:**	**Mary Mtoi**
		Test Date:	**20/10/2023**

Test No.	Test Scenario	Steps Taken	Provided Data	Expected Output	Post-test Outcome	Actual Observation	Result
TC_TRSF_01	Transfer Concerns to the Ministry	a. The user logs in and navigates to the concerns section. b. Click the action and select the transfer button c. Write a comment Click the submit button.	Comment related to the concern that was transferred	The system stores the transferred concerns and displays a message" Concern transferred successfully."	The concern is stored in the database. The user receives a notification confirming the successful submission of their concern.	The system displays a message" Concern transferred successfully."	**PASS**
TC_TRSF_02	Transfer Concerns to the Ministry with an empty field	a. The user logs in and navigates to the concerns section. b. Click the action, select	Comment on the related concern transferred: none	The submission button will be inactive.	The submit button will be inactive, and the System highlights the missing field	System highlights missing and prevents the submission of empty concerns	**PASS**

Test Description:	**To verify the functionality of the transfer of the concerns from members of parliament to the Ministry**			**Test Written by:**	**Mary Mtoi**		
Module Name:	**Concerns**			**Test Written date:**	**16/08/2023**		
Pre-conditions:	**The user must be signed in to the system**			**Test Performed by:**	**Mary Mtoi**		
				Test Date:	**20/10/2023**		
Test No.	**Test Scenario**	**Steps Taken**	**Provided Data**	**Expected Output**	**Post-test Outcome**	**Actual Observation**	**Result**
		the transfer button c. Write a comment. Click the submit button.					
TC_TRSF_03	System error while storing the Transferred concerns.	a. MP is logged and views the submitted concern b. Click the transfer button. Type a comment. Click the Submit button c. The system encounters an error while storing the Transfer concerns.	Comment on the related concern transferred: none	The system displays a notification highlighting a problem with storing the response, with an option to attempt resubmitting it.	The system encounters an error, notifies the user, and the response is not stored.	System error while storing the data.	**PASS**

Table 31: Functionality of viewing the response

Test Description:	**To verify the functionality of viewing the response**	**Test Written by:**	**Mary Mtoi**
Module Name:	**Concerns**	**Test Written date:**	**16/08/2023**
Pre-conditions:	**The user must be signed in to the system.**	**Test Performed by:**	**Mary Mtoi**

Test No.	Test Scenario	Steps Taken	Provided Data	Expected Output	Post-test Outcome	Actual Observation	Result
TC_CF_01	View the response for previously submitted concerns.	a. The user is signed into the system. b. The user navigates to the submitted concern and opens it.	a. The user has previously submitted data that has been processed.	The system displayed the submitted response.	The user receives feedback and can comment on it	The response is displayed as expected	**PASS**
TC_CF_02	Receive notification when feedback is available.	a. The system stores the response. b. The system notifies the user that the response is available	a. Submitted Response	The user receives a notification indicating that a response to their submitted concerns is available.	The user is notified that the response is available.	The user successfully receives the notification.	**PASS**

Table 32: Tracking submitted concern

Test Description:	**To verify the functionality of tracking submitted concerns**	**Test Written by:**	**Mary Mtoi**
Module Name:	**Status**	**Test Written date:**	**16/08/2023**
Pre-conditions:	**The user must be signed in to the system.**	**Test Performed by:**	**Mary Mtoi**
		Test Date:	**20/10/2023**

Test No.	Test Scenario	Steps Taken	Provided Data	Expected Output	Post-test Outcome	Actual Observation	Result
TC_TRACK_WEB_CNC_01	Track concern via the Web	Citizen logs in Navigates to the status column	None	Concern status and details are displayed	Concern status retrieved	Concern details are shown with the status	**PASS**
TC_TRACK_SMS_CNC_02	Track concern via SMS	Citizen sends the Reference Number to a short code	CNC510	System replies via SMS with the concern status	Concern status retrieved	SMS received showing status	**PASS**
TC_TRACK_SMS_CNC_03	Track concern with invalid reference (SMS)	Citizen sends SMS with a non-existent reference number	Wrong data: CNC890	SMS reply: "Reference number not found. Please confirm and resend."	The system detects invalid input and replies accordingly	The SMS reply correctly identifies the invalid reference	**PASS**

Test Description:	**To verify the functionality of tracking submitted concerns**	**Test Written by:**	**Mary Mtoi**
Module Name:	**Status**	**Test Written date:**	**16/08/2023**
Pre-conditions:	**The user must be signed in to the system.**	**Test Performed by:**	**Mary Mtoi**
		Test Date:	**20/10/2023**

Test No.	Test Scenario	Steps Taken	Provided Data	Expected Output	Post-test Outcome	Actual Observation	Result
TC_TRACK_SMS_CNC_04	Track concern using the wrong reference number format	The citizen sends an SMS with incorrect reference number format	Wrong data: CNC-510	SMS reply: "Invalid Reference Number"	The system responds with clear instructions	SMS reply with correction instructions	**PASS**

4.8.3 Performance testing results

To ensure the reliability of the developed system, comprehensive performance testing was conducted under various loads. These tests aimed to evaluate the system's ability to handle concurrent users and data transactions under varying conditions.

(i) Load test results

The performance test simulated typical system usage by ramping virtual users to 10, representing normal operational load. This setup reflected the traffic the system would handle under regular conditions. Throughout the test, the system maintained stable and consistent performance with a 0% failure rate and a 100% success rate. The average response time was 859 milliseconds, as shown in Table 33 and Fig. 35. These results indicate the system is reliable and ready to support real-world usage at this load level.

Table 33: Web application report of performance metrics from baseline load test

Metrics	Values
Success Rate	100%
Failure Rate	0%
Peak Request Rate	16.67 reqs/sec
Average Request Rate	11 req/sec
Response Time	859 ms (less than a second)

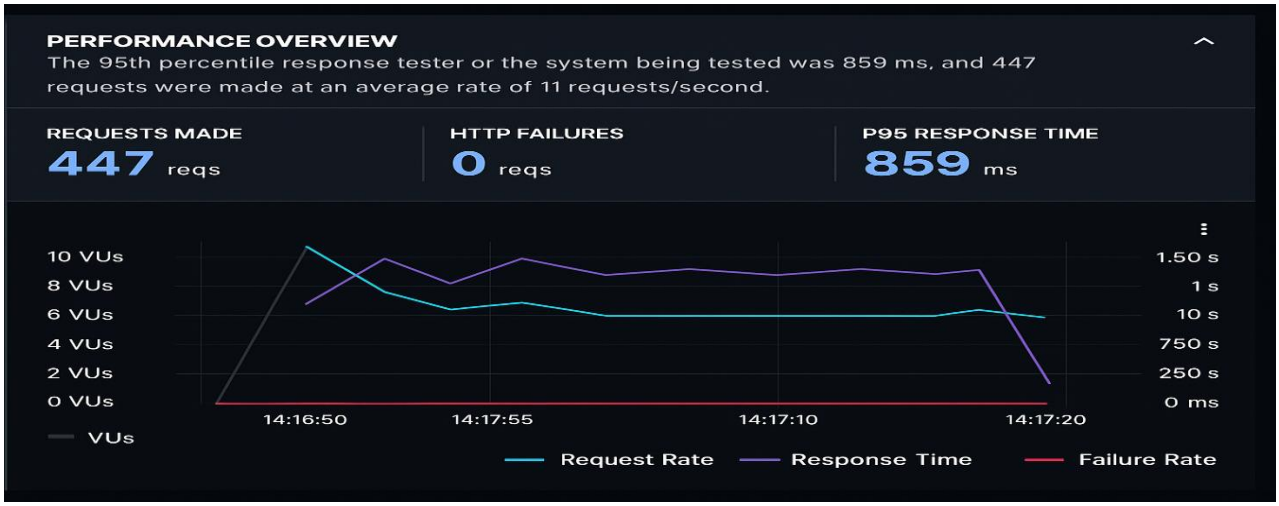


Figure 35: Report of performance metrics from baseline load test

(ii) A two-way messaging system of performance metrics from the baseline load test

The baseline load assessment simulated regular usage patterns by adjusting the virtual user activity to reflect standard operational demand. This scenario mirrored the typical traffic the system is expected to handle during normal conditions. During the test, the system consistently performed well, remained stable, and achieved a 100% success rate. The average response time measured was 353 milliseconds. Comprehensive performance results for this baseline evaluation are presented in Fig. 36 and Table 34.

Table 34: A two-way messaging system report of performance metrics from the baseline load test

Metric	Value
Success Rate	100%
Failure Rate	0%
Peak Request Rate	0.755 reqs/sec
Average Request Rate	0.755 reqs/sec
Response Time	353.84 ms

```
HTTP
http_req_duration                    avg=353.84ms min=176.59ms med=
 { expected_responsee:true }         avg=353.84ms pax=590.74ms p55.39ms
http_reqs failed                     0.00% out of 8
                                     8      0.755647/s

EXECUTION
iteration_duration                   avg=2.64s min=1.46s med=1.75s max
                                     4
iterations                           0.377523/s    max=1
vus                                  1             max=1

NETWORK
data_received                        12 kB  1.2 kB/s
data_sent                            3.3 KB  316 B/s
```

Figure 36: A two-way messaging system report of performance metrics from the baseline load test

(iii) Stress testing results

Stress testing was conducted to evaluate the system's behavior under extreme load conditions, beyond typical operational levels. The test increased the number of virtual users (VUs) to 250 to simulate a high volume of concurrent users interacting with the system. During the test, the system successfully processed a total of 150 000 requests. The success rate was measured at 97.5%, indicating a slight increase in failed requests compared to lower load conditions. The average response time increased to 1.85 seconds, reflecting additional processing demands, while the maximum response time peaked at 2.3 seconds, as shown in Table 35.

Despite the heavier load, the system remained generally stable and functional, with only occasional performance delays observed during peak usage periods. These results demonstrate that the system can handle a substantial number of simultaneous users but may require further optimization to reduce response times and failure rates for large-scale deployments.

Table 35: Summary of stress testing results

Metric	Value
Total Requests	150 000
Success Rate	97.5%
Failure Rate	2.5%
Average Response Time	1.85 seconds
Maximum Response Time	2.3 seconds

Overall, the stress testing indicates that the PPIS is resilient under high user loads, with opportunities for improvement to enhance performance and reliability at the full national scale.

(iv) Compatibility testing result

Compatibility testing was performed to ensure that the Public Participation Information System (PPIS) delivers a consistent and reliable user experience across various browsers and devices. The web application was evaluated on Google Chrome, Mozilla Firefox, Microsoft Edge, and Opera, using both laptops and mobile devices, as shown in Table 36. Additionally, Web application responsive design was assessed on different screen sizes to verify that it adapts effectively to both desktop and mobile interfaces, as shown in Table 37.

Table 36: Computer browser compatibility results

Brower	Functionality	Consistency	Results
Opera	Passed	Passed	Fully compatible
Microsoft Edge	Passed	Passed	Fully compatible
Google Chrome	Passed	Passed	Fully compatible
Mozilla Firefox	Passed	Passed	Fully compatible

Table 37: Mobile compatibility testing results

Phones category	Resolution	Functionality	Consistency	Results
Small	480×800	Passed	Passed	Fully compatible
Medium	1280×720	Passed	Passed	Fully compatible
Large	1920×1080	Passed	Passed	Fully compatible
Extra Large	2560×1440	Passed	Passed	Fully compatible

(v) Usability testing results

Usability testing was conducted in person to evaluate how effectively users could interact with the developed Public Participation Information System (PPIS), designed to enhance communication between Members of Parliament (MPs) and citizens in Dodoma, Tanzania. The testing involved direct observation, where participants were guided through system tasks by the researcher. Following task completion, participants completed the System Usability Scale (SUS) questionnaire, which consists of 10 statements designed to measure the usability of the system, as shown in Appendix 7. SUS statements address specific aspects such as system complexity, ease of use, user confidence, and satisfaction, and are rated on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). A score above 68 is generally considered indicative of good usability (Lewis, 2018). The responses were scored to generate an overall usability score, used to identify strengths and areas for improvement.

(vi) Observational findings

Participants generally found the system intuitive and easy to navigate, with most completing their tasks independently. However, some minor usability issue was noted. In particular,

participants suggested that incorporating a voice input option could help reduce the time required for typing concerns, especially benefiting users who are less comfortable with typing. This feedback informed further system refinement and opened up possibilities for future improvements aimed at increasing accessibility and efficiency.

(vii) Computation of score

Therefore, after participants completed testing the system, they responded to the 10-item System Usability Scale (SUS), rating each item on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Scoring was performed as follows:

- For odd-numbered items, score = user rating – 1

$$Q_o = \sum_{i \in \{1,3,5,7,9\}} (x_i - 1)$$

- For even-numbered items, score = 5 − user rating

$$Q_e = \sum_{j \in \{2,4,6,8,10\}} (5 - x_j)$$

- The total score was then multiplied by 2.5 to obtain a final SUS score out of 100

$$\text{SUS} = 2.5 \times \left(\sum_{i \in \{1,3,5,7,9\}} (x_i - 1) + \sum_{j \in \{2,4,6,8,10\}} (5 - x_j) \right)$$

Therefore, by reviewing the SUS responses, we found a mean score of 78.9. This exceeds the commonly accepted usability threshold (≥68), indicating strong user satisfaction(Lewis, 2018).

4.9 System validation results

System validation was conducted to ensure that the developed Public Participation Information System (PPIS) met both functional and non-functional requirements and performed reliably under realistic usage conditions. Validation involved User Acceptance Testing (UAT) supported by technical performance observations, focusing on the system's usefulness, user-friendliness, performance, and responsiveness. Structured user feedback was collected through a questionnaire Appendix 5, and results were summarized in Figs. 37-40.

4.9.1 Description of system validation results

(i) System friendliness

This assessed how easily users could navigate and interact with the system. It involved evaluating interface clarity, ease of navigation, and overall user experience. According to the results in Fig. 37, 83.3% strongly agreed and 16.7% agreed that the system is user-friendly. No participants responded neutrally or negatively.

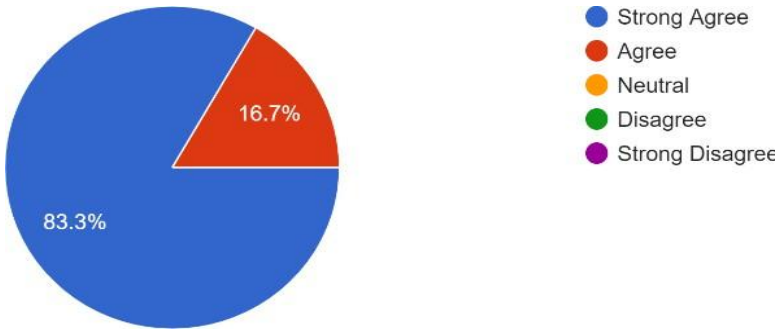


Figure 37: Validation of system friendliness

(ii) System usefulness

This examined whether the system met its intended purpose, enabling users to raise concerns and communicate with their representatives effectively. As shown in Fig. 38, 58.3% strongly agreed and 41.7% agreed that the system is useful and supports communication anytime, from anywhere. They can voice their concerns to their representative anywhere and at any time.

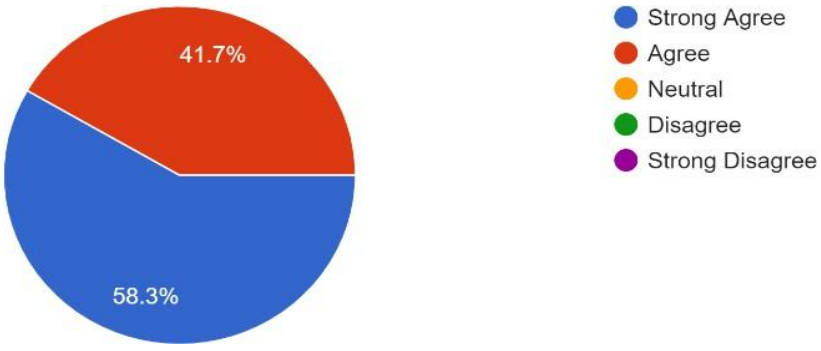


Figure 38: Validation of system usefulness

(iii) System performance

The aim was to assess and measure how well a system functions in terms of response time, success rate, failure rate, and reliability. As a result, 81.8% strongly agree that the system performance is good, and 18.2% agree that the performance is good, as shown in Fig. 39.

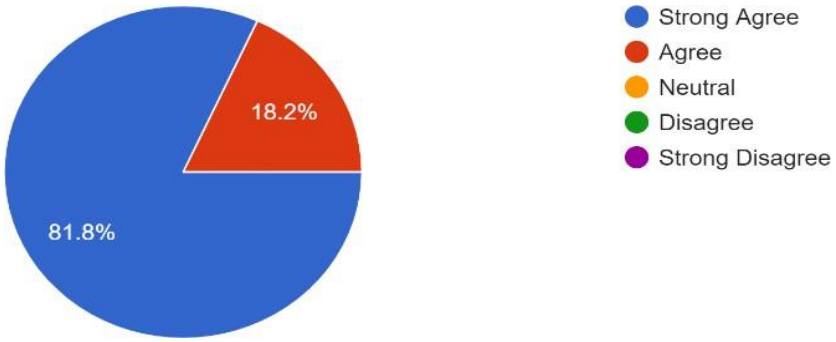


Figure 39: Validation of system performance

(iv) System responsiveness

The aim of evaluating the responsiveness of a system was to assess how quickly and effectively the system reacts to user inputs or requests of the user. The results show that 66.7% strongly agree that the system is responsive and 33.3% agree, as shown in Fig. 40.

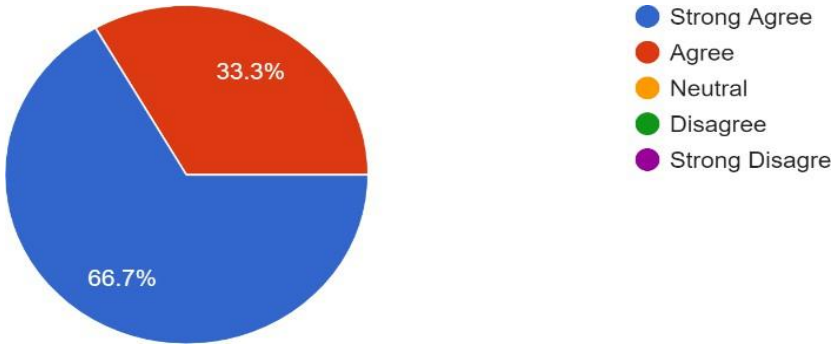


Figure 40: Validation of system responsiveness

Overall, the UAT results demonstrate strong user acceptance of the developed system, with the majority of participants expressing satisfaction with the system's functionality.

4.10 Discussion on findings in support of related works

This study sought to address the persistent communication gap between citizens and their elected Members of Parliament (MPs) in Tanzania by developing an inclusive and accessible digital platform. A comparative review of existing systems, including parliamentary websites, mobile applications, and social media platforms, reveals that while these tools have improved political visibility and outreach, they exhibit critical limitations in terms of inclusivity, responsiveness, and system functionality.

Firstly, existing platforms are predominantly internet-dependent and optimized for smartphone, tablet, or computer users. This inherently excludes a significant portion of the population, particularly in rural areas, who rely on feature phones or lack stable internet connectivity. The Public Participation Information System (PPIS) addresses this digital divide through a dual-access system that combines a web application for online users and a two-way messaging system for offline users. This ensures equitable access to parliamentary communication regardless of device type, internet connectivity, or geographic location.

Additionally, the PPIS system introduces features that are largely absent in previous tools, including options for public or private submissions, multilingual support (Swahili and English), and role-based access for different user groups, citizens, MPs, MP assistants, and ministries. This structure allows MPs to delegate tasks, forward concerns to relevant ministries, and manage issues more efficiently. The system also categorizes submitted concerns automatically based on sectors, making it easier for MPs to identify and prioritize critical issues within their constituencies. Furthermore, PPIS personalizes communication by automatically linking each citizen's concern to their respective constituency. This ensures that MPs receive and respond only to issues relevant to their constituencies.

Overall, the PPIS system represents a technically robust and socially inclusive solution. By addressing the accessibility, interactivity, and operational limitations of prior systems, it contributes a novel approach that strengthens citizen engagement, transparency, and public accountability in governance processes. This comparative advantage emphasizes the system’s innovation and practical value within the context of Tanzania’s digital governance efforts.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The study of the Public Participation Information System (PPIS) to improve communication between Members of Parliament (MPs) and citizens in Tanzania. The system is designed to support both online and offline interaction through a web platform and two-way SMS interface, ensuring inclusivity for users regardless of digital literacy, internet access, or device type. Key features include concern submission, status tracking, real-time feedback notifications, and multilingual support in Swahili and English.

The research contributes to the field of citizen engagement and participatory governance by addressing the persistent challenges of citizens to MPs' communication in low-connectivity environments. The system bridges digital and infrastructural divides and aligns with Tanzania's national e-government and ICT development strategies.

Under the first specific objective, the study conducted a literature review and used a mixed-methods approach involving MPs and citizens. The literature review also revealed that most existing solutions depend on internet-connected devices such as mobile applications, websites, and social media platforms, which limits the accessibility of the solutions. The study further identified significant gaps: 69% of citizens reported MP unavailability, 42.9% experienced delays of more than three days to submit concerns, and 30.3% had never submitted any concern. These insights guided the identification of functional and non-functional system requirements, emphasizing the need for offline support, real-time interaction, and accessibility via basic feature phones.

For the second objective, the study designed and developed the PPIS as a hybrid system combining a responsive web platform with a two-way messaging system. Functional features include concern submission, response tracking, and public concern visibility (via web). Usability testing using the System Usability Scale (SUS) produced a score of 78.9, reflecting high user satisfaction. Stress testing confirmed the system's scalability and reliability under concurrent usage, with a 97.5% success rate, 1.85 seconds response time, and a failure rate of 2.5%.

The third objective involved validating the system against user expectations and requirements. Feedback showed that 58.3% of users strongly agreed and 41.7% agreed that the system is user-friendly, useful, and accessible. There were no disagreements, confirming strong support for the system's usability and relevance among both citizens and MPs.

Nonetheless, the system has some limitations. Users of the two-way messaging system cannot view concerns submitted by others, reducing their access to public discourse. Although stress testing showed promising results, national-scale deployment will depend on infrastructure investments, including SMS gateway reliability, hosting services, and mobile network coverage. Additionally, the study was limited to the Dodoma region; broader validation is needed to address variations in infrastructure, sociopolitical contexts, and digital literacy across Tanzania. Long-term sustainability, system maintenance, and integration with existing parliamentary workflows will be essential to ensure continued impact.

In conclusion, the PPIS effectively meets the study's objectives and addresses the core research objective on the requirements for an inclusive citizens and MPs communication platform. It offers a practical, scalable, and inclusive approach that improves transparency, accountability, and public participation. Future research should explore long-term adoption strategies and nationwide implementation to maximize its governance impact.

5.2 Recommendations

5.2.1 Implications for policy makers

This Platform can be very useful to members of the Parliament as it will help them to directly collect the challenges of their citizens and work on them. Also, it helps them to determine more critical issues in their province and prioritize them. This will increase citizens' trust in them and make it easier for them during the election. Finally, fostering open dialogue with citizens and actively incorporating their feedback into policy decisions will contribute to a more inclusive and responsive parliamentary-citizen interaction platform. However, there is a need for improvement of the network, as some of the members of parliament suggested during the research for this study.

5.2.2 Implications for researchers

Researchers are recommended to conduct region-specific studies to understand diverse sociopolitical, infrastructural, and behavioral factors across Tanzania. They should also explore user experience improvements for marginalized groups, including rural users and people with disabilities, and investigate advanced features like automated message filtering, natural language processing, and AI integration to enhance system scalability and usability.

5.2.3 Implications for practitioners

The developed system allows citizens to submit their concerns online via a web application and offline via a two-way messaging system in either Swahili or English. However, comprehensive training programs and ongoing support are needed to empower both members of parliament and citizens to utilize the system effectively.

To effectively educate rural users, many of whom use feature phones and have low literacy, radio programs in local languages can be used to broadcast clear, step-by-step instructions on interacting with the system via SMS. Additionally, community demonstrations led by local leaders or volunteers can provide hands-on, spoken guidance, allowing users to learn through direct interaction and practice. This combination of audio outreach and in-person training ensures accessibility, despite limitations in literacy and technology.

Furthermore, People with disabilities are encouraged to utilize accessibility tools or assistive technologies, such as screen readers and voice commands, to enhance their interaction with systems. Examples include NVDA (Nonvisual Desktop Access) and Apple's Siri.

5.3.4 Implications for government institutions

These recommendations are directed to the e-Government Authority and the Parliament of Tanzania to support effective deployment and sustainability of the PPIS. The e-GA should prioritize strengthening ICT infrastructure, such as reliable hosting, optimized SMS delivery, and sufficient bandwidth, to enable nationwide scalability. Parliament should champion capacity-building initiatives by endorsing training and support to members of parliament throughout the system. Both bodies should promote policies that enhance transparency, accountability, and citizen engagement. Close collaboration between e-GA, Parliament, and other stakeholders is vital for successful implementation.

5.4 Contribution of the study

While several studies have been conducted regarding Information Systems for Enhancing Communication between Members of Parliament and Citizens, none of them have developed a two-way messaging system (GSM technology) for communication between members of parliament and citizens, catering to those without smartphones or computers. The developed system, PPIS, is suitable for submitting concerns to representatives either online or offline.

5.5 Future work

The study also opens up new avenues for further research and development in the area of citizen engagement through digital platforms. Some of the future directions recommended are:

(i) Authenticity of SMS submissions

To improve the verification of citizen-submitted concerns via SMS, especially in the absence of strong user authentication, we propose the future implementation of Unique Reference Codes or PINs. After registration, each user will be assigned a personal code that must be included in their SMS messages. This approach will enhance authenticity and reduce impersonation or misuse.

(ii) Data privacy and compliance

As the platform collects and stores sensitive information, it must comply with data protection laws. Future updates will include features such as explicit user consent, data retention policies, and role-based access control. These improvements will apply across the web, SMS, and mobile platforms to ensure users' data is handled transparently and responsibly.

(iii) Accessibility and inclusivity

Ensuring the system is inclusive for all citizens is a critical area for future development. While support for external screen reader devices is available, upcoming enhancements will focus on broader accessibility features for users with visual or physical impairments. These include voice-assisted navigation, keyboard-friendly web interfaces, and structured SMS prompts (such as numeric reply menus) to make interaction easier for all users. Additionally, a dedicated mobile application will be developed to serve the increasing number of smartphone users. The app will offer offline data caching, real-time notifications, voice input for concern submission,

and an intuitive touchscreen-friendly interface. These improvements will expand the platform's reach.

(iv) Inclusion of other authorities and automated escalation

In future enhancements, other authorities such as local government leaders will be included in the system to broaden responsibility and improve responsiveness. Suppose a Member of Parliament (MP) fails to respond to a concern within a predefined timeframe. In that case, the system will automatically escalate the issue to the relevant local authority, minimizing delays and improving resolution timelines.

(v) Applying machine learning for enhanced resolution tracking

Future enhancements will explore the integration of Machine Learning (ML) to improve concern resolution and feedback management. ML techniques such as sentiment analysis can automatically evaluate citizen satisfaction from feedback messages, while predictive models can identify concerns at risk of remaining unresolved, enabling timely escalation. Additionally, automated classification of concerns by urgency or topic will help prioritize responses efficiently. ML can also detect anomalies in feedback data, ensuring accuracy and reducing false confirmations. These capabilities will strengthen MP accountability and optimize the overall response process.

(vi) Public dashboard and accountability monitoring

The system will be extended to include an interactive public dashboard showing real-time data on concerns by sector, response rates, and resolution trends. Political party secretaries will also have access to performance metrics, strengthening accountability and encouraging timely action from MPs.

(vii) Managing political sensitivity and anonymity

While anonymous submissions are not allowed due to accountability requirements, the system will incorporate role-based access controls and privacy-preserving views to limit the exposure of sensitive information. Citizens raising concerns about MPs will remain traceable to administrators, but their details will be shielded from public visibility, thereby encouraging participation while respecting policy boundaries.

(viii) Application of AI and NLP for intelligence and efficiency

To improve user experience and system intelligence, future enhancements will focus on integrating Artificial Intelligence (AI) and Natural Language Processing (NLP) techniques into both the web and SMS platforms. Currently, when a citizen begins to submit a concern on the web platform, the system displays related concerns based on basic keyword matching. While useful, this approach may fail to detect concerns phrased differently but with the same meaning. In future versions, advanced NLP models such as BERT embeddings and TF-IDF with cosine similarity will be implemented to analyze the semantic meaning of submissions. This will allow the system to more accurately identify and suggest existing concerns that are similar, helping users avoid redundancy and improving the quality of submissions.

On the SMS platform, where interactions are limited by character count and no real-time display is possible, a more tailored approach will be applied. When a citizen submits a concern via SMS, the system will automatically run a keyword-based match in the background. If a closely related concern already exists, the user will receive a prompt such as, "*We received a similar concern, please reply 1 to view it or 2 to continue submitting your* own". This lightweight interaction model ensures usability on feature phones while still enabling concern deduplication.

Additionally, AI will support automatic clustering and categorization of submitted concerns by topic and region. This will enable MPs and system administrators to identify frequently mentioned issues and respond more effectively. For example, similar concerns from different citizens about school infrastructure in a specific region could be grouped and presented as a trend. To maintain the platform's relevance and professionalism, AI-based classifiers will also be trained to detect spam, harassment content, repetitive entries, and politically biased submissions. This is especially important for protecting the system's integrity during politically sensitive times or public campaigns, ensuring that genuine concerns are prioritized.

REFERENCES

Adam, A. M. (2020). Sample Size Determination in Survey Research. *Journal of Scientific Research and Reports*, 90–97. https://doi.org/10.9734/jsrr/2020/v26i530263

Agarwal, P., Sastry, N., & Wood, E. (2019). *Tweeting MPs: Digital Engagement between Citizens and Members of Parliament in the UK*. http://www.mpsontwitter.co.uk/list

Allawi, N. (2020). *What is the FlowChart*? https://doi.org/10.13140/RG.2.2.25183.89767

Alshareef, H., Tuma, K., Stucki, S., Schneider, G., & Scandariato, R. (2022). Precise Analysis of Purpose Limitation in Data Flow Diagrams. *ACM International Conference Proceeding Series*. https://doi.org/10.1145/3538969.3539010

Anastasha, F., & Zakaria, T. (2022). *Build Software of Information Management Community Service Events*. 305–313. https://doi.org/10.5220/0010753000003113

Asakawa, K., & Tanaka, T. (2022). Visual Programming Environment for Learning Functional Programming Using Unit Test. *2022 12th International Congress on Advanced Applied Informatics (IIAI-AAI)*, 220–223. https://doi.org/10.1109/IIAIAAI55812.2022.00051

Babeiya, E. E., & Magoti, G. M. (2023). Digital Revolution and the Prospects for Online Political Communication. *University of Dar Es Salaam Library Journal*, *18*(1), 3–21. https://doi.org/10.4314/udslj.v18i1.2

Beutelspacher, L., Mainka, A., & Siebenlist, T. (2022). Citizen Participation via Mobile Applications. In *Research Anthology on Citizen Engagement and Activism for Social Change* (pp. 988–996). IGI Global. https://doi.org/10.4018/978-1-6684-3706-3.ch053

Bunge. (2020). *Parlaiment of Tanzania*. https://www.Bunge.go.tz/Pages/Structure.

Dube, S. (2019). *Leading by Example: Greener Parliaments. Taking Parliament to the people.Citizen Engagement for Social Change* (pp. 98–119). IGI Global. https://doi.org/10.4018/968-1-6784-3706-3.ch053

e-GA. (2021). *The United Republic Of Tanzania President's Office Public Service Management And Good Governance e-Government Authority*.

Griffith, J., & Leston-Bandeira, C. (2020). How Are Parliaments Using New Media to Engage with Citizens? *The Impact of Legislatures*, 380–397. https://doi.org/10.4324/9781003033783-20

Krause, J. (2020). Introduction to Bootstrap. *Introducing Bootstrap 4*, 1–17. https://doi.org/10.1007/978-1-4842-6203-0_1

Lewis, J. R. (2018). The System Usability Scale: Past, Present, and Future. *International Journal of Human–Computer Interaction*, *34*(7), 577–590. https://doi.org/10.1080/10447318.2018.1455307

MWTH. (2016). *The United Republic Of Tanzania Ministry Of Works, Transport And Communication National Information And Communications Technology Policy*.

MWTH. (2024). *Tanzania Digital Economy Strategic Framework*.

NBS. (2022). *Matokeo ya Sensa*. https://sensa.nbs.go.tz/

Neihouser, M. (2022). *The literature on the Parliamentarians' Digital Communication: A Scoping Review*.

Neprytskyi, O., Neprytska, T., Kyyenko-Romaniuk, L., Melnychuk, T., & Zayachkovskyi, V. (2021). Building The Communicative Culture Of Mp's Teams And The Communities. *Society. Integration. Education. Proceedings of the International Scientific Conference*, *4*, 160–170. https://doi.org/10.17770/sie2021vol4.6214

Nissen, S. (2021). *Political Participation: Inclusion of Citizens in Democratic Opinion-Forming and Decision-Making Processes*. 665–675. https://doi.org/10.1007/978-3-319-95960-3_42

Odeyemi, T. I., & Abioro, T. (2019). Digital Technologies, Online Engagement and Parliament-Citizen Relations in Nigeria and South Africa. *Advances in African Economic, Social and Political Development*, 217–232. https://doi.org/10.1007/978-3-319-93509-6_12/COVER

Poncian, J. (2020). ICT, citizen engagement and the governance of extractive resources in Tanzania: Documenting the practice and challenges. *The Extractive Industries and*

Society, *7*(4), 1498–1510. https://doi.org/10.1016/J.EXIS.2020.09.006

Quick, K. S., & Bryson, J. M. (2022). *Handbook on Theories of Governance, Chapter 14: Public participation* (C. Ansell & J. Torfing, Eds.). Edward Elgar Publishing. https://doi.org/10.4337/9781800371972

Saud, M., & Margono, H. (2021). Indonesia's rise in digital democracy and youth's political participation. *Journal of Information Technology & Politics*, *18*(4), 443–454. https://doi.org/10.1080/19331681.2021.1900019

Sotnik, S., Manakov, V., & Lyashenko, V. (2023). Overview: PHP and MySQL Features for Creating Modern Web Projects. In *International Journal of Academic Information Systems Research* (Vol. 7, Issue 1). www.ijeais.org/ijaisr

sublime. (2023). *Sublime Text*. Https://Www.Sublimetext.Com/.

Swaen, B., & George, T. (2022, November 15). *What Is a Conceptual Framework? | Tips & Examples*. Https://Www.Scribbr.Com/Methodology/Conceptual-Framework/.

TCRA. (2024). *Communication Statistics Tanzania Communications Regulatory Authority*. www.tcra.go.tz

Telerivet. (2025). *Messaging when it matters*. Https://Www.Telerivet.Com/.

Trautsch, F., Herbold, S., & Grabowski, J. (2020). Are unit and integration test definitions still valid for modern Java projects? An empirical study on open-source projects. *Journal of Systems and Software*, *159*, 110421. https://doi.org/10.1016/j.jss.2019.110421

Twaweza. (2020). *Citizens are talking, is anybody listening? – Twaweza*. https://twaweza.org/citizens-are-talking-is-anybody-listening/?

Venkatesh, V., Thong, J. Y. L., Chan, F. K. Y., Hoehle, H., & Spohrer, K. (2020). How agile software development methods reduce work exhaustion: Insights on role perceptions and organizational skills. *Information Systems Journal*, *30*(4), 733–761. https://doi.org/10.1111/ISJ.12282

Wahyudi, J., Asbari, M., Sasono, I., Pramono, T., & Novitasari, D. (2022). *Database Management in MYSQL*. *6*(2).

Widodo, S., & Kristiyono, J. (2025). Digital democracy: transforming political communication in Indonesia. *Jurnal Studi Komunikasi (Indonesian Journal of Communications Studies)*, *9*(1), 153–168. https://doi.org/10.25139/jsk.v9i1.9524

Xu, C. K., & Tang, T. (2020). Closing the Gap or Widening the Divide: The Impacts of <scp>Technology-Enabled</scp> Coproduction on Equity in Public Service Delivery. *Public Administration Review*, *80*(6), 962–975. https://doi.org/10.1111/puar.13222

Yadav, N., Rajpoot, D. S., & Dhakad, S. K. (2019). LARAVEL: A PHP Framework for E-Commerce Website. *2019 Fifth International Conference on Image Information Processing (ICIIP)*, 503–508. https://doi.org/10.1109/ICIIP47207.2019.8985771

APPENDICES

Appendix 1: Use case description

1. Manage User Account: Administrator

Use Case Description

Use case Name: *Manage User Account*

Actor: *Administrator*

Purpose: *To allow the Administrator to edit, block or delete an added user in the system.*

Overview: *Administrator can use block, edit and delete user button to manage registered users.*

Cross References: *This use case involves login into the system and viewing donors.*

Pre-Conditions: *The administrator must be logged in*

Post-Conditions:

Type: Real use case

Typical Course of Events:

Action	**System Response**
1. Administrator logs into the system	If authentic credentials are given system gives access
2. He/she clicks the responsible button to management manage button	System, shows option for user
The administrator supplies all the they important user details and submits the form.	The system verifies the supplied details and if are correct the system saves the user record

2. Submit Concerns: Citizens

Use Case Description

Use case Name: *Submit Concerns*

Actor: *Citizen*

Purpose: *To allow citizen to Submit Concerns to Member of Parliament.*

Overview: *This use case begins with registered citizen, who will add and submit his/her concerns either public or privately.*

Cross References: *This use case involves login into the system, being verified with your nida number and submission of concern in public or private chat.*

Pre-Conditions: *The citizen must be logged in and verified.*

Post-Conditions:

Type: *Real use case*

Typical Course ofEvents:

Action	**System Response**
1. Citizen logs into the system	If authentic credentials are given system gives access
2. He/she then clicks the add concern button	The system displays the form for add concern
3. He/ She can see common question if any.	The system displays common question as citizen continue to input the data.
4. Citizen, clicks submit to submit the concern.	The system will submit the concern to MP.

3. Track Response: Citizen

Use Case Description

Use case Name:	*Track Response*
Actor:	*Citizen*
Purpose:	*To allow Citizen to track the progress of the concern he/she submit.*
Overview:	*This use case begins with citizen, clicking the submit button. On completion, the system shows who receive the citizen concern and approximate time when citizen will receive response.*
Cross References:	*This use case involves login into the system.*
Pre-Conditions:	*The citizen must be logged in.*
Post-Conditions:	
Type:	*Real use case*

Typical Course of Events:

Action	**System Response**
1. Citizen logs into the system	If authentic credentials are given system gives access
2. He/she then clicks submit button	The system displays personnel who receive or working on the concern of citizen.

4. View Response: Citizen and Member of Parliament

Use Case Description

Use case Name:	*View Response*
Actor:	*Citizen and Member of Parliament*
Purpose:	*To allow Citizen to view the response from MP or Ministry and MP to view response from Ministry.*
Overview:	*This use case begins with citizen and MP, clicking the notification /my concerns button. The system shows the response the MP or Ministry provide.*
Cross References:	*This use case involves login into the system.*
Pre-Conditions:	*The citizen must be logged in.*
Post-Conditions:	.
Type:	*Real use case*

Typical Course of Events:

Action	System Response
1. Citizen or MP logs into the system	If authentic credentials are given system gives access
2. He/she then clicks notification/my concerns button	The system displays response of the concern.

5. View concerns: Member of Parliament

Use Case Description	
Use case Name:	*View* concerns
Actor:	*Member of Parliament*
Purpose:	*To allow the view and read submitted* concerns *from the system.*
Overview:	*This use case begins with the Member of Parliament, clicking the concerns buttons from the system.*
Cross References:	*This use case involves login into the system.*
Pre-Conditions:	*Member of must be logged in.*
Post-Conditions:	.
Type:	*Real use case*

Typical Course of Events:

Action	**System Response**
1. Member of parliament logs into the system	If authentic credentials are given system gives access
2. He/she then clicks the concern button	The system displays citizens' concerns base on responsible sector.

6. Respond to Question/Challenge: Member of parliament

Use Case Description

Use case Name: *Respond to* concerns

Actor: *Member of parliament*

Purpose: *To allow the Member of parliament to respond to the citizens'* concerns .

Overview: *This use case begins with the Member of parliament, to view a list of* concerns*. He/she the clicks a single* concern *and respond to it.*

Cross References: *This use case involves login into the system.* **Pre-Conditions:** *Member of Parliament must be logged in.* **Post-Conditions:** .

Type: *Real use case*

Typical Course of Events:

Action	**System Response**
1. Member of Parliament logs into the system	If authentic credentials are given system gives access
2. He/she then clicks the concerns button	The system displays the list of concerns base on sectors.
3. Member of Parliament clicks a single sector in the system.	The system displays list of concerns related to that sector
4. Member of parliament click on concern he/she wants to respond	The sytem display a form for provide response

7. Transfer Concerns: Member of parliament

Use Case Description

Use case Name:	*Transfer concerns*
Actor:	*Member of Parliament*
Purpose:	*To allow Member of Parliament to Foward concerns to responsible Ministry* .
Overview:	*This use case begins with the Member of Parliament, to view a concern. He/she the clicks the forward button of a single concern*
Cross References:	*This use case involves login into the system.*
Pre-Conditions:	*Member of Parliament must be logged in.*
Post-Conditions:	.
Type:	*Real use case*

Typical Course of Events:

Action	System Response
1.Member of Parliament logs into the system	If authentic credentials are given, system gives access
2.He/she then clicks the concerns button	The system displays the list of concerns sectors on the system.
3.Member of Parliament clicks the corresponding sector button.	The system displays the concerns
4.Member of Parliament click view button	The system open the concerns
5.Member of Parliament click transfer button	System transfer and submit the concerns to Ministry

8. View assigned task: MP's Assistant

Use Case Description

Use case Name:	*View Assigned Task*
Actor:	*MP's Assistant*
Purpose:	*To allow Member of parliament assistant to view task assigned ..*
Overview:	*This use case begins with the Member of parliament to view a list of assigned task. He/she the clicks my tasks button and view them.*
Cross References:	*This use case involves login into the system.*
Pre-Conditions:	*Member of parliament must be logged in.*
Post-Conditions:	.
Type:	*Real use case*

Typical Course of Events:

Action	**System Response**
1. Member of parliament and logs into the system	If authentic credentials are given system gives access
2. He/she then clicks the tasks button	The system displays the list of tasks on the system.
3. He/she then clicks one of task.	The system displays the details of the task.

9. Attend Task: MP's Assistant

Use Case Description

Use case Name:	*Attend Task*
Actor:	*Member of parliament assistant*
Purpose:	*To allow Member of parliament assistant to attend task assigned ..*
Overview:	*This use case begins with the Member of parliament assistant, to view a list of assigned task. He/she the clicks my tasks button and attend them.*
Cross References:	*This use case involves login into the system.*
Pre-Conditions:	*Member of parliament assistant must be logged in.*
Post-Conditions:	.
Type:	*Real use case*

Typical Course of Events:

Action	**System Response**
1. Member of parliament and Minister assistant logs into the system	If authentic credentials are given system gives access
2. He/she then clicks the tasks button	The system displays the list of tasks on the system.
3. He/she then clicks one of task .	The system displays the details of the task.
4. He/she then click attend task button	The system provide a form for add feedback.

Appendix 2: Questionnaire questions

INFORMATION SYSTEM FOR ENHANCING COMMUNICATION BETWEEN MEMBERS OF PARLIAMENT AND CITIZENS: A CASE STUDY OF DODOMA, TANZANIA

QUESTIONNAIRE

Dear Participant,

The findings of this research will be primarily used to identify user requirements that will help to improve the Information system for enhancing interaction between members of parliament and citizens of Tanzania. All information provided will be treated with strict confidentiality.

INFORMED CONSENT

This survey will take about 5 to 10 minutes of your time. Participation in the survey is voluntary. All the information you give will be confidential. The information will be used to prepare general reports, but will not include any specific names. There will be no way to identify that you are the one who gave this information. The findings of this study will be published in academic journals.

If you have any questions about the survey, please contact the researcher via email: mtoim@nmaist.ac.tz

SECTION A: FOR CITIZENS

1. Gender

a) Male

b) Female

2. Age

a) 18-25

b) 26-44

c) 45 and above

3. How long does it take for you to submit your challenges/concerns to Your MP?

a) 3 days

b) More than 3 days

c) Less than three days

d) I never Submit Challenges

e) Others_____

4. Which way/Media do you use the most to communicate with your MP?

a) Telephone

b) Face-to-Face

c) Through Local government leaders/MP's Assistants

d) Public Meeting

e) Others_____

5. What Challenges do you face when want to communicate with MP?

a) Unavailability of MP

b) Distance

c) Travelling Costs

d) Others_____

6. When is the last time the public meeting conducted in your area?

a) Last week

b) Last Month

c) Last Year

d) Others_____

7. How often do you attend public meeting?

a) Never

b) Rarely

c) Frequently

d) I prefer not to say

8. Do you think this Information system will help you to reach your MP easily?

a) Agree

b) Strong Agree

c) Disagree

9. Should this system be able to submit challenges openly or confidentially?

a) Openly

b) Confidentially

c) Both openly and confidentially

d) I don't know

e) Others_

10. Would you like to track the progress of your challenges or feedback after submitting them?

a) Yes

b) No

c) I'm not sure.

11. Is there anything else you would like to add or share regarding your requirements for our Information System?

.....

SECTION A: MEMBER OF PARLIAMENT

MASWALI: (Weka Tiki kwenye Jibu lako)

1. Jinsia

A. Mwanaume

B. Wanamke

2. Age

A. 18-25

B. 26-44

C. 45 and above

3. Ni njia gani kuu unayotumia sasa kukusanya changamoto zinazowakabili wananchi katika eneo lako?(Chagua zote unazotumia).

A. Mkutano wa Umma

B. Simu

C. Viongozi wa serekali za mitaa

D. Zinginezo.Zitaja

……

4. Njia gani wananchi wako hutumia zaidi kuwasiliana nawe?(Chagua zote zinazotumika).
   A. Mkutano wa Umma
   B. Simu
   C. Viongozi wa serekali za mitaa
   D. Zinginezo.Zitaja

5. Je unapata Changamoto zipi unapo wasiliana na wananchi wako kupitia njia hizi?Zitaje

……

6. Je, unaridhishwa na njia za sasa za mawasiliano kati yako na wananchi kuhusu changamoto zao na maoni yao?
   A. Naridhishwa Sana
   B. Naridhishwa
   C. Siridhishwi

7. Je, unatumia mitandao ya kijamii kama mojawapo ya njia za kuwasiliana na wananchi?
   A. Ndiyo
   B. Hapana

8. Je unadhani mitandao ya kijamii inachangia kwa kiwango gani kuwezesha mawasiliano yako na mwananchi?
   A. Kiwango Kikubwa
   B. WastaNI
   C. Kiwango kidogo
   D. Haisaidi

9. Je kwa siku unauwezo wa kujibu meseji ngapi kupitia simu yako ya mkononi?
   A. 1-20
   B. 20-50
   C. 20-50
   D. Idadi nyingine?.....

10. Je, unafikiri teknolojia ya habari na mawasiliano inaweza kuboresha ufanisi wa kukusanya changamoto au maoni ya wananchi?
    A. Ndio
    B. Hapana
    C. Sina Uhakika

11. Je, upo tayari kupokea mifumo mipya ya kitehama inayotumika kuboresha mawasiliano yako na wapiga kura wako?
    A. Ndio
    B. Hapana
    C. Sina Uhakika

12. Je, kuna kitu kingine ungependa kuongeza kuhusu mahitaji yako kwa mfumo?

……

Appendix 3: Interview guide

1. What communication methods do you use to collect citizens' challenges?
2. How many times do you meet with citizens per year?
3. What are the limitations of the current method used to collect citizens' challenges?
4. Do you think the Information system will help to overcome the limitations of the traditional methods used currently?
5. What additional features or services would you like to see in the system to make the system more helpful to you and citizens?

Appendix 4: Focus group guidelines

1. When engaging with your Member of Parliament, which methods or channels do you utilize and find most efficient?
2. Can you share your experiences in submitting your challenges or concerns to your MP? How long does it take for you to submit your challenge, and are there any specific challenges you've encountered in this process?
3. Public Meetings are one of the methods employed by Members of Parliament. How frequently do these meetings occur in your area? Have you had the opportunity to participate in them?
4. In your opinion, do you believe that an Information system would be effective in addressing the challenges posed by the current communication systems between MPs and citizens? If so, why?
5. Would you like to monitor the progress of your challenges or provide feedback after submitting them?
6. What will be your preferences regarding the submission of challenges, should this system be able to submit challenges openly, confidentially, or both ways?
7. Are there any additional information or thoughts you would like to share regarding your specifications or needs for this Information System?

Appendix 5: Validation Questions

PUBLIC PARTICIPATION INFORMATION SYSTEM FOR ENHANCING COMMUNICATION BETWEEN MEMBERS OF PARLIAMENT AND CITIZENS

Dear Participant,

I am a Master's student at The Nelson Mandela African Institution of Science and Technology, Arusha, Tanzania, and I invite you to participate in this system validation survey.

This survey aims to validate the developed Public Participation Information System web application and Two-way Messaging system, which provides an easy way for communication between Members of Parliament and citizens.

Your responses will be shared in a report as a result of the system being validated. Thank you for your valuable time and participation!

QUESTIONS: Please Circle your Answer

1.By clicking Yes, you consent that you have used the developed system and the response given is a true representation of your experience with the system.

A. Yes
B. No

2.Are you satisfied with the developed system?

A. Strong Agree
B. Agree
C. Neutral
D. Disagree
E. Strong Disagree

3.Do you think the system is User Friendliness?

A. Strong Agree
B. Agree
C. Neutral
D. Disagree
E. Strong Disagree

4.Was it easy to accomplish the task you wanted to do?

A. Strong Agree
B. Agree
C. Neutral
D. Disagree
E. Strong Disagree

5. Is the system Responsive?

A. Strong Agree
B. Agree
C. Neutral
D. Disagree
E. Strong Disagree

6. Does system's performance meet your expectations?

A. Strong Agree
B. Agree
C. Neutral
D. Disagree
E. Strong Disagree

7.would you recommend this system to others?

A. Strong Agree
B. Agree
C. Neutral
D. Disagree
E. Strong Disagree

Appendix 6: System usability testing questionnaire

Please select the answer that best expresses how you feel about each statement after using the System.

Statements	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. I think I would like to use this system frequently.	☐	☐	☐	☐	☐
2. I found the system unnecessarily complex.	☐	☐	☐	☐	☐
3. I thought the system was easy to use.	☐	☐	☐	☐	☐
4. I think that I would need the support of a technical person to be able to use this system.	☐	☐	☐	☐	☐
5. I found the various functions in this system were well integrated.	☐	☐	☐	☐	☐
6. I thought there was too much inconsistency in this system.	☐	☐	☐	☐	☐
7. I would imagine that most people would learn to use this system very quickly.	☐	☐	☐	☐	☐
8. I found the system very cumbersome to use.	☐	☐	☐	☐	☐
9. I felt very confident using the system.	☐	☐	☐	☐	☐
10. I needed to learn a lot of things before I could get going with this system.	☐	☐	☐	☐	☐

INFORMATION SYSTEM FOR ENHANCING COMMUNICATION BETWEEN MEMBERS OF PARLIAMENT AND CITIZENS: A STUDY OF DODOMA, TANZANIA

Mary Samwel Mtoi
Supervisors: Dr. Mussa Ally, Prof. Anael Sam

The Nelson Mandela African Institution of Science and Technology

Introduction

Tanzania operates under a multi-party political system, with Members of Parliament (MPs) elected every five years to represent constituents in the National Assembly. Citizen engagement is considered crucial for democratic practices, and various channels, including public meetings, local leaders, phone calls, letters, emails, physical meetings, and social media, allow citizens to communicate with their elected members of parliament. However, the effectiveness of these channels is hindered by factors like low public meeting attendance, MP unavailability, delayed concern delivery, social media character limits, and challenges related to time, money, and smartphone access for citizens.

Problem

Communication challenges between citizens and MPs arise from issues like low public meeting attendance, MP unavailability, delayed concerns delivery, social media character limits, and the costs associated with traditional approaches. Some literature recognizes the absence of a system for direct communication between MPs and citizens, proposing solutions such as mobile and web applications that are accessible via smartphones, tablets, and computers. However, these solutions exclude citizens with feature phones.

Solution

To develop an Information System that integrates with GSM Technology, that will help citizens to voice their concerns direct to their representatives either online or offline using Smartphone, computer or feature phone, anywhere and at any time. The system interface is user friendly and effective and allow Quick user adoption.

How it works

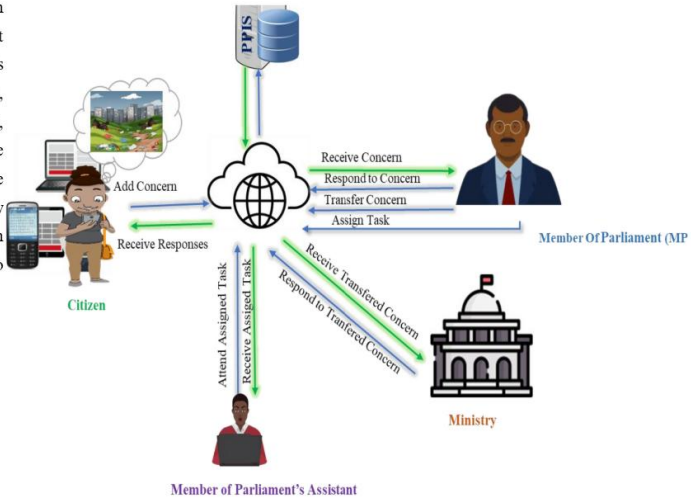


Figure 1: Public Participation Information System Conceptual Diagram

Fig 3. Two-way message (GSM Technology)

Conclusion

The system was validated by users, confirming its efficiency and alignment with their requirements. This study contributes an information system integrated with GSM technology, enabling two-way messaging for citizens to voice concerns to Members of Parliament via feature phones.

References:

Nissen, S. (2021). *Political Participation: Inclusion of Citizens in Democratic Opinion-Forming and Decision-Making Processes*. 665–675. https://doi.org/10.1007/978-3-319-95960-3_42

Odeyemi, T. I., & Abioro, T. (2019). Digital Technologies, Online Engagement and Parliament-Citizen Relations in Nigeria and South Africa. *Advances in African Economic, Social and Political Development*, 217–232. https://doi.org/10.1007/978-3-319-93509-6_12/COVER