Web-based Household Sanitary Facility Data

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Nowadays, safely managed sanitation, access to safe water, and good hygiene are essential to public health. According to the World Health Organization (WHO) (2023), sanitation is one of the most fundamental aspects of community well-being, as it safeguards human health and contributes to longer life spans. Similarly, Blom (2015) emphasizes that sanitation also pertains to maintaining germ-free conditions through services such as wastewater disposal and garbage collection.

The WHO (2010) identifies sanitation as a basic human right and an essential component for ensuring improved health outcomes. Globally, access to safe drinking water, proper sanitation, and good hygiene remain vital to human survival. However, many regions still face limited water supply, poor water quality, and inadequate accessibility (VanDerslice, 2011; Outreach International, 2023; UNICEF, 2021). Proper excreta disposal and solid waste management are also persistent challenges that require urgent solutions (Schrecongost & Evans, 2017; Clasen et al., 2010).

Globally, sanitation issues remain widespread (Centers for Disease Control and Prevention, 2024; World Bank, 2022; WHO, 2025; United

Nations, 2019). In 1990, WHO and UNICEF's Joint Monitoring Programme reported that 2.4 billion people lacked access to basic sanitation, with 946 million individuals practicing open defecation in public spaces such as street gutters, bushes, or water bodies. By 2015, approximately 68% of the global population had access to improved sanitation facilities, up from 54% in 1990 (WHO, 2022). Despite this progress, more than 2.4 billion people still lacked access, and nearly 946 million continued to defecate in open areas (WHO, 2015). By 2020, 54% of the world's population used hygienic sanitation facilities, with 34% connected to sewers and 20% using latrines with proper disposal of human excreta. Meanwhile, 78% of the global population (6.1 billion people) had access to at least basic sanitation. Although open defecation has decreased globally from 24% to 13%, it continues to affect millions of people worldwide (WHO, 2022).

Poor sanitation remains a significant driver of disease. It is estimated that 10% of the world's population consumes food irrigated with wastewater, increasing the risk of waterborne illnesses (WHO, 2023). Diseases such as dysentery, cholera, diarrhea, polio, trachoma, and intestinal worm infections are directly linked to unsafe sanitation and hygiene practices. Each year, poor sanitation contributes to the deaths of approximately 280,000 people from gastrointestinal illnesses (WHO, 2022). Additionally, the lack of clean sanitation has been associated with malnutrition and poor health outcomes.

The Department of Health (DOH) and the WHO have stated that all nations must work toward achieving sustainable sanitation by 2030. Unfortunately, the Philippines still struggles with this issue. It is estimated that around 10 million Filipinos lack access to safe and proper sanitation facilities, with many relying on unimproved toilets and latrines (UNICEF

Philippines, 2023). Safely managed sanitation is defined as the use of improved toilet facilities where human waste is properly collected and treated.

The primary objective of this study is to develop a system that can monitor water quality, excreta disposal, and solid waste management in households within the municipality of Sariaya. By addressing these issues, the system aims to promote better sanitation practices, improve public health, and contribute to the achievement of sustainable sanitation goals.

Theoretical Framework

Government Responsibility and Definition of Sanitation

One of the main obligations of the government is to provide basic necessities for individuals within the community, ensuring that environmental concerns such as sanitation, clean water, and waste management are addressed. Sanitation is one of the most essential needs of human beings, crucial for both well-being and health. Despite this, a large number of people worldwide still lack access to proper sanitation facilities. The rising demand for safe and clean water is driven by population growth and increasing requirements in agriculture, industry, and energy (Ingrao et al., 2023).

According to Kabir et al. (2021), preventing infections and controlling pathogen transmission requires continuous improvements in hygiene and sanitation practices, particularly in educational settings. Naughton and Mihelcic (2017) further emphasize that improved sanitation not only benefits human health but also plays a significant role in social and economic development, especially in low-income countries. Proper sanitation reduces disease and morbidity rates, thereby enhancing quality of

life, particularly for children. Similarly, McGill University (2023), in Improving Sanitation in Coastal Communities, highlights that sanitation promotes healthy living, environmental quality, and overall community well-being by ensuring proper waste collection (Abanyie et al., 2022). Aboah and Miyitta (2022) also note that improvements in water quality, sanitation, and hygiene have positive impacts on health, social development, and economic growth. However, global progress in ensuring universal access to safe water and sanitation remains limited.

Importance of Sanitation and Hygiene

The importance of proper sanitation and hygiene has been widely recognized. Humanitarian Global (2022) outlines six key reasons why sanitation and hygiene are vital:

Disease prevention – Lack of sanitation, poor water quality, and malnutrition are leading causes of death in underdeveloped countries. Proper waste disposal and clean water are fundamental to reducing illness and mortality.

Mental health – Clean environments and proper sanitation reduce anxiety and psychological problems linked to poor living conditions, supporting holistic health.

Confidence and self-esteem – Good sanitation contributes to self-perception, confidence, and empowerment by promoting a clean and healthy lifestyle.

Community status – Proper sanitation enhances social interactions and social status, as individuals with good hygiene are perceived more positively within communities.

Productivity and concentration – Clean environments support better focus and productivity, allowing individuals to achieve continuous

development and personal growth.

Quality of life – Ultimately, sanitation and hygiene improve overall quality of life by fostering healthier homes and communities.

Challenges in Sanitation

Despite its importance, sanitation faces significant challenges. Many communities, particularly in developing countries, lack adequate facilities for excreta disposal. For instance, almost seven million Filipinos still practice open defecation, particularly in rural areas (Naughton & Mihelcic, 2017). This practice poses serious health risks, as human waste is often disposed of in open areas or connected directly to rivers, seas, and canals.

WHO (2023) reports that approximately 2.6 billion people worldwide lack access to proper sanitation, contributing significantly to the spread of diarrheal and other diseases. McGill University (2023) further explains that poor sanitation disproportionately affects urban poor communities living in overcrowded settlements with limited financial capacity and knowledge to improve conditions (Adugna, 2023; Kitole et al., 2024; Okesanya et al., 2024; Anthonj et al., 2024). The World Health Organization (2022) stresses that inadequate sanitation and hygiene are contributing factors to tropical diseases such as intestinal parasites, schistosomiasis, and trachoma. Annually, around 890,000 people in low- and middle-income countries die due to unsafe water, poor sanitation, and inadequate hygiene, which account for nearly 60% of gastroenteritis-related deaths.

Web-Based Systems for Addressing Sanitation Challenges

Several systems have been developed to address sanitation-related

challenges. One example is the Sanitation Management System (SMS), a web-based application developed using PHP and MySQL. The system provides functionalities for both administrators and users, featuring login and logout options, service management, inquiries, and dashboards. Administrators can manage requests and user data, while staff and public users can browse services, read descriptions, and submit inquiries (Montero, 2022). The system utilizes tools such as Google Chrome, XAMPP, PHP, HTML, CSS, JavaScript, and MySQL for development and deployment.

The relevance of SMS lies in its similarity to the proposed system, as both provide separate user and administrator interfaces with user-friendly features. However, unlike SMS, the proposed system incorporates enhanced login credentials for both public and management users, ensuring greater data confidentiality. The developed web-based household sanitary facility data system aims to address these challenges. The system will provide data on excreta disposal, water surveillance, and solid waste management. Local officials can encode survey data from their barangays into the system, enabling the municipality to identify areas most in need of facilities such as water systems, garbage segregation areas, and public comfort rooms. This initiative will help ensure that sanitation needs are systematically addressed, contributing to healthier and more sustainable communities.

Research Framework

Data

The data for this study were gathered through a survey conducted to the IT expert, office staff and barangay sanitation auxiliary with a total of thirty-six (36) respondents. The researcher used Slovin's formula to determine the total number of respondents and utilized a purposive

sampling method of distributing questionnaires. The questionnaires are based on ISO 25010 that contains the following criteria: functionality, reliability, usability, efficiency, maintainability, portability, compatibility and security.

Table 1

Distribution of respondents

Profession/Expertise	No. Of respondents	Percentage
Sanitation Office Staff and Admin	10	27.78%
IT Expert	5	13.89%
Barangay Representative	21	58.33%
Total	36	100%

Table 1 presents the distribution of respondents who evaluated the system. The respondents included 10 sanitation office staff and administrators, 5 IT experts, and 21 barangay representatives, for a total of 36 participants.

A five-point Likert scale was utilized to allow respondents to provide their ratings. The categories were outstanding, good, satisfactory, poor, and unsatisfactory. Each category was assigned a specific mean range to guide the interpretation of results and ensure accurate analysis. To assess the system, the researchers employed the Weighted Average Mean (WAM), which was used to evaluate its functionality, usability, reliability, efficiency, portability, maintainability, compatibility, and security.

Data Privacy

Every firm should have a written data security policy, particularly because most organizations are now subject to increasingly strict information confidentiality legislation. A data security policy typically

addresses issues such as password security, data encryption, and access control. Beyond simply outlining precautionary measures, the policy demonstrates management's commitment to comply with legal obligations. In particular, it should ensure organizational protection for sensitive and confidential data, such as personal information.

The policy must clearly define the roles and responsibilities of all parties involved in safeguarding data, including the Data Protection Officer (DPO) in ensuring compliance with GDPR. Furthermore, access control guidelines are established to ensure that users can only access information necessary for their role. In this study, the researchers provide a data policy to secure the information submitted by system users.

To prevent unfavorable effects on clients, the company treats data confidentiality as a priority, ensuring that information is not lost or mishandled. While the policy cannot fully prevent malicious attempts to steal private information, its main purpose is to raise awareness among users and prevent accidental data loss or breaches. The data security policy applies to all personal information classified as sensitive under the organization's data classification guidelines.

This policy extends to servers, databases, and IT systems designed to handle collected data, as well as all devices used for email, web access, and related activities. Every user interacting with the organization's services is subject to this policy. The system guarantees that all user-provided information remains secure and confidential.

User responsibilities. Administrators should maintain a clear workspace, free from sensitive information. They must keep their passwords confidential. c. Residents must provide only accurate information required by the system and they should review their information before final submission.

Application and information access. Administrators are granted access permissions and are responsible for record management. Sanitation office representatives may only access the survey forms. Access to sensitive information is restricted to authorized personnel and isolated for enhanced security.

Confidentiality and information restriction. Confidentiality and restricted access are granted solely to authorized personnel for purposes aligned with their job responsibilities. The IT Security Department is responsible for enforcing access restrictions.

Verification, Validation, and Testing Plans

The researchers conducted a series of evaluations to determine whether the system meets its objectives and intended purpose. In addition, barangay representatives are required to visit households and complete a survey form regarding household sanitation. Once submitted, administrators validated and analyzed the encoded data to prevent the

Development Model

It is a development tool that guided the researchers in pursuing a structured system. The proponents adopted the Rapid Application Development (RAD) model for developing the web-based household sanitary facility data system.

Figure 1

Rapid application development model

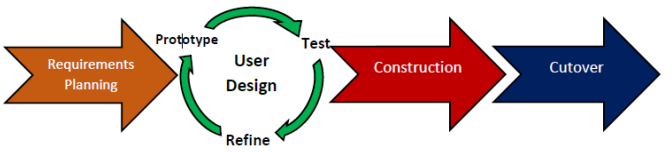


Figure 1 illustrates how the proposed system was built on the basis of the development model used.

Requirements planning. This phase involves identifying and organizing the details necessary for the project. It emphasizes collaboration between the research team and the client, focusing on current issues that need to be addressed in system development. The goals and objectives of the program are established, and project assumptions are analyzed by all stakeholders. Input from each significant team member and developer is gathered to secure agreement and avoid future misunderstandings or costly changes. At this stage, the researchers plan the system to be developed and collect requirements as provided by the client.

User design. In this phase, developers and team members begin working on the project by producing user designs through various prototypes. This is the core component of RAD that distinguishes it from other development approaches. Developers collaborate with clients to ensure that requirements are addressed at every stage of the design process. Users evaluate each prototype to confirm alignment with project goals. Errors and bugs are identified and resolved through an iterative process. The developer creates prototypes for user testing, and both parties work together to determine necessary adjustments. This iterative feedback loop allows modifications until the design meets expectations.

Rapid construction. At this stage, prototypes and beta versions evolve into working models. The development team collaborates to build the final functioning system, using iterative processes to resolve problems identified earlier. Client input remains crucial during this stage, as users can provide insights, adjustments, suggestions for improvement, or new concepts that contribute to system refinement. Collaboration ensures that the system functions properly and meets the goals and requirements defined

by the client.

Cutover. This is the execution phase, where the fully developed system is prepared for implementation. Activities in this stage include data conversion, system testing, final adjustments, and user training. Programmers and clients continue monitoring the system to detect and resolve any issues. The researchers conduct multiple tests to ensure that the system operates effectively and achieves its intended purpose.

Technical Framework

Materials

This section outlines the specifications that the researchers used in designing the project.

Software

Table 2 shows the software programming tools and specifications that were used in the project.

Table 2

Software specification

Software	Specification
Database	MySQL
Server/UI testing	Google Chrome, XAMPP
IDE Platform	VS code
Operating System	Windows 10
Android Operating System	Android 10

Hardware

Table 3 shows the hardware tools and specifications that were used in the project.

Table 3

Hardware specifications

Hardware	Specification	
	Minimum	**Recommended**
Internal Memory	4GB of disk space	8GB of disk space
Memory	4GB RAM	8GB RAM
Processor	12	17
Resolution	1280x81500 screen display	
Internal memory (Smartphone)	100MB of disk space	250MB of disk space
Memory (Smartphone)	1GB RAM	2GB RAM

Development Approach

The goal of the development approach is to identify how the system will be developed and implemented. For this study, the chosen development model is the RAD model, complemented by the top-down approach. The top-down method begins with a general principle and breaks it down into smaller components. Using this approach, the researchers analyzed how the system could be efficiently applied, ensuring that the basic concepts were gradually decomposed to quickly understand the system's flow.

To build the system, the proponents integrated various software and tools. By combining these technologies, the design and implementation of the system became feasible. The tools used include:

PHP (Hypertext Preprocessor). A widely used, open-source, general-purpose scripting language chosen for system development. PHP served as the primary programming language for building the system.

MySQL (My Structured Query Language). A widely adopted database management system. MySQL was employed as the storage location for information and data entries. Data was created, stored, and

managed in the MySQL database, with PHP facilitating database interactions.

XAMPP (Cross-Platform, Apache, MySQL, PHP, and Perl). Used for server and user interface testing, XAMPP provided an integrated platform to connect the website with the MySQL database.

Microsoft Word. Utilized for documentation purposes, particularly in creating and typing project-related reports.

Figma. A collaborative web-based application for interface design, offering additional offline functionality through desktop versions for macOS and Windows. Figma was used to design and edit the system's interface.

HTML (Hypertext Markup Language). Used to define the structure of web pages. HTML served as the backbone of the system's front-end, providing the essential framework for content display.

CSS (Cascading Style Sheets). Applied to format text, tables, and overall web page layouts. CSS allowed the researchers to define styles, enhance readability, and ensure a structured presentation of web content.

JavaScript. Employed as the programming language to add dynamic and interactive elements to the website. JavaScript enhanced user interaction and improved system usability.

Analysis of the System

Figure 2 presents the system context diagram. The diagram displays the process of the monitoring the household sanitary facility data between the system and the users. Admin will add, edit, delete and manage records to the software and system admin will view the residents' information. The user sends request form to the system. System will give form to be filled out by the users.

Figure 2

Context diagram of the developed system

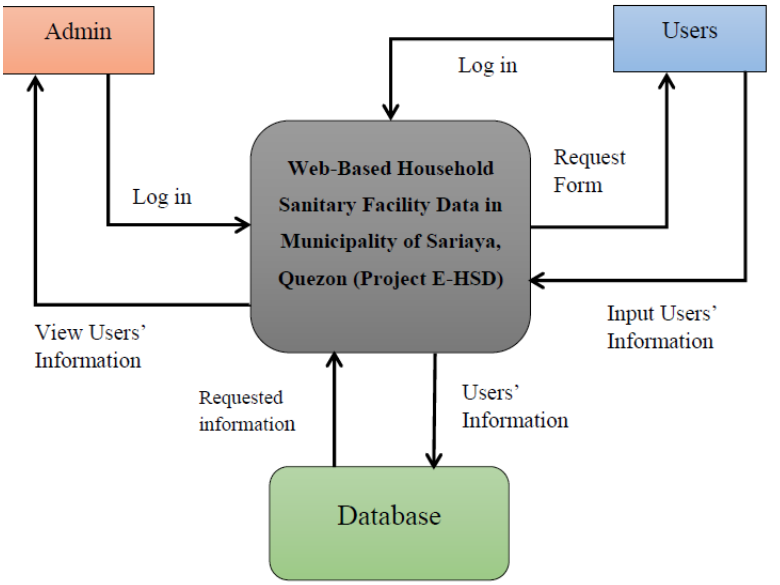


Figure 3

Data flow diagram of the developed system for inputting and storing users' information

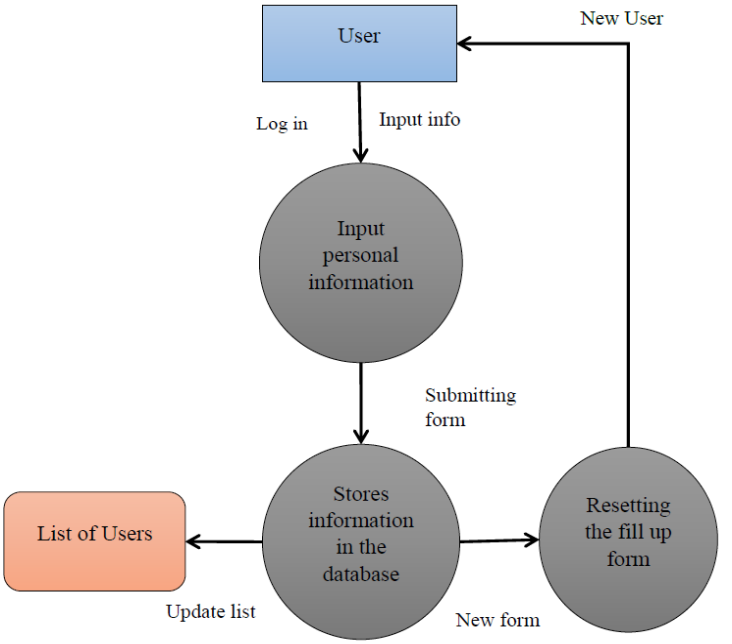


Figure 3 illustrates the user's DFD. In this process, users log in to the system, input the collected personal information, and the system directly stores the data in its database.

Figure 4

Data flow diagram of the developed system for the admin accessing the users' list

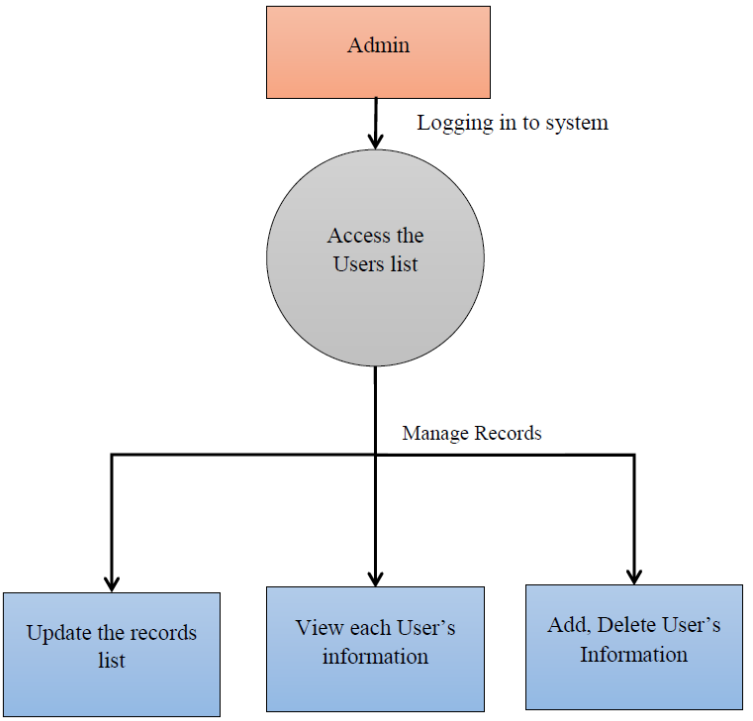


Figure 4 presents the DFD for administrators. In this process, the administrator logs in to the system using a designated username and password to access the users' list. The system then displays all user information, allowing the administrator to view and manage the details submitted by each user.

Design

System design is a step in which system engineers evaluate and

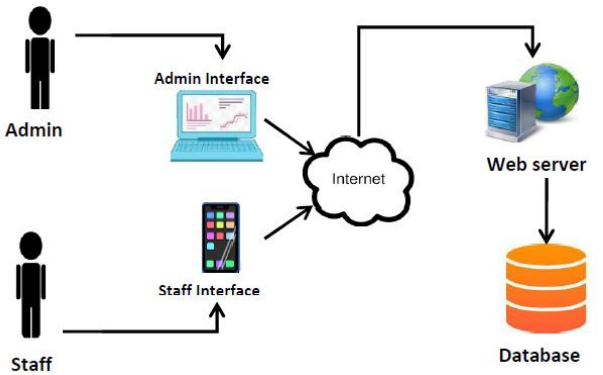
understand the function of the proposed system by reviewing the user specifications text. They define the possibilities and strategies by which the specifications of the user can be implemented. On the other hand, system development is an approach to establishing or modifying structures along with the methods, processes, designs, and methodologies used to produce them. System design is the method of determining the constituent elements, modules, interfaces, and data for an application to satisfy particular requirements.

System Architecture

Figure 5 illustrates how users access the developed system. The diagram shows the flow of data encoded by the administrator and staff. Users connect to the system via the internet, enabling their information to be stored in the database. The administrator, represented by a computer interface in the diagram, has full access to all system functions. In contrast, staff members, represented by a mobile device interface, have limited access restricted to the survey form. The use of mobile devices allows staff to conveniently conduct surveys in the field.

Figure 5

System architecture



Use Case

Figure 6 presents the use case model of the system, illustrating how administrators and users interact with and manage system functions. The administrator can manage user accounts, generate reports, and handle record information, while users interact with the system to submit and access their personal data as permitted.

Figure 6

Use case model of the system for admin

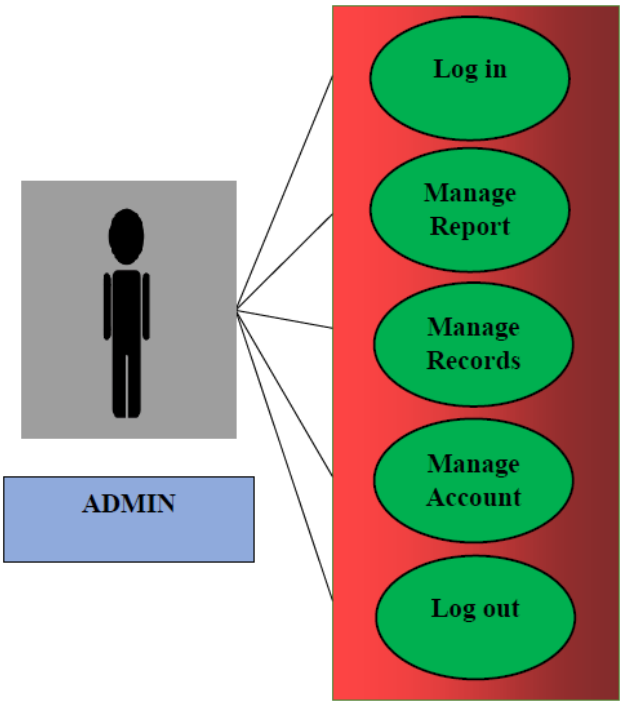
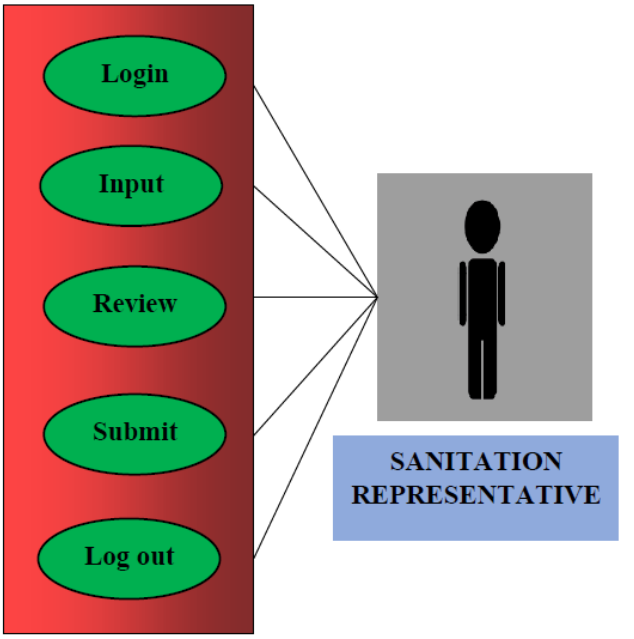


Figure 7 presents the use case model of the system for the Sanitation Representative. It illustrates how the representative interacts with the system by inputting residents' information, reviewing it, and submitting it for storage and processing within the system.

Figure 7

Use case model of the system for sanitation representative



User GUI

A Graphical User Interface (GUI) is a type of interface that allows users to interact with electronic devices through graphical icons and visual elements. Users engage with the system using graphical components such as windows, icons, and buttons. Navigation is primarily performed using a mouse and keyboard, which are best suited for desktop computers; these input devices may not function as effectively on portable gadgets.

Figure 8

Homepage

The Home Page serves as the main screen of the system and contains buttons for “Home,” “About Us,” “Contact,” and “Login.”

Figure 9 shows the Login Page for Admin/Barangay Representative/Staff. It is designed for administrators, barangay representatives, and staff members. Users are required to enter a username, which serves as a unique identifier, and a password to securely access the system.

Figure 9

Login page

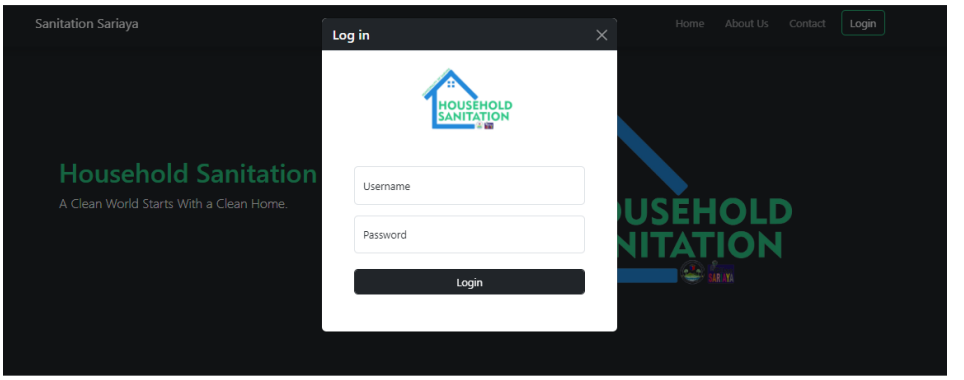


Figure 10

Dashboard

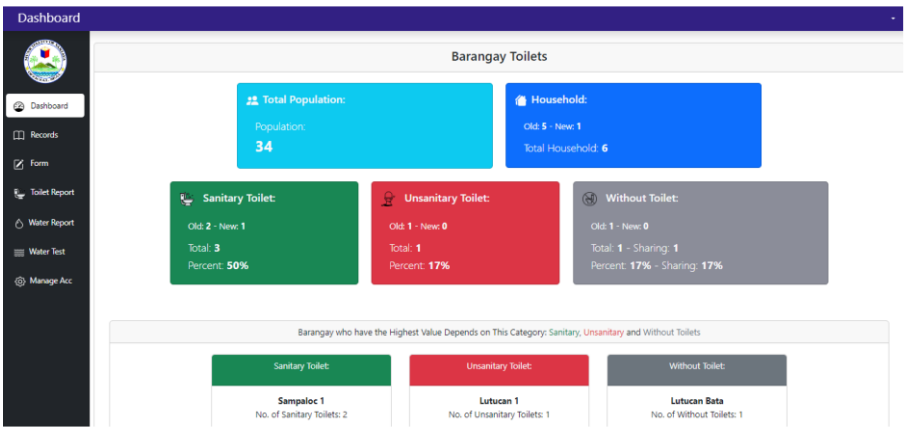


Figure 10 shows the dashboard. It provides an overview for the admin, displaying the total number of populations, households, sanitary toilets, unsanitary toilets, and households without toilets.

Figure 11

Record page

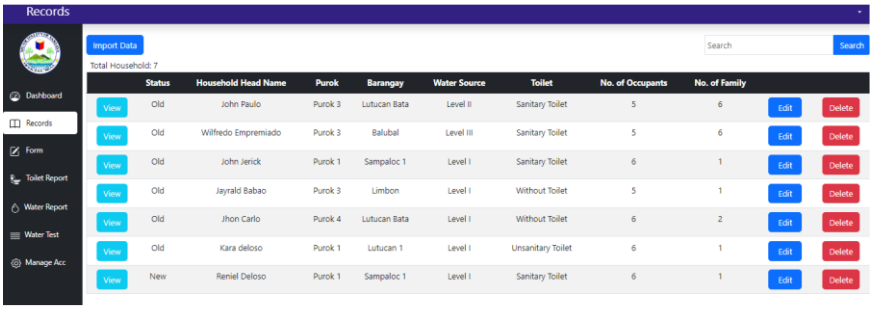


Figure 11 shows the record page. On the Record Page, the admin can view, edit, and delete existing records.

Figure 12

Importing data

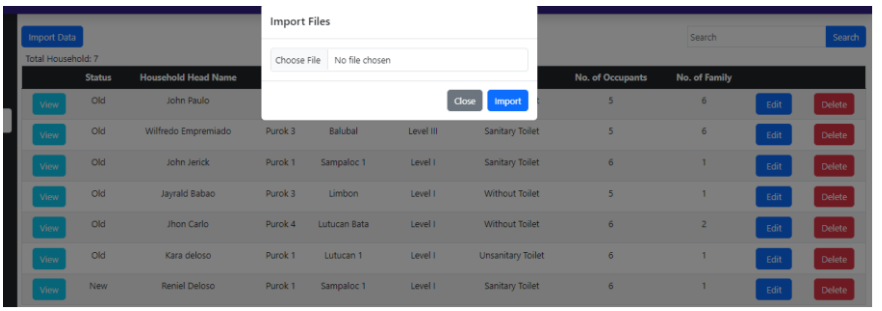


Figure 12 shows the importing of data. The Importing Data screen allows the admin to import data files into the system's records.

Figure 13 shows the survey form. The survey form screen enables both the admin and barangay representatives to fill out household surveys.

Figure 13

Survey form

Figure 14

Toilet report

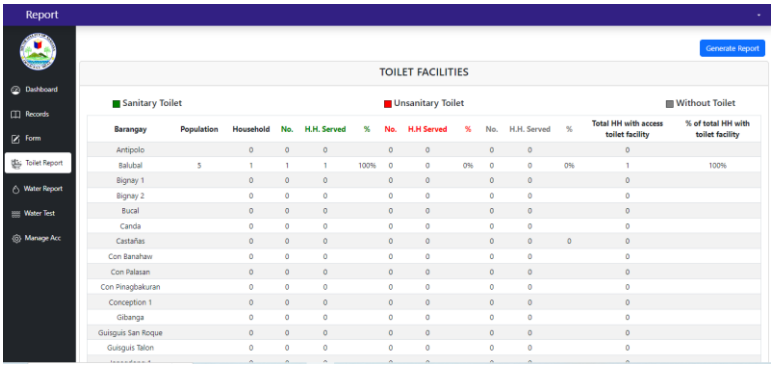


Figure 15

Water supply report

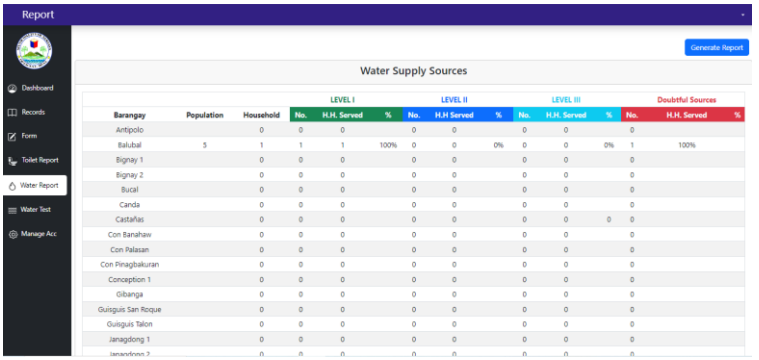


Figure 14 shows the toilet Report screen displaying a report on the sanitary, unsanitary, and households without toilets. On the other hand, Figure 15 shows the water supply report, providing a report on water surveillance, indicating sources categorized as Level 1, Level 2, Level 3, or doubtful sources.

Figure 16

Water supply test report

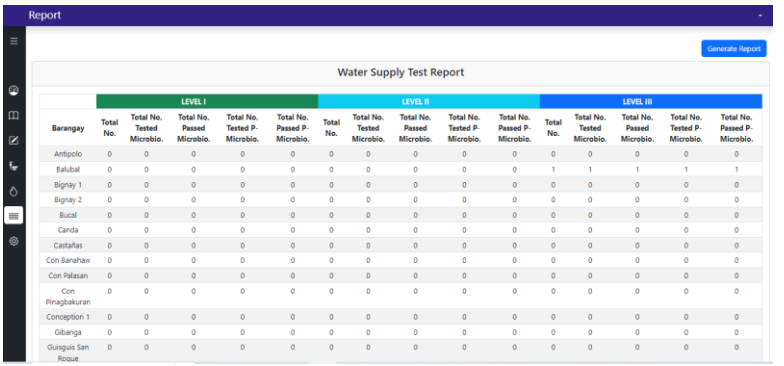


Figure 16 shows the water supply test report. This report presents findings from microbiological and physico-chemical testing of different water sources.

Figure 17

Generated report

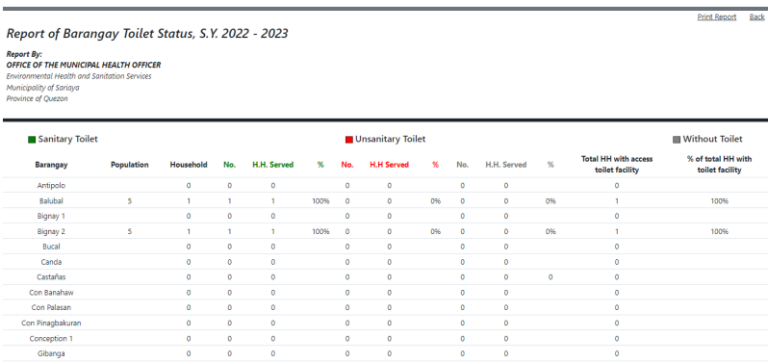


Figure 17 shows the generated report. It consolidates data on water surveillance, excreta disposal, and solid waste management, allowing the admin to generate and print comprehensive reports.

Figure 18

Manage accounts

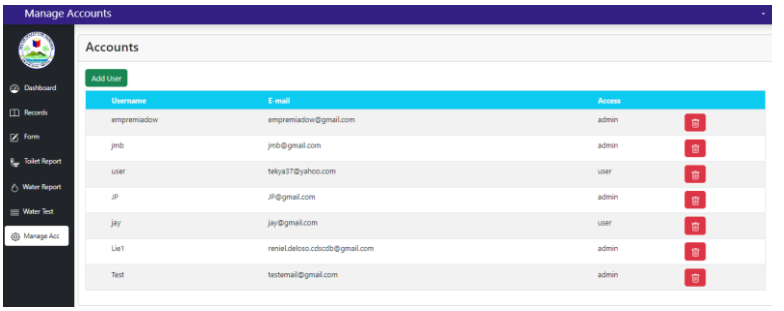
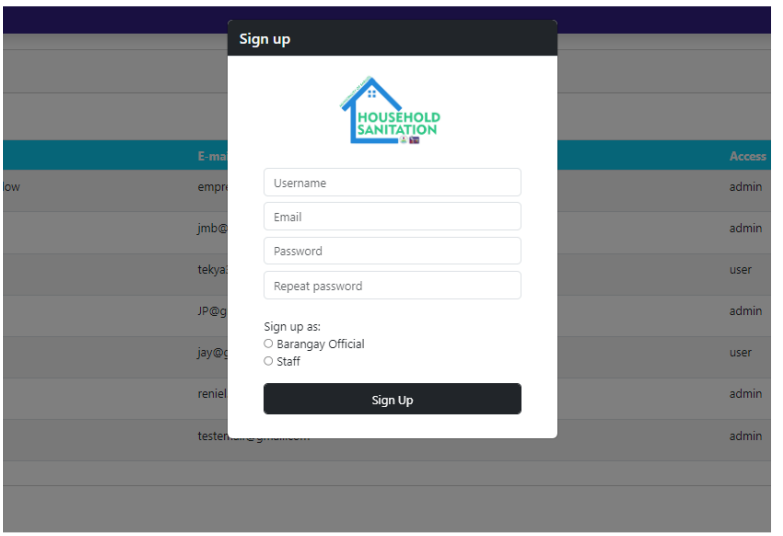


Figure 18 shows the manage accounts screen, showing records of all registered admin and user accounts. Meanwhile, Figure 19 shows the sign-up page. It allows the admin to add new admin and user accounts as needed.

Figure 19

Sign-up page



Database Design

A database schema defines the logical structure of the database, outlining how data is organized, stored, and related within the system. It serves as the blueprint for the system's data management, supporting the proper storage of user information, survey data, reports, and other essential records in a structured and consistent manner.

Figure 20

Database schema

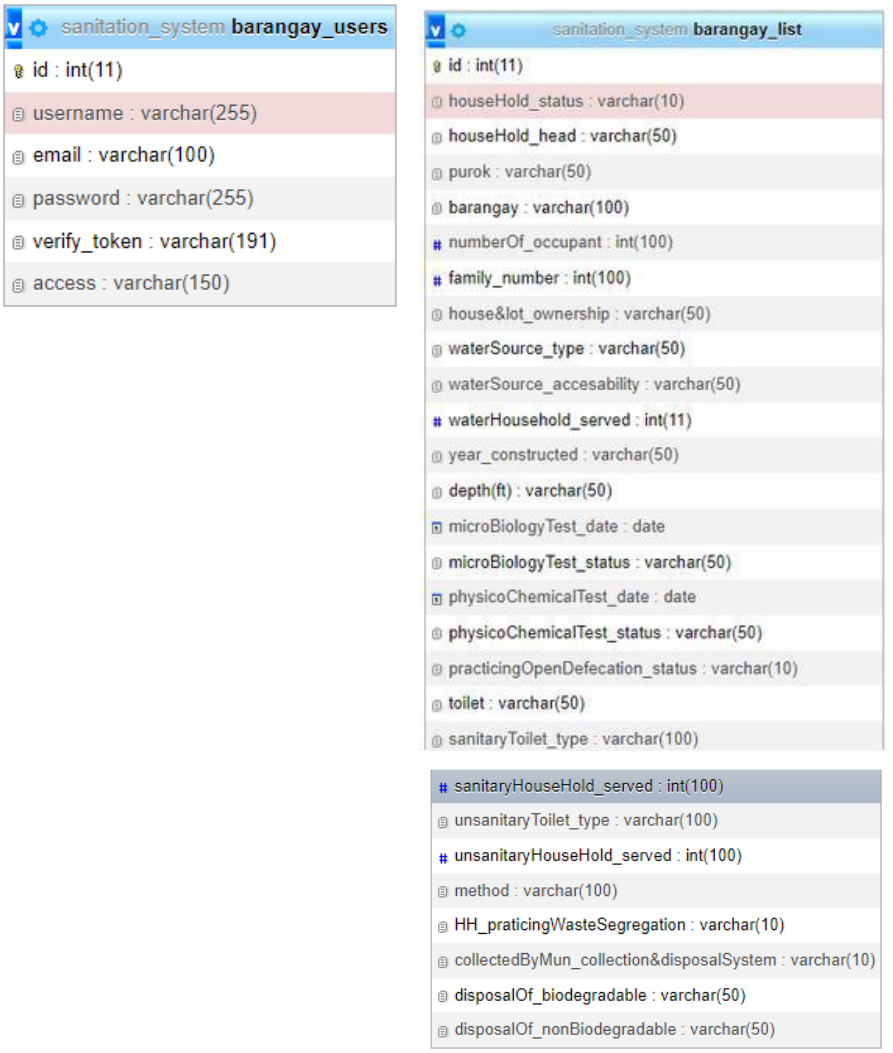


Table 4

User's table

Name	Users	
Description	This table is for the Users of the system	
Field	**Type**	**Description**
id	Int(11)	Primary Key
username	varchar(255)	Stores username of the user
email	varchar(100)	Stores email of the user
password	varchar(255)	Stores password of the user
access	varchar(150)	Access of the user

Table 3 presents the User Table, which contains information about the login credentials of the system users. The table includes an ID as the primary key to prevent redundancy, along with fields for username, email, password, and access level, which indicates whether the user is an admin or staff member.

System/Software Evaluation Testing

This section provides the evaluation conducted through a survey in Sariaya, Quezon, involving IT experts, office staff, and barangay sanitation auxiliaries, with a total of thirty-six (36) respondents. The questionnaires were based on ISO 25010 and covered the following criteria: functionality, reliability, usability, efficiency, maintainability, portability, compatibility, and security.

Overall, the evaluation indicates that the developed system performs well across all ISO 25010 criteria, with most aspects rated between Good and Outstanding. Table 5 shows the overall weighted mean of each criterion based on the responses of 36 participants. The system evaluation survey yielded an average weighted mean of 4.30, showing that respondents agreed

on the system's reliability, functionality, efficiency, usability, maintainability, portability, compatibility, and security. This result demonstrates that the system is capable of meeting the specified requirements effectively.

Table 14

Weighted mean distribution of criteria for the developed system

Criteria	Weighted Mean	Remarks
Functionality	4.36	Good
Reliability	3.68	Good
Usability	4.51	Outstanding
Efficiency	4.53	Outstanding
Maintainability	4.15	Good
Portability	4.34	Good
Compatibility	4.34	Good
Security	4.5	Outstanding
Average	**4.30**	**Good**

Functionality: The results show that the developed system effectively supports data encoding, meeting the needs of the sanitation office. Respondents were satisfied with this aspect, with a weighted mean of 4.36, interpreted as Good.

Reliability: The system was found to run consistently, with an overall weighted mean of 3.68, also interpreted as Good. This indicates that the system is reliable for regular use.

Usability: Respondents agreed that the system is easy to operate and understand. The usability criterion received an average weighted mean of 4.51, with a remark of Outstanding.

Efficiency: The system responds quickly and performs well in its operations. The efficiency criterion received an average weighted mean of

4.53, also interpreted as Outstanding.

Maintainability: The system allows for easy detection and correction of faults or errors. This criterion received a weighted mean of 4.06, interpreted as Good.

Portability: The respondents agreed that the system can be accessed easily across devices. Portability garnered a weighted mean of 4.34, interpreted as Good.

Compatibility: The system meets client requirements and functions correctly within the intended environment. Compatibility received a weighted mean of 4.34, with a remark of Good.

Security: The system provides protection against unauthorized modifications of data. The security criterion received a weighted mean of 4.50, interpreted as Good.

Economic feasibility assesses the cost-effectiveness of the system, primarily through a cost-benefit analysis. Its purpose is to determine the expected benefits of implementing the system. In this study, the institution found the system economically feasible, as it significantly reduces the time and effort required to collect data compared to traditional paper-based methods.

The system is technologically feasible and is expected to receive positive feedback from users. It contributes significantly to monitoring water quality, excreta disposal, and solid waste management in each community. Additionally, the system is easily accessible via the internet and can be efficiently managed and operated, making it a practical technological solution.

The developed system is operationally feasible due to its user-friendly interface and intuitive design. Clients expressed satisfaction with the system, noting that it is easy to operate and understand. The operational

process and demonstration showed that the system can be effectively used with minimal training and effort.

Conclusion

The developed system is capable of collecting and managing sanitary information for every household. The system allows administrators to generate comprehensive reports, including the total number of households, water sources, households with and without sanitary toilets, and households practicing solid waste management. Its accessibility and security features ensure that survey activities in each community are more efficient, reducing the risk of data loss and redundancy while optimizing time and minimizing the workforce required. Furthermore, testing and evaluation demonstrated that the system meets ISO/IEC 25010 standards for functionality, reliability, usability, efficiency, maintainability, portability, compatibility, and security. Overall, the system provides a valuable tool for efficient data collection, storage, and monitoring, offering a significant contribution to sanitation management in the municipality.

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