

# A Novel Web Based Waste Control and Management Platform

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## ABSTRACT

Waste management remains a significant issue in urban areas worldwide, especially in the ever growing and expanding cities of developing nations. The substantial increase in population and per capita income has led to a heightened challenge in effectively managing solid waste, posing a considerable risk to both environmental quality and human health. Access to sanitation services and sufficient clean water is essential for the overall health and well-being of individuals. To address this concern, a novel web-based waste control and management platform was developed utilizing the web design and development tools within the Visual Studio Framework. The design methodology employed in this project is based on Object-Oriented Methodology.

**Keywords:** Waste, Web-based, Waste Generation, Waste Control, Waste Management

## I. INTRODUCTION

Waste management has continues to be a major challenge in rural and urban settlement throughout the world mostly in the developing world. Access to sanitation services and clean adequate water are therefore regarded as crucial to the health and wellbeing of people [1]. Many principles of waste reduction and management has been proposed over the years like the 3-R method of waste control and management; reduce, reuse and recycle but has not clearly yielded the desired results. Waste control and management has evolved over the years from the manual method to the electronic system of waste control and management. This is motivated by the desire to minimize the environmental impact of waste and enhance the effectiveness of waste management procedures [2]. There are various approaches, ranging from conventional techniques like composting or landfilling, to modern, more advanced solutions using IoT technologies. As more cities become industrialized, the congenital problem of waste management comes along with it. Technological and economic advancement has made the types and kinds of waste very diverse and their management are becoming more complex[3].

A web based waste management system is an online platform that is used for waste management which includes waste collection, disposal, and recycling waste[4]. This is web based system which provides information on forecast waste flow, disposition maps, successor stream maps, GIS maps, reports, waste shipment, and printing. The benefits of a web based waste management system includes increased efficiency, reduced costs, and improved environmental sustainability. The system typically includes features such as scheduling waste pickups, tracking waste generation, monitoring waste disposal methods, and generating reports on waste management activities.

Another new innovation in waste management is known as waste information management system[5]. An ideal waste information management system is that we always have the right information in the right place, in the right form, and of sufficient completeness and quality to meet our current need. Technologies and tools such as waste information managers help us spend less time with time-consuming and error-prone activities of waste information management system. We then have more time to make creative, intelligent use of the information at hand in order to get things done or, simply, to enjoy the information itself [6]. Interest in the study of waste information management system has increased in recent years. One goal in the study of waste information management system is to identify ways to introduce new tool support without inadvertently increasing the complexity of a person's information management challenge. The study of waste information management system means understanding better how people manage information across tools and over time[7] and this is the value of a new platform must be assessed over time and in a broader context of a person's various waste information management system activities [8]. Waste information management system is a type of application software that functions as a Waste organizer. As an information management tool, a purpose is to facilitate the recording, tracking, and management of certain types of waste information [9].

## II. STATEMENT OF THE PROBLEM

The following are the problems associated the system;

- i. Inability for individuals/cities to have waste management service regularly within their homes at any point in time.
- ii. The previous system supports high rate of street littering due to lack of good and reliable remote system where citizens can make a request for waste dumping subscriptions.
- iii. The previous platform increases irregularity in income balances of the company due to non-availability of good auditing system.
- iv. It incurs more costs on the waste management board as they have to get more stationaries to stock records of cities and dumping sites to manage.

## III. AIM AND OBJECTIVES OF THE SYSTEM

The aim of this work is to design and implementation of a novel web based waste control and management platform. The proposed system will help to provide a remote system that will provide better service delivery to citizens using automatic feedbacks, reduce the rate of indiscriminate dumping of refuse on a non-waste dumping site in order to keep cities clean, serve as a better auditing tool to reduce irregularities in income generated by refuse dumping and reduce costs incurs in procuring stationaries in the board office.

## IV. REVIEW OF RELATED LITERATURE

Management and control of Waste is an increasingly critical aspect of environmental sustainability, with the proper management and disposal of waste being vital to preserving our planet's health. The amount of waste generated is continually increasing, making it more challenging to manage and dispose of waste effectively [10]. As such, there is a growing need for innovative waste management solutions that can help reduce waste generation, promote recycling, and encourage sustainable practices. Informal recycling practices have been predominant due to the functional comfort and cost advantage proposed at the price of detrimental effects on the atmosphere and health [11]. Several stakeholders' participation, waste constitution and poor creating of awareness of the negative effects of waste disposal to the health and environmental impact has not been properly implemented. In [12], they developed an Arduino based system that work between Microcontroller-ultrasonic sensor and the RF

devices. The application is fully automated where the garbage car moves automatically when it gets a signal via RF Module from the Garbage bin, when it gets filled.

The importance of addressing the issues in waste management systems and implementing effective strategies for creating a robust and sustainable waste management system was highlighted in the research conducted by [13]. The escalating population growth has led to various challenges associated with waste disposal, as these dumps emit harmful gases with adverse effects on human health. In the work of [14], it expressed concerns about the continuous rise in waste volumes, capturing the attention of researchers and experts across different fields. Additionally, [15] suggested that in response to the escalating waste problem, scientists, foundations and companies globally have devised ideas and technologies to slow down this process.

Issues linked to waste management encompass negative impacts on the biosphere, as well as pollution in water, soil, and air [14]. To mitigate these environmental impacts, [15] proposed the necessity for coordinated actions at the global, national, regional, and local levels. While measures at the local level are crucial, [16] acknowledged the limitations individuals face in reducing waste. The improvement of economic conditions and living standards worldwide has led to an increased generation of waste products [17].

Therefore, the proper implementation of waste management activities at the source of generation is crucial, as emphasized by [18]. Recognizing the inefficiency and high costs associated with traditional waste management systems, the integration of the Internet of Things (IoT) and deep learning models becomes imperative to utilize resources efficiently [19]. In the work of [25] they proposed an intelligent garbage classification system based on deep learning, showcasing positive results in waste control and management. From the work of [20], they designed a smart waste management system capable of generating information on different types of waste, waste dump locations, residents, and the routes for waste collection and disposal. Similarly, [21] developed a deep learning-based waste management system that not only identifies and classifies waste types but also contributes to cost reduction in terms of time and human resources while positively impacting the environment. In efforts to enhance waste management procedures, [22] introduced a convolutional neural network based image processing system, featuring feature extraction and

a multi-layered perceptron to consolidate essential features of selected or detected waste types in a dump. Recent studies highlight the effectiveness of deep learning models over traditional techniques in object detection and classification. The ongoing trend of smart cities, driven by rapid urbanization, incorporates IoT technologies for smart and automated waste management, resulting in increased efficiency, flexibility, energy and time savings, and sustainable environmental practices [23]. IoT-based solutions offer real-time monitoring, collection, and management of garbage [24]. It is clear that the best way to go in waste control and management is an improved technological approach that will keep track of waste generation, generator/household and other management attributes which are all contained in the proposed system known as a novel web based waste control and management platform.

### V. RESEARCH METHODOLOGY

The methodology employed in this project is the Object-Oriented Methodology (OOM). This approach to system development emphasizes and facilitates the reuse of software components. By adopting OOM, a computer system can be constructed in a modular manner, allowing for the

efficient reuse of existing components and enabling the sharing of these components across different systems. Another perspective considers system analysis within this methodology as a problem-solving technique that involves breaking down a system into its individual components. This breakdown allows for a detailed study of how these components function and interact to achieve their intended purpose.

### VI. WASTE GENERATION AND MANAGEMENT LIFE CYCLE

Waste are generated in different form but they are mostly from the household, business places, industrial waste generation etc. They also comes in different form considering different characteristics like the physical states, physical properties, reusable potentials, biodegradable potentials, source of production and the degree of environmental impact [26]. The diagram below shows the life cycle of waste generation and management. It is divided in six states that includes; household/industrial waste, waste collection, waste transportation route, waste dump site, waste recycle site and production of finished materials.

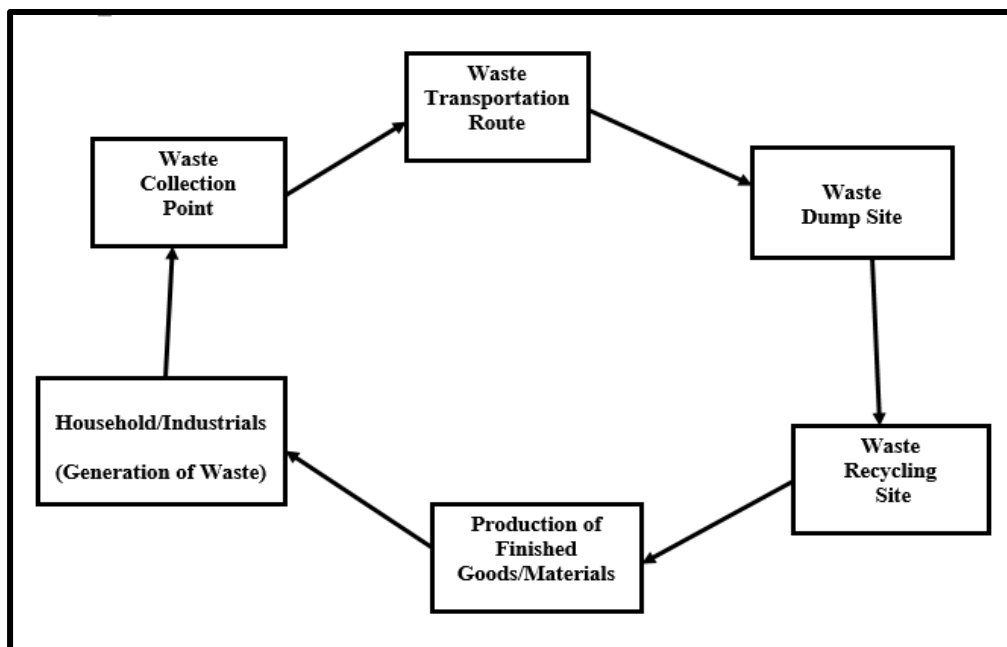


Fig 1: Waste Generation and Management Life Cycle

## VII. ANALYSIS OF THE PROPOSED SYSTEM

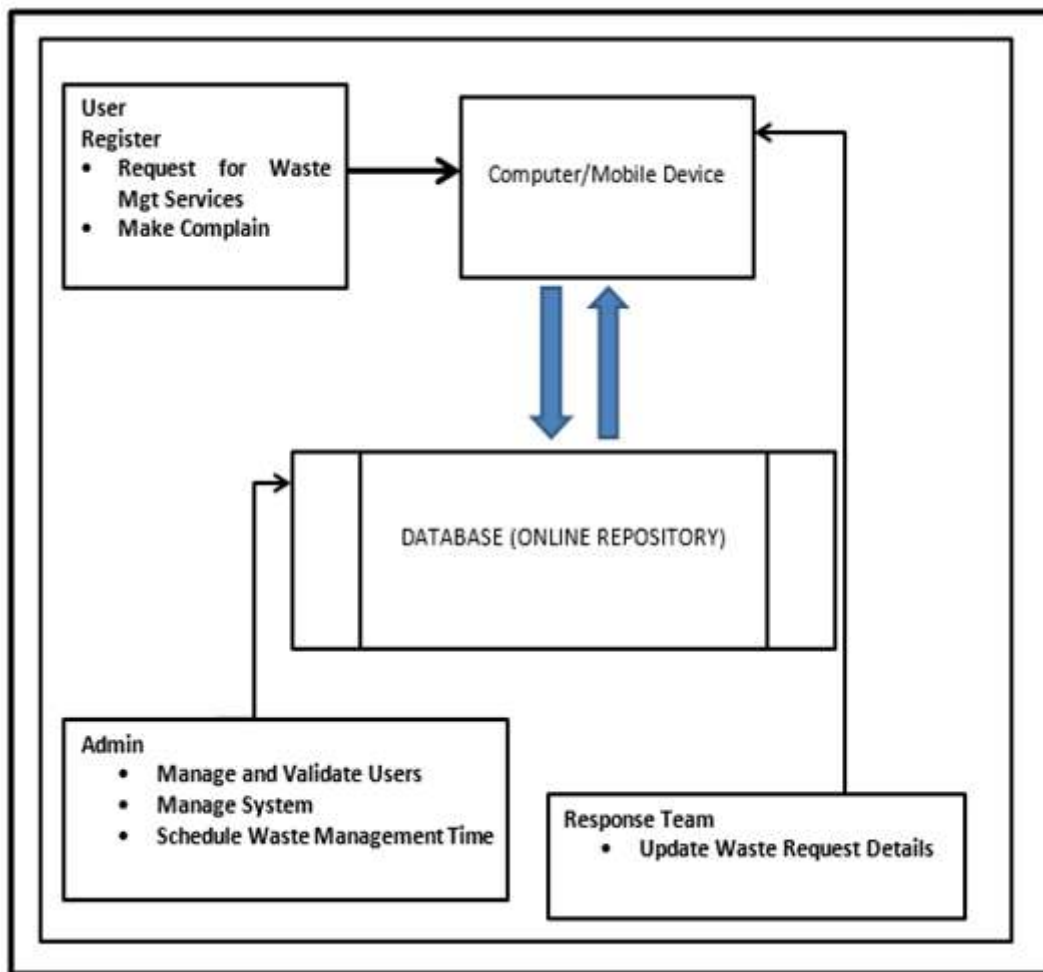
The proposed system is the design and implementation of a novel web based waste control and management platform. The system will be used to keep track and collection different kind of waste and their information generated from various household, industries and other points within a geographical location. The following are the advantages of the proposed system;

- i. It will help bridge the gap caused by time and space of communication between apartments and waste management boards.

- ii. It will reduce cost spent on papers used to keep track of waste management information
- iii. It will promote waste management staffs productivity and efficiency
- iv. It will improve prompt waste collection and disposal.

## VIII. THE SYSTEM ARCHITECTURE

The diagram below show the architecture of the proposed system.



**Fig 2:** The Architecture of the Proposed System

### User

The key participant in the web-centric waste management system is the end user, actively engaged in the platform for various tasks. These tasks include the initial sign-up process, establishing a unique presence within the system, and utilizing the platform for effective waste management. This involvement extends to tasks such as submitting waste disposal requests,

monitoring waste collection schedules, and overseeing their individual user profile.

### Computer/Mobile Device

Functioning as the interactive interface, the computing device or mobile platform within the web-based waste management system serves as the channel through which users seamlessly connect with waste management functionalities. Whether

accessed through a computer or a mobile device, this technologically-driven component provides users with an accessible platform for activities such as submitting waste disposal requests, checking collection schedules, and overseeing their waste-related data.

#### Database (Online Repository)

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#### Administrators

The system administrator holds a pivotal role in ensuring the seamless operation of the web-based waste management system. This skilled overseer is tasked with managing user accounts, monitoring the system's health, and addressing potential challenges associated with waste management processes. Administrators also contribute to system improvements by refining capabilities through the curation and application of relevant waste-related data, aiming to enhance overall efficiency and sustainability.

### IX. HOW THE SYSTEM WORKS

This novel web-based waste control and management platform has been developed to prioritize user efficiency and environmental sustainability. Users actively interact with the platform through their preferred computing devices or mobile interfaces, beginning their journey by registering and utilizing the system for various waste management tasks. This includes submitting waste disposal requests, keeping tabs on collection schedules, and efficiently managing individual profiles. The user-friendly and intuitive technological interface, accessible via web browsers or mobile apps, ensures a seamless navigation experience for waste-related features.

At the system's core is a sophisticated database that serves as a centralized repository, meticulously storing and managing an array of data, ranging from user profiles to recycling records. System administrators, acting as proficient overseers, play a crucial role in ensuring the smooth operation of waste management processes.

They monitor the system's health, address user concerns, and actively contribute to enhancements by analyzing and applying relevant waste-related data. This comprehensive and integrated approach not only optimizes waste management but also aims to elevate the overall effectiveness of the system, fostering a sustainable and user-centric waste management ecosystem.

### X. ALGORITHM OF THE SYSTEM

#### Step 1: Start

**Step 2:** Turn up and internet enabled computer

**Step 3:** visit the uniform Resource Locator of the system

**Step 4:** Click on Registration and register as a user

- i. if user email exists
  - a. User already registered
- ii. Else
  - a. Register User

**Step 5:** Click on User Login after successful registration

- i. If user criteria is valid
  - a. Redirect user to main page
- ii. Else
  - a. Message "Invalid User"

**Step 6:** Waste Management

**Step 7:** Request for Waste Disposer Service

**Step 8:** Receive dates of scheduled Disposal Teams

**Step 8: Stop**

### XI. SYSTEM SOFTWARE REQUIREMENTS

The Software used for the development of this system are stated as below; An Operating System (Window 10 Operating System), Microsoft Visual Studio 2017 (Front end ), Microsoft Access (back end) and Any of the Web browser. Hardware Requirements

The following minimum requirements are needed: Computer System with the following hardware configurations and accessories; Core Duo Celeron and any Core series processor, 1 Terabyte of HDD, 4 Gigabyte of RAM, 1024 X 768 screen resolution, LCD screen

### XII. MAIN MENU DESIGN

The main menu design shows the structure which the system can be accessed from one module to another. It illustrates the overall purpose of the program and shows all modules and sub-modules needed to achieve that purpose as well as the relationship existing among them. The main menu and the respective modules on the platform is shown in the diagram below.

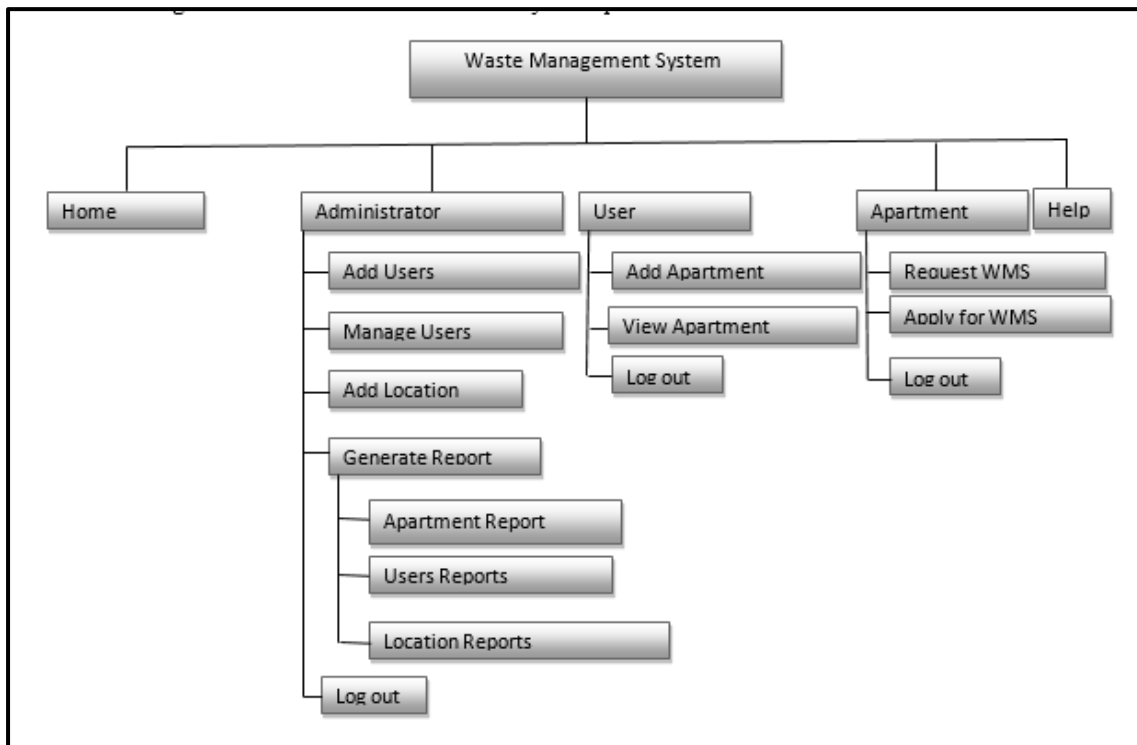


Fig 3: The Main Menu of the System

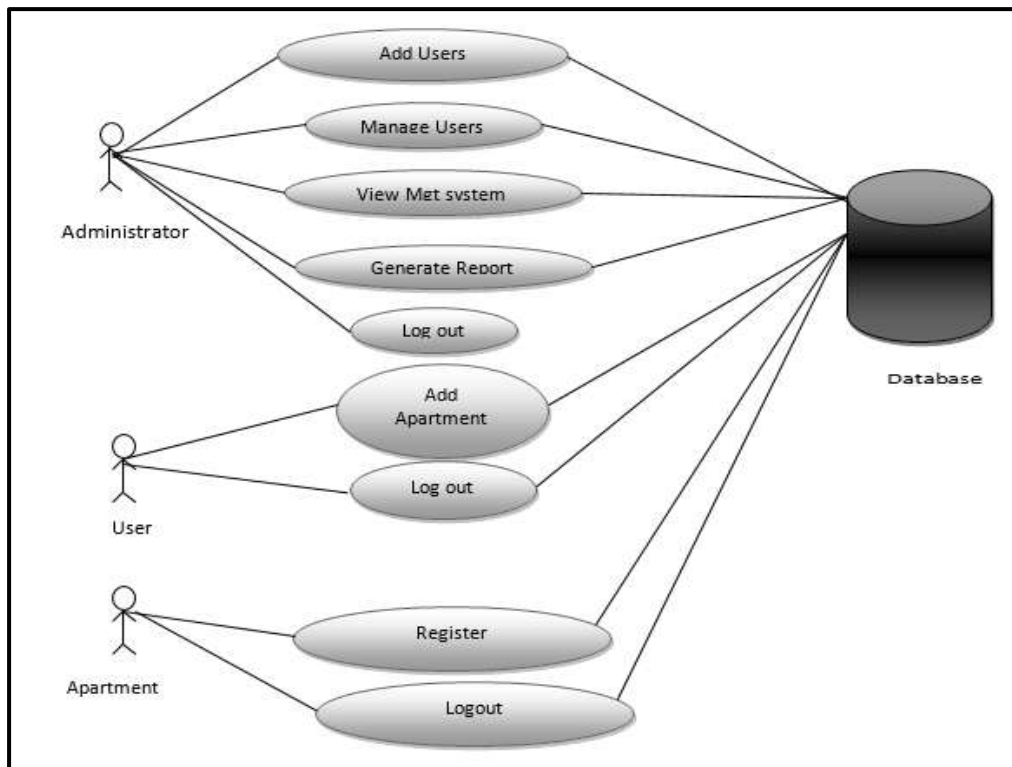


Fig 4: The Activity Diagram of the System

### XIII. SYSTEM IMPLEMENTATION

This system known as a novel web-based waste control and management platform was developed with tools that support web solutions. In this case, ASP.Net, Bootstrap 4.5 (Control mobile devices of different size) JQuery, JAVA Script, C# and CSS are used as the front end tool while SQL Server serves as the backend tool for storing the operation information.

Furthermore, ASP.Net is chosen for the following reasons:

- i. It is suitable for web-based solutions.
- ii. Its supports structured programming methodology which provides for an effective way of organizing the software into self-contained program blocks called modules.
- iii. It makes it easier for errors to be diagnosed and corrected. Simply put, it provides for easy maintenance.
- iv. It makes it easier for components to be easily added or removed from the software as it becomes necessary.

### XIV. RESULTS AND DISCUSSION

Description of Developed System

The web based waste control and management platform will help the reduce waste in the environment.

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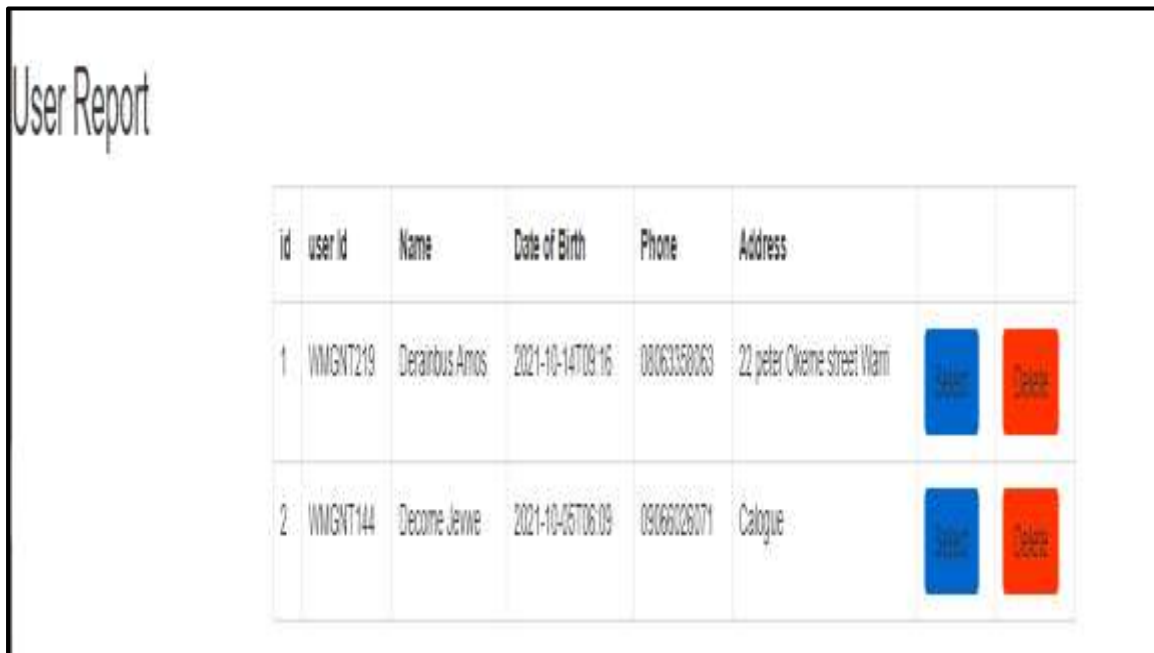
- i. It is suitable for Mobile/Android Based solutions.
- ii. Its supports structured programming methodology which provides for an effective way of organizing the software into self-contained program blocks called modules.
- iii. It makes it easier for errors to be diagnosed and corrected. Simply put, it provides for easy maintenance.
- iv. It makes it easier for components to be easily added or removed from the software as it becomes necessary.

### XV. REQUIREMENTS FOR SYSTEM INSTALLATION/DEPLOYMENT

System requirements is a detailed statement that contains the hard and software requirements of the entire system. Before installing the System, ensure that the following minimum systems requirements are met by the computer systems acquired for this purpose.

### XVI. SYSTEM OUTPUT

Some of the output taken from the system are shown below;



id	user id	Name	Date of Birth	Phone	Address		
1	WMGNT219	Derainbus Amos	2021-10-14T09:16	00063358063	22 peter Okeme street Warri	<input type="button" value="Add"/>	<input type="button" value="Delete"/>
2	WMGNT144	Decome Jevine	2021-10-06T06:09	09066028071	Caloque	<input type="button" value="Add"/>	<input type="button" value="Delete"/>

Fig 5 : User Input

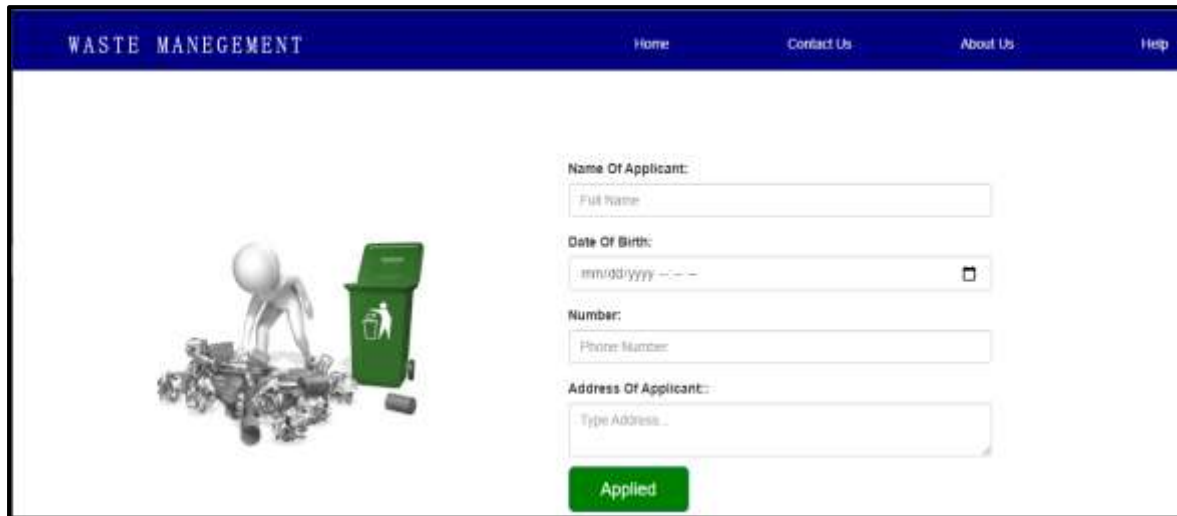


Fig 6: User Information Interface

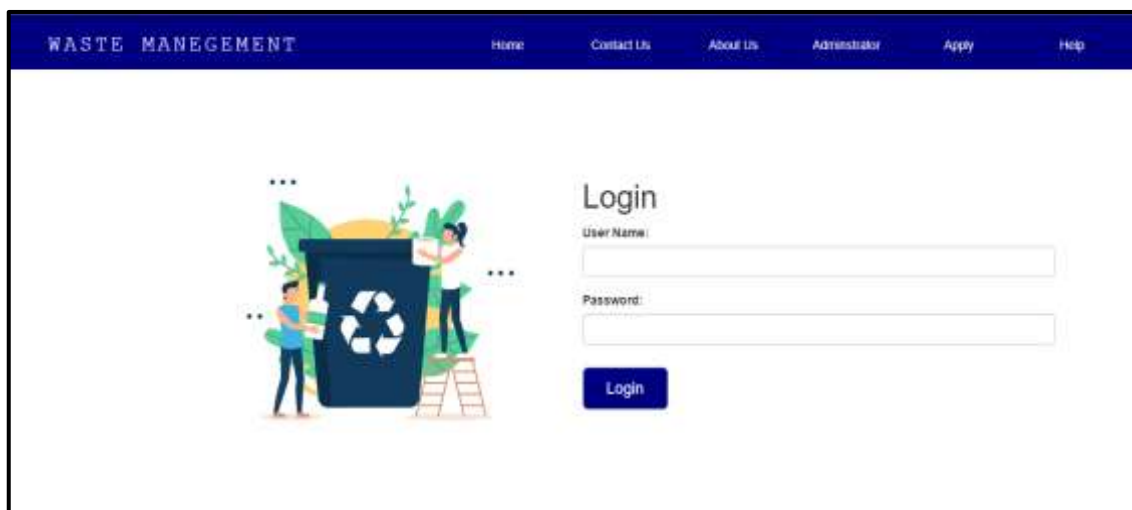


Fig 7: Login Interface

## XVII. OPERATIONAL PROCEDURES (USER'S GUIDE) OF THE SYSTEM

To operate the system effectively, the users need the user's guide. The basic tasks involved in operating the Online Learning System are clearly outlined in the simplified user's guide given below:

How to Add Users

Step 1

The User should power on a computer system that is connected to the internet.

Step 2

The user should launch any web browser of his choice and enter the correct Uniform Resource Locator (URL) to redirect to the Home/Welcome page

Step 3

From the home page click on the Login tab on the menu bar and login as a student.

Step 4 (only already registered user)

## XVIII. SUMMARY/CONCLUSION

In this work, a novel web-based waste control and management platform was developed using the Object-Oriented methodology. The emphasis on obtaining timely information about pill-taking schedules and ensuring customer satisfaction through efficient transaction processes is crucial for an organization's expansion in today's competitive market. With the support of Internet technology, communication devices such as PDAs and full-function mobile phones can easily access the Internet.

Furthermore, governments should actively supports the development of information



technology, especially broadband technology, making the Internet a primary communication medium for various nationwide businesses. Consequently, this work aims to contribute to reducing littering in the environment by providing citizens with a virtual platform to apply for waste management services.

As a recommendation, I suggest further research on this topic, exploring a hybrid web-based approach to waste control and management. This could involve combining machine learning and Geographic Information System (GIS) technologies to enhance the control and management of waste within specific localities. Such an approach holds the potential to bring innovative solutions and efficiencies to waste management processes.

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