**DESIGN AND IMPLEMENTATION OF A COMPUTERIZED RECYCLING SYSTEM FOR PROTECTING THE GREEN ENVIRONMENT**

**ABSTRACT**

*Our earth suffers a lot from the things that are tossed uselessly; these things might be advantageous to our society. Then again, communities across the country endure a lot of waste particularly plastic waste; this has led to environmental pollution and depletion of natural resources. Therefore, this research aims to achieve sustainable development and designing a computerized system to aid in the recycling of waste products. As part of the Nigeria’s vision 2020. The implementation of the Recycle site, will improve waste and plastics disposal in an environmentally positive manner. The proposed system was developed using the HTML & CSS, and the PHP and mySQL programming language for the client server.*

**CHAPTER ONE**

**INTRODUCTION**

* 1. **BACKGROUND OF THE STUDY**

According to Roch man, Browne, in the year 2012 alone, it was estimated that about 280 million tons of plastic has been produced worldwide. From that amount, about 130 million tons of the plastics were land filled or recycled. Of the remaining 150 million tons, plastic will find their place in daily lives of human being. Meanwhile, the rest of the plastic fraction find their final way as litters in the oceans or land filled. Thus, the plastic waste carries genuine natural risk to present day society since it is made up from a few poisonous synthetic concoctions, and subsequently plastic dirties soil, air and water ifa not properly managed or treated. Accordingly, when a large portion of the accessible plastic today is made up from non-biodegradable sources, land-filling by utilizing plastic would mean covering the destructive material for over a period until it naturally degrades. In their unique condition, any plastic materials would build the waste volume during area filling. However, their degradation rate and bulky in nature creates environmental risks tremendously. Besides, the plastic waste mass may hinder the ground water movement. Plastic waste may usually in the form of film and hard plastic may contains harmful metal based elements such heavy metal, at which when mixed up with water or rain water can impede soil and receive water.

Moreover, plastic trash can block the pace of permeation and in turns would fall apart the dirt fruitfulness on the off chance that it is blended with soil. Moreover, plastic waste which is mostly disposed into surface water, public drain, river or sea water can create imbalance of the water and aquatic life.

The idea of recycling began during the First and Second World Wars, when countries suffered from a severe shortage of some basic materials such as rubber, which led to the collection of these waste materials for reuse. After years, recycling became one of the most important methods for waste management; For many years, direct recycling by scrap producers was the basic form of recycling, but by the early 1990s, the focus was on indirect recycling, ie, the manufacture of waste materials to produce other products based on the same raw material as recycling of glass, paper, plastics, aluminum and other materials. Industry experts have found that if recycling programs are taken seriously, they can help reduce the cost of raw materials and operating costs, and improve their image as being guilty for environmental pollution.

After ten years of application of the idea the question about the effectiveness of the process and the best means to get rid of waste has appeared. They have discovered over time that the cost of remanufacturing is high compared to its advantages and returns. The recycled product is usually lower in quality than the primary product used for the first time; also it is not used for the same purposes as the primary product. However, the cost of manufacturing it is higher than the cost of manufacturing the primary product from its raw materials, making the recycling process economically illogical and energy wasting. Where, another method of waste disposal should be sought while at the same time non-renewable raw materials are not wasted. Some ideas already begun to emerge, such as using crushed glass in waste as an alternative to sand in street paving or trying to use waste to generate clean energy. In the future, many other ideas are expected to get rid of waste piles in a way that conserves the environment and does not waste energy. Green parties have emerged in many parts of the country, and many are aware of environmental awareness and a genuine desire to stop the drain of resources. A generation was emerging that knew new vocabulary such as the Ecological System, Global Warming, the Effect Green House, the ozone hole, recycling use, the ozone hole, recycling.

* 1. **STATEMENT OF THE STUDY**

Communities endure a huge amount of waste and this has promoted ecological pollution and depletion of natural resources, and the expansion of this negative phenomena resulting from the use of the wrong methods to get rid of these wastes and the negative consequences on public health and also suffer from plastic waste as it is one of the products manufactured from petrol, Which is used in many industries such as: making cups and dishes, but at the same time it does not decompose easily, it may take millions of years to decompose completely, so it is dangerous to the environment. The negative disposal of these wastes also affects the ozone layer, increasing global warming, increasing the temperature level in general, and burying some of the waste, which leads to soil spoilage, plant death and increases desertification rates.

Therefore the computerized recycling system for protecting green environment will promote the culture of recycling across nations around the world and show it importance to the environment and general public.

* 1. **MOTIVATION OF THE STUDY**

Where the statistics indicate the high per capita consumption will reach 1.39kg per person in 2018, indicating the high consumption of plastic materials, paper and other materials, which will increase the cost of burning and burying these materials and increase the environmental pollution resulting from the burning and will corrupt soil as a result of dumping of non-biodegradable materials. This will increase the percentage of desertification and increase the global warming, which led to the extinction and scarcity of many living creatures. Therefore, recycling processes should be taken seriously to reduce environmental problems and provide a less harmful environment for us and for future generations.

**1.4 AIMS AND OBJECTIVE OF THE STUDY**

The aim of the study is design and implement a computerized recycling system for protecting the green environment with the following objectives:

* Achieving part of the United Nations vision 2020 which aims to achieve environmental sustainability.
* Reducing environmental pollution caused by plastics materials, paper and cans.
* Reduce the human damages caused by pollution of ground and surface water and also soil pollution.

**1.5 DEFINITION OF TERMS**

- **Pollution** - Pollution is the introduction of contaminants into the natural environment that cause adverse change.

- **Green environment**- Green Environment relates to the concerns for environmental conservation and improved health of the environment.

**- Plastics Materials**- Plastic is material consisting of any of a wide range of synthetic or semi-synthetic organic compounds that are malleable and so can be molded into solid objects.

- **Computerized**: convert to a system that is operated or controlled by computer.

- **Decomposed:** (with reference to a chemical compound) break down or cause to break down into component elements or simpler constituents.

- **Clean energy:** energy, as electricity or nuclear power, that does not pollute the atmosphere when used, as opposed to coal and oil, that do.

- **Recycling:** the action or process of converting waste into reusable material.

**CHAPTER 2**

**LITERATURE REVIEW**

**INTRODUCTION**

This chapter will discuss about article review of the proposed project. Literature review is the summary of article that are sourced from reliable articles. This article review is important because it is used to help the developer to build the system, so the developer get some knowledge of the strengths and limitation of the system. All of these helps the developer to choose the best way to develop the system. Researches and analysis an existing system or current system to be done in order to build a good system. For this project, literature review serves the purpose of gathering information related to the development of a computerized recycling system for protecting the environment. This review will focus on the current existing system. The result of the review will serve to better equip the developer with knowledge relevant or essential in the design and planning of the system. It will also discuss the approach that will be used for this project and related research and information about the approach, methodology and tools that will be used to develop this project. Besides that, literature review serves the purpose of gathering information related to the development of a computerized recycling system for protecting the environment. This review will focus on the method how the system will operate by implementing some technologies.

**2.1 HISTORY AND INTRODUCTION OF GREEN COMPUTING**

Green computing is the study and practice of using computing resources efficiently. The goals are reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote recyclability or biodegradability of defunct products and factory waste. Many IT manufacturers and vendors are continuously investing in designing energy efficient computing devices, reducing the use of dangerous materials and encouraging the recyclability of digital devices and paper. Green computing practices came into being in 1992, when the Environmental Protection Agency (EPA) launched the Energy Star program. Green computing is also known as green information technology (green IT). The idea of green computing has been around a good time, the government themselves play a role in it. For example the Environmental Protection Agency (EPA) launched the 'energy star' program in the 90s, to promote energy efficient methods. The EPA today still plays an active role by providing not only energy effective methods, but also cost effective methods for the consumers. In 2006 the EPA established a way to save U.S. households and businesses money; "With an eye to saving U.S. households and businesses more than $1.8 billion in energy costs over the next 5 years, today EPA announced new Energy Star specifications for computers and related equipment. These new modifications are also expected to prevent greenhouse gas emissions equal to the annual emissions of 2.7 million cars."(Jones, 2006) Though the EPA is a recognizable agency, they are not the only ones who promoting new ways of going green in the technological aspect. Organizations such as European Union and TCO Certification are one of the leading groups in green computing.

**2.2 CONCEPT OF GREEN COMPUTING**

Green computing, or green IT, aims to attain economic viability and improve the way computing devices are used. Green IT practices include the development of environmentally sustainable production practices, energy efficient computers and improved disposal and recycling procedures. To promote green computing concepts at all possible levels, the following four complementary approaches are employed:

* **Green Use**: Minimizing the electricity consumption of computers and their peripheral devices and using them in an eco-friendly manner.
* **Green Disposal**: Re-making an existing computer or appropriately disposing of, or recycling, unwanted electronic equipment.
* **Green Design**: Designing energy-efficient computers, servers, printers, projectors and other digital devices.
* **Green Manufacturing:** Minimizing waste during the manufacturing of computers and other subsystems to reduce the environmental impact of these activities.

**2.3 E-WASTE DEFINITION**

E-Waste for short - or Waste Electrical and Electronic Equipment - is the term used to describe old, end-of-life or discarded appliances using electricity. It includes computers, consumer electronics, fridges etc which have been disposed of by their original users. "e-waste" is used as a generic term embracing all types of waste containing electrically powered components. E-Waste contains both valuable materials as well as hazardous materials which require special handling and recycling methods. This guide covers all categories of e-waste but emphasizes categories which contain problematic, scarce and valuable or otherwise interesting materials. Examples: Computers, LCD / CRT screens, cooling appliances, mobile phones, etc., contain precious metals, flame retarded plastics, CFC foams and many other substances.

**2.3.1 E-WASTE MANAGEMENT AND RECYCLING**

E-Waste management practices comprise of various means of final disposal of end-of-life equipment which have different impacts on human health and the environment. It can be distinguished between state-of-the-arte recycling technologies, which comply with high environmental and occupational health standards and hazardous technologies that bear a great risk for both health and the environment and are often applied in countries, where no strict standards exist.

**2.4 RELATED WORK**

**2.4.1 – Tadweer Website for Recycling.**

Tadweer is a web based platform also available in mobile application which collects excess materials from furniture, plastic, paper and other recyclable materials, which are considered as waste materials that can be recycled and sold. The money is then donated to serve charitable projects; the project of Tadweer is currently supporting the following:

1. Watering.
2. Building Churches and Mosques.
3. A fasting breakfast project.

**2.4.2 - Considered Recycling.**

Considered Recycling is a global Orientation Since the increased risks of wastes on the environment through decomposed waste which leads to leakage of toxins into water sources, whether groundwater or surface and soil pollution are affecting the cycle of food as well as pollution of drinking water and thus risk to the safety of communities and companies, considered recycling came as specializing in recycling services.

**2.4.3 – Arab Recycling Company LTD**

Arab Recycling Company LTD is a company specialized in recycling services and the most important products offered by it are carton - plastic - white paper- light Metal. Arab Recycling Company LTD aims to protect nature and human and reduce waste with the opening of new jobs, the most important services are:

1. Collecting waste of Carton, paper, Plastic.

 2. Export materials that are acceptable for recycling to our external customers.

3. Collecting raw materials that acceptable for recycling from suppliers and all available resources.

**2.5 BENEFITS OF RECYCLING**

Recycling raw materials from end-of-life is the most effective solution to the growing e-waste problem. Most electronic devices contain a variety of materials, including metals that can be recovered for future uses. By dismantling and providing reuse possibilities, intact natural resources are conserved and air and water pollution caused by hazardous disposal is avoided. Additionally, recycling reduces the amount of greenhouse gas emissions caused by the manufacturing of new products. Overall the effects of green computing with its benefits, practicality, and uses are all positives. All which are great for not only the individual, but also all around the globe. By going "green" in technology we help promote an ecofriendly and cleaner environment.

**CHAPTER THREE**

**SYSTEM ANALYSIS AND DESIGN**

**3.1 INTRODUCTION**

This chapter discusses the methodology used for developing a computerized recycling system. This chapter also informs and describe about the System Development Life Cycle, software and hardware specification that are needed for implementation and develop the system.

**3.2 SYSTEM ANALYSIS OF THE SYSTEM**

A system is a harmonious arrangement of components hardware and software; that interact to achieve a common goal. (Stella C.C and France A.E., 2006). Analysis is the focus of system development and is the stage when system designers’ works at two levels - what to do and how to do. Analysis of a computerized recycling system involves a detailed study of various operation performed by other related or existing system. Every system is created against at least a particular problem; that is systems are created to solve problems. The computerized e-waste recycling system solves the problem of Recycling raw materials from end-of-life electronics is the most effective solution to the growing e-waste problem.

The existing recycling system is not automated to solve basic recycling challenges, this is, and it uses manual method where a request is usually sent via to the recycling institutions about what items do they recycle, produce for recycling and how to get the items across for recycling. In comparison with the existing system, the computerized recycling system is an automated system that simplifies the activities of the manual system with better integration and is more updated than the existing systems activities. This automated system is designed and developed with Hypertext Preprocessor (PHP) as it language, MYSQL, HTML, AJAX, and JAVASCRIPT Technologies. System analysis squarely deals with the software development activities. Three basic stages are involved in designing and delivering a good driving school information system (and any other system), namely;

1. A thorough analysis of the system. A problem understood is half solved.
2. Development of an effective automated system for recycling waste to save the environment; to meet requirement in an effective and efficient way.
3. Developing, installation, testing of system components, training, management, programming, monitoring and delivery the system; into production yields to successful construction and implementation of the system in the user’s environment.

**3.3 CONSTRAINTS OF THE EXISTING SYSTEM**

The existing system which is not an automated system of recycling waste is associated with the following constraints or problems;

1. Unreliability: The existing system can be manipulated since it is not automated and can affect the process of verification.
2. Speed: this has to do with time, it takes longer time to send an application for items you want to recycle, then you’ll wait for verification and the reply thereof when all your submission is verified compared to the automated recycle system. The speed of the existing system is a snail’s speed.
3. It increases paper work since it is not an automated system. The paper work of the existing system is far greater than the paper work of the automated system.
4. During the process of application for verification and reply to application, some important and vital document might be lost.

**3.4 PROPOSED SYSTEM DESIGN**

The Computerized recycling system for protecting the green environment system is the proposal system and it is designed for institution of learning and be used by every country or community in the world ready to recycle their waste and save earth. The system is designed to achieve the establishment objectives of the proposal system.

**3.4.1 INPUT DESIGN**

For there to be an output, there must be an input which must be processed to yield the required output. The input document used to record information of computerized recycling system for protecting the green environment and to verify basic information thereafter makes up the input forms.

The supplied data on the input forms servers as the input to the system. These inputs are submitted to the systems database and comparison is made with the pre-stored data in the database.

The verification form is shown on the clicking of any of the sub-menus. The required fields used as inputs in this form include the recycler information.

**FIRST NAME**

**LAST NAME**

**Address**

**country**

**state**

**city**

**phone**

**number**

**age**

**item to recycle**

**SUBMIT**

Fig 3.1 – Input form to Register Item to Recycle

**3.4.2 INTERFACE DESIGN**

The programming languages utilized in this work is HTML, CSS and PHP programming language. The programming language was chosen relying on the languages features which make them more suitable for this work. In the proposed system, the user starts with the registration in the system; after that the system offers the user a form for login and the user has to enter the information required as shown figure 3.1. If the information is found correct by in the database, it displays to the user the system homepage and allows the user to make use of the proposed system. However, if it’s not valid, the user will be redirected to the login page. The Interface Design is the front and of the system, which the users of the system interacts with, it comprises of both inputs and output forms. The interface of the system is a graphical user interface and not a command type; it is also an interactive, clear and not clumsy.

**3.4.3 OUTPUT DESIGN**

After recycler information has been inputted into the system, recycling institutions can view their items to be recycled, and request the user to send it in. This form that shows the output (result) is the output form.

**3.4.5 SYSTEM DATABASE DESIGN**

Database is a repository for data and information in an organized way to prevent redundancy and to preserve data integrity amongst others. The design and implementation of the database is done on MYSQL server engine. This database consists of tables.

The name of the database is ‘recycle\_data’ and it has 22 tables in which 1 table will be displayed here as an analysis.

|  |  |
| --- | --- |
| **Fields** | **Data type** |
|  |  |
| id | int |
|  |  |
| first\_name | varchar |
|  |  |
| Last\_name | varchar |
|  |  |
|  address |  Varchar |
|  country |  Varchar |
|  state |  Varchar |
|  city |  varchar |
|  phone |  Varchar |
|  age |  varchar |
|  Item\_recycle |  varchar |

Table: Items\_data

**3.5 TECHNOLOGY, TOOLS AND PROGRAMMING LANGUAGE USED**

The Web based application are developed systems or applications that are objects oriented and can run on a web environment. Thus, it needs or no internet connection if hosted on a local server like xampp.

Hypertext Preprocessor (PHP) is an integrated Development Environment (IDE) developed for web programming. it can be used for development of different things such as, console programs, GUI (Graphical User Interface) application, web sites, web pages, web application and services (native code and managed codes and included).

PHP is an object oriental programming language used for developing a variety of applications that runs on web framework. PHP and Javascript is simple, powerful, type-safe objective oriented and encourages Rapid Application Development (RAD).

MYSQL server is a relational database management system (RDMBS) developed for database entry. It runs as a server giving access to a number of databases. The SQL is an acronym for structured Query Language, pronounced officially as “S.Q.L” but one often pronounced as “S-equ-el”.

**CHAPTER FOUR**

**DESIGN AND IMPLEMENTATION**

**4.0 INTRODUCTION**

This chapter focuses, on the requirements for this automated system’s implementation. Information about the installation is also discussed, moreover, the automated system is described in UML (Unified Modeling Language) and the use case diagram is given.

An automated system that is not implemental or is not successful implemented cannot be used to perform well as the case may be. “Even after the development phase is over, the system project isn’t complete. The new system must be implemented or installed” (said Stella C.C. and Franca A.E, (2006)).

**4.1 SYSTEM DESIGN**

This automated system is designed using the SSADM (Structured System Analysis and Design Methodology and RAD (Rapid Application Development) Model which are object oriented. The UML which was formulated by Booch, Rumbaugh and Jacobson in 1997 is used to describe the system and the use Case diagram shows the system design (Detail Design or design Overview). UML is a language for specifying, visualizing and constructing the artifacts of software system. A Use case diagram is one of the UML diagrams. Others are sequence diagram, state diagram, collaboration diagram and so on.

A use case diagram shows typical interactions between a user (actor) and the computer system. As defined by Stella C. C. and Franca A.E. (2006) in their book principle of system analysis and design, use case are included in UML and it is a narrative document that describes the sequence of event of an actor using a system to complete a process.

**4.1.2 USE CASE DIAGRAM**

The Use-Case Model depicts system requirements. Use-case captures the communication between system, users and other stakeholders in order to achieve the internal goal of the system. It shows the interaction between the system and the external entities. The actors are external entities are represent roles. They could be external hardware, human users or other systems users.



Figure 4: Use Case Diagram of the proposed system

**4.2 SYSTEM IMPLEMENTATION**

Designing or developing a system is one thing, another is implementing, not just implementing it, but the successful implementation. Implementation of any information system or automated system depends on the hardware, software and people. Hence, the hardware being mainly a personal computer (PC) with printers, scanners and any peripheral that is needed. The software for the implementation of this automated system is MySQL server which serves as the database but there is no need for this software if a recycler or an organization desires to make use of it. The web browser must be an eligible to view the web system. The people consist of the users of the system which encompasses of Administrators, organization or single recycler. All the users must be trained and computer literates else the system’s aim and objective will be defeated.

**4.3 HARDWARE REQUIREMENT**

The following hardware components are needed:

* Personal computer (PC) – a desktop or laptop
* Printer – a desk jet or inkjet
* Scanner – Preferably color scanner pictures.

The personal computer should have a minimum of

* Pentium 4 Processor
* 512 kb RAM
* GB Hard disk

**4.4 SOFTWARE REQUIREMENTS**

The needed software is as follows:

* Web browser
* MySQL Server. (Xampp or Wampp)
* Text Editor.

**4.5 SYSTEM TESTING**

Before a system is put into operation, its components programs must be tested to make sure. They work both individually and as a unit. Testing whether unit testing (individual testing) or individual testing, removes bugs from individual programs and system application. The testing of this system is done with life data and test data. An automated system may have a hundred programs and a comprehensive database, all must be tested together to ensure harmony of operation. The purpose of system testing is to validate all software, input/output, databases and procedures and so on as the case may be.

**4.6 SYSTEM REVIEW AND MAINTENANCE**

After successful testing and implementation, system review and maintenance is necessary to do check and balances and for the following.

* Comparison of the system’s actual performance versus the anticipated performance objectives.
* Assessment of each facet of the system with respect to present criteria.
* Correction of any error that may occur after its use on a monthly base.
* Updating of new features.
* Unexpected problems.

**4.7 INSTALLATION PROCEDURE**

After development of the system, the software can be hosted on a live server, or ran on a local host of a computer system. This software does no open on its own but open on the users demand by entering the link to access the system on a browser.

**4.8 USERS GUIDE**

Users of the software should take the following as a guide:

* Avoid the use of this software by a computer illiterate
* Ensure that the computer hardware and software meets the hardware requirements and software requirement as stipulated in 4.4 and 4.5 respectively.
* Regular maintenance should be done on the software to avoid unexpected problems.

Input Data – Master Entry

Processor

Disk

Storage

Output (Report)

Result to Screen

Input From the

Keyboard

Figure 4.1: The System Flowchart



Figure 4.2: The Program Flowchart

**CHAPTER FIVE**

**SUMMARY AND CONCLUSION**

**5.0 SUMMARY**

The computerized recycling system for protecting the green environment is a major and important system to save our precious planet from climate change activities. The current system that has been in existence is not automated and cannot handle the current challenges facing our planet, in which also has many defects as mentioned earlier in section 3.3 of this research. The merits of this automated system over the existing one are as follows:

1. Save our planet from climate change caused by not recycling used plastics can, paper, wears, burning of fossil fuel and many more.
2. Accuracy
3. Reliability
4. Reduced paper work
5. Speed in processing time
6. It cannot be manipulated
7. Simple process
8. User’s friendliness with GUI

**5.2 RECOMMENDATION**

This work should not put a stop to research on making our planet earth a better place to live using technology as artificial intelligence, recycle machines at major stations across cities over the globe can be integrated to the technology used in this system.

Despite the fact that the system is a web based system, it can be re-developed into a mobile application running on android and IOS phones to easily make it available for anyone across the world to access and recycle their old properties recyclable. Also security measures should be put in place to avert web hackers and theft.

Also, we strongly recommend this software for anyone interested in recycling old or used properties into reusable items across the world.

**5.3 CONCLUSION**

The results of this study show the importance of recycling and its impact on the environment and the extent of community interest in this issue and their support. We have analyzed the use of a web based recycling system to help. We also designed the pages for the site (Home, Login, Registration, Products, etc.) for the computerized system, this site combines the recycler and the recycling institution through several specifications. The web based system will improve waste and plastics disposal in an environmentally positive manner.

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