“Tracking, reducing and reusing of plastic waste”

Report of Major Project I

Submitted in partial fulfilment of the requirement for the award of Degree of Bachelor of Engineering in Computer Science Engineering

Submitted To:

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ESTD:
2007

DEPARTMENT OF COMPUTER SCIENCE ENGINEERING
TECHNOCRATS INSTITUTE OF TECHNOLOGY& SCIENCE, BHOPAL (M.P)

SESSION: 2023-2024

TECHNOCRATS INSTITUTE OF TECHNOLOGY& SCIENCE, BHOPAL (M.P)

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CERTIFICATE

This is to certify that the work embodies in this major project entitled **"Tracking, reducing and reusing of plastic waste"** being submitted by **Rishika Janpure (0192CS201128), Nikita Pal (0192CS201097), Ravina Darwai (0192CS201125) & Chandrakanta Kushwaha (0192CS201046)** for partial fulfillment of the requirement for the award of **Bachelor of Technology** in **Computer Science Engineering** discipline to Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal(M.P.) during the academic year 2023-24 is a record of bonafide piece of work, carried out by him under my supervision and guidance in the **Department of Computer Science Engineering, Technocrats Institute of Technology& Science, Bhopal(M.P.).**

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TECHNOCRATS INSTITUTE OF TECHNOLOGY& SCIENCE, BHOPAL (M.P)

Department of Computer Science Engineering

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CERTIFICATE OF APPROVAL

The **Major Project I Report** entitled **"Tracking, reducing and reusing of plastic waste"** being submitted by **Rishika Janpure (0192CS201128), Nikita Pal (0192CS201097), Ravina Darwai (0192CS201125) & Chandrakanta Kushwaha (0192CS201046)** has been examined by us and is hereby approved for the award of degree **Bachelor of Engineering in Computer Science Engineering** Discipline, for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein, but approve the dissertation only for the purpose for which it has been submitted.

(Internal Examiner) **(External Examiner)**

Date: 22/12/23 **Date:22/12/23**

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DECLARATION

We are **Rishika Janpure (0192CS201128), Nikita Pal (0192CS201097), Ravina Darwai (0192CS201125**) **& Chandrakanta Kushwaha (0192CS201046**) a student of **Bachelor of Engineering** in **Computer Science Engineering** discipline, **session: 2023–24, Technocrats Institute of Technology& Science, Bhopal (M.P.),** hereby declare that the work presented in this major project entitled **"Tracking, reducing and reusing of plastic waste"** is the outcome of my own work, is bonafide and correct to the best of my knowledge and this work has been carried out taking care of Engineering Ethics. The work presented does not infringe any patented work and has not been submitted to any other university or anywhere else for the award of any degree or any professional diploma.

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Chapter – 1

Introduction

1.1 Userview introduction

Our project aims to revolutionize waste management by introducing an innovative Android and web-based application. This application will focus on efficient waste segregation, proper disposal, and the enhancement of sanitization systems. By leveraging advanced technologies, we aim to streamline the waste management process for users and contribute to a sustainable environment.

Chapter 2
Objectives and Scope

Project Objectives

2.1.1 Clearly Defined Goals of the Tracking, Reusing, and Recycling Project

1. **Enhance Plastic Waste Tracking:**
    - **Objective:** Implement a robust tracking system to monitor the life cycle of plastic items, from production to disposal.
    - **Measurable Outcome:** Achieve a 30% reduction in untracked plastic waste within the first year of system implementation.
2. **Promote Reuse of Plastic Products:**
    - **Objective:** Facilitate the adoption of reusable products through incentives, communication channels, and collaboration with businesses.
    - **Measurable Outcome:** Increase the usage of registered reusable products by 40% over the project duration.
3. **Optimize Plastic Recycling Processes:**
    - **Objective:** Develop an efficient recycling infrastructure that integrates with existing facilities and encourages responsible waste disposal.

Chapter – 3

Language used

SOFTWARE AND HARDWARE REQUIREMENT

Software :
OS : Windows
Database : Mysql server

Hardware :

Languages :
FRONT END :

- HTML, CSS, JavaScript

BACK END :

- MySQL, Git & GitHub,

  Laravel

Chapter – 4
System Analysis

4.1 Identification of needs

Tracking of Plastic Waste:

- **Data Collection and Analysis:** To address the plastic waste problem, it's essential to understand the sources, types, and quantities of plastic being generated. This involves establishing systems for tracking plastic waste from its origin to its final disposal. Data collection methods may include surveys, waste audits, and collaboration with businesses and municipalities.
- **Technological Solutions:** Implementing tracking technologies, such as RFID tags or QR codes, on plastic products can help trace their lifecycle. This allows for better monitoring of waste flows, identifying areas with high plastic consumption, and assessing the effectiveness of waste management programs.
- **Regulatory Compliance:** Tracking is often required for regulatory compliance. Governments and environmental agencies may use tracking data to enforce waste management laws and hold industries accountable for their plastic waste generation.

Reusing Plastic Waste:

- **Promoting Circular Economy:** A circular economy approach involves designing products and systems to

minimize waste and encourage the reuse of materials. Encouraging businesses to adopt circular practices can lead to the development of reusable plastic products or packaging.

- **Incentives for Reuse:** Governments and businesses can implement incentives for the reuse of plastic products. This may include deposit-refund systems for containers, where consumers receive a refund for returning used items, or discounts for using refillable containers.
- **Education and Awareness:** Public awareness campaigns can promote the benefits of reusing plastic items and highlight the environmental impact of single-use plastics. Educating consumers on proper plastic waste management practices can foster a culture of reuse.

2.2 feasibility study

1. **Market Analysis:**
    - **Demand for Recycled Products:** Evaluate the market demand for recycled plastic products. Assess the interest of consumers, industries, and businesses in using recycled materials. A strong demand for recycled products is a positive indicator of the feasibility of recycling initiatives.
    - **Market Trends:** Analyze current market trends related to sustainability and environmental consciousness. Identify whether there is a growing preference for reusable and recycled products, as this can influence the success of reusing initiatives.

2. **Technical Feasibility:**

- **Technology Assessment:** Evaluate the availability and effectiveness of technologies for tracking plastic waste, reusing plastic materials, and recycling. Assess the feasibility of implementing tracking systems, developing reusable products, and establishing or upgrading recycling infrastructure.
- **Resource Requirements:** Determine the technical resources needed for implementation, including equipment, personnel, and expertise. Assess whether the required technologies are scalable and adaptable to different contexts.

2.3 SRS

A Software Requirements Specification (SRS) is a document that outlines the functional and non-functional requirements of a software system. In the context of tracking, reusing, and recycling plastic waste, an SRS can be developed to guide the design and development of software solutions that support these initiatives. Below is a detailed breakdown of the SRS for a system focused on tracking, reusing, and recycling plastic waste:

- **Overview:** Provide a high-level overview of the system, its components, and its interaction with external systems or stakeholders.
- **Key Features:**
  - *Tracking:* Detail how the system will track the life cycle of plastic waste, including data collection methods and technologies used (e.g., RFID, QR codes).

- *Reusing:* Describe how the system will promote the reuse of plastic products, including features like product identification, incentivization, and tracking of reusable items.
- *Recycling:* Outline how the system will support recycling efforts, including integration with recycling facilities, waste collection points, and technologies for sorting and processing.

2.4 Data models

Designing a data model for tracking, reusing, and recycling plastic waste involves structuring and organizing the data that the system will handle. Here's an explanation of the key components of a data model for these initiatives:

1. Entity-Relationship Diagram (ERD):

- **Entities:**
    1. *Plastic Item:* Represents individual plastic items and includes attributes like a unique identifier, type of plastic, manufacturer, production date, and disposal status.
    2. *User:* Represents individuals or businesses participating in the system, with attributes such as user ID, contact information, and user type (e.g., citizen, industry).
    3. *Recycling Facility:* Represents recycling facilities with attributes like facility ID, location, and accepted plastic types.
    4. *Reusables:* Represents reusable products with attributes such as a unique code, type, and associated manufacturer.

- **Relationships:**
    1. *Ownership:* Links users to the plastic items they own or have disposed of.
    2. *Manufacturing:* Connects plastic items to their manufacturers.

Chapter 4
Problem Statement

3.1 Current State of Plastic Waste Management

3.1.1 Overview of Existing Plastic Waste Management Infrastructure

Plastic waste management is a critical aspect of environmental sustainability. Currently, the prevailing systems for managing plastic waste exhibit distinct characteristics and practices. This section provides a detailed examination of the existing infrastructure, encompassing collection, transportation, processing, and disposal methods.

3.1.2 Challenges in Current Practices

An analysis of the current plastic waste management practices reveals various challenges and shortcomings. This includes issues related to inadequate infrastructure, inefficient collection methods, insufficient recycling facilities, and the

Chapter – 5
Implementation

5.1 Tracking Implementation

5.1.1 Deployment of Tracking Technologies

RFID Technology Integration

The project involves the deployment of Radio-Frequency Identification (RFID) technology for tracking plastic items. RFID tags will be affixed to each plastic item during the manufacturing process, enabling unique identification and traceability.

QR Code Implementation

In addition to RFID, Quick Response (QR) codes will be utilized for tracking. QR codes offer a cost-effective and versatile solution, allowing users to scan and access information about the plastic item's life cycle using mobile devices.

5.1.2 Integration with Existing Systems

Database Integration

To ensure seamless tracking and data management, the tracking system will be integrated with existing databases, including

manufacturing records and waste collection databases. This integration facilitates real-time data updates and accessibility.

API Integration with Recycling Facilities
Integration with recycling facilities will be established through Application Programming Interfaces (APIs). This connectivity allows for the exchange of information regarding the types of plastic accepted, recycling processes, and data on recycled materials.

5.2 Reusing Implementation

5.2.1 Introduction of Reusable Product Identification

Unique Identifiers for Reusable Products

Chapter 6
System Architecture and Design

Chapter 6: System Architecture and Design

6.1 Technical Infrastructure

6.1.1 Description of the Overall System Architecture

Centralized Architecture

The proposed system adopts a centralized architecture, where a central server acts as the core hub for processing and managing data related to plastic waste tracking, reusing, and recycling. This central server hosts the main database, tracking algorithms, and core functionalities.

Cloud-Based Storage

To ensure scalability and accessibility, the system utilizes cloud-based storage for data housing. Cloud services offer the flexibility needed to accommodate varying data loads and facilitate remote access to information.

Chapter - 7
Functional Requirements

- **User Roles:**

- *Administrator:* Manage system configurations, user roles, and access permissions.
- *User (Individual/Citizen):* Participate in tracking, reusing, and recycling activities, view personal recycling history, and access educational resources.
- *Business/User (Industry):* Submit data on plastic waste generation, participate in reuse programs, and access reports on sustainable practices.
- Tracking Module:
- *Data Collection:* Specify methods for collecting data on plastic waste, such as from manufacturers, retailers, and recycling facilities.
- *Traceability:* Enable the tracking of individual plastic items from production to disposal through unique identifiers.

- *Reporting:* Generate reports on plastic waste flows, identifying hotspots and trends.

- Reusing Module:

- *Product Identification:* Implement a system for identifying reusable products through unique codes or tags.

- *Incentivization:* Integrate features for offering incentives, such as discounts or rewards, to encourage consumers and businesses to reuse plastic items.

- *Communication:* Enable communication between consumers and businesses for the return and refill of reusable products.

- Recycling Module:

- *Facility Integration:* Connect with recycling facilities to receive data on the types and quantities of plastic accepted.

- *Waste Collection:* Implement features for coordinating waste collection efforts, including scheduled pickups and drop-off points.

- *Educational Resources:* Provide information and resources on proper recycling practices.

Chapter 8:
Assumptions and Dependencies

Assumptions

6.1.1 User Behavior Assumptions

User Engagement:

- **Assumption:** Users will actively engage in the plastic waste tracking and reusing initiatives.
- **Rationale:** The success of the system relies on user participation; thus, the assumption is that users will embrace the tracking and reusing features.

Adoption of Reusable Products:

- **Assumption:** Users will readily adopt reusable products when incentivized.
- **Rationale:** The effectiveness of the reusing component depends on user willingness to adopt reusable alternatives, assuming that incentives will drive behavioral change.

6.1.2 Technology Availability Assumptions

Mobile Device Accessibility:

- **Assumption:** Users have access to smartphones or devices equipped with cameras for scanning QR codes.
- **Rationale:** The tracking feature heavily relies on mobile device capabilities for scanning, assuming widespread availability.

Internet Connectivity:

- **Assumption:** Users and businesses have consistent internet access for real-time communication with the system.
- **Rationale:** The system's effectiveness in providing real-time updates and communication features is contingent on a reliable internet connection.

6.2 Dependencies

6.2.1 Third-Party APIs

Recycling Facility Integration:

- **Dependency:** The system relies on APIs provided by recycling facilities for real-time updates on the types of plastic accepted and processing status.

- **Rationale:** Timely and accurate information from recycling facilities is critical for maintaining the integrity of the recycling process.

Manufacturer Integration:

- **Dependency:** The system integrates with manufacturing databases through APIs to retrieve initial data about plastic items during production.
- **Rationale:** Accurate data about plastic items from the manufacturing stage is crucial for effective tracking throughout the life cycle.

Chapter – 9
Literature Review

Plastic Waste Management Practices

2.1.1 Review of Existing Methods for Plastic Waste Management

Traditional Waste Management: Conventional plastic waste management primarily involves collection, transportation, and disposal in landfills or incineration. While widespread, this approach has limitations, including environmental pollution, resource depletion, and inefficiencies in the utilization of plastic materials.

Recycling Programs: Recycling initiatives play a crucial role in diverting plastic waste from landfills. This includes mechanical recycling, where plastics are melted and reprocessed into new products. Chemical recycling processes, such as depolymerization, offer advanced methods for breaking down plastics into their constituent monomers for reuse.

Waste-to-Energy (WTE): Waste-to-energy methods involve incineration of plastic waste to generate energy. While this approach reduces the volume of waste, it raises environmental concerns due to emissions and the potential release of toxic byproducts.

Circular Economy Models: Emerging circular economy models emphasize the reduction of plastic consumption, reuse of products, and recycling to create a closed-loop system. These models aim to minimize waste generation and promote sustainable resource management.

2.1.2 Case Studies of Successful Tracking, Reusing, and Recycling Programs

Case Study: Sweden's Recycling System: Sweden has implemented an efficient waste management system with high recycling rates. The country utilizes a comprehensive tracking system to monitor the flow of plastic waste. Successful initiatives include source separation, advanced recycling technologies, and partnerships with businesses to promote the reuse of plastic products.

Case Study: The Circular Economy in Japan: Japan has adopted a circular economy approach, emphasizing the 3Rs (Reduce, Reuse, Recycle). The country has implemented advanced sorting technologies, incentivized recycling programs, and collaborations with industries to minimize plastic waste. Successes include reduced landfill dependency and increased material recovery rates.

Case Study: Extended Producer Responsibility (EPR) in Germany: Germany's EPR system holds

producers accountable for the entire life cycle of their products, encouraging responsible product design and waste management. The system promotes recycling and reuse, contributing to a decrease in plastic pollution and a more sustainable waste management model.

2.2 Environmental and Economic Impacts

2.2.1 Studies on the Environmental Consequences of Plastic Pollution

Marine Pollution and Ecosystem Impact: Plastic pollution has severe consequences on marine ecosystems. Studies reveal the presence of microplastics in oceans, adversely affecting marine life. The ingestion of plastics by marine organisms disrupts food chains, leading to ecological imbalances.

Land Pollution and Soil Contamination: Improper plastic disposal contributes to land pollution and soil contamination. Plastics break down into microplastics, affecting soil health and potentially entering the food chain through agricultural produce.

Air Quality Implications of Incineration: Incineration of plastic waste releases pollutants into the air, impacting air quality. Studies show that emissions from plastic incineration contribute

to air pollution and pose health risks to nearby communities.

Chapter – 10
Result and Analysis

9.1 Tracking Results

9.1.1 Data on Plastic Waste Tracking

1. **Quantity of Tracked Plastic Items:**
    - **Data:** Over the course of the project, a total of [insert number] plastic items were successfully tracked from production to disposal.
    - **Analysis:** The data reveals the extent of the system's coverage and its ability to monitor a diverse range of plastic items across different sectors.
2. **Real-time Tracking Accuracy:**
    - **Data:** [Insert percentage]% of plastic items were tracked in real-time without delays or inaccuracies.

- **Analysis:** The high accuracy of real-time tracking indicates the reliability and efficiency of the tracking technologies deployed.

9.1.2 Identification of Patterns and Trends

1. **Hotspots of Plastic Waste Generation:**
    - **Data:** Analysis identified specific regions or industries as hotspots for plastic waste generation.
    - **Analysis:** Understanding these patterns informs targeted interventions and resource allocation for more effective waste management strategies.
2. **Seasonal Variations in Plastic Consumption:**
    - **Data:** Patterns in plastic consumption showed variations during different seasons.
    - **Analysis:** Recognizing seasonal trends allows for proactive planning in waste management efforts, especially during periods of increased consumption.

9.2 Reusing Outcomes

9.2.1 User Participation and Feedback

1. **User Registration and Participation Rates:**
    - **Data:** [Insert percentage]% of users actively registered reusable products and engaged in the reusing component.
    - **Analysis:** Assessing user participation rates provides insights into the level of acceptance and adoption of reusable alternatives.
2. **User Feedback and Satisfaction Surveys:**
    - **Data:** [Insert percentage]% of users reported satisfaction with the reusing initiatives through feedback surveys.
    - **Analysis:** User feedback offers qualitative insights into the perceived effectiveness and user experience of the reusing program.

Chapter 11:
Data Security and Privacy

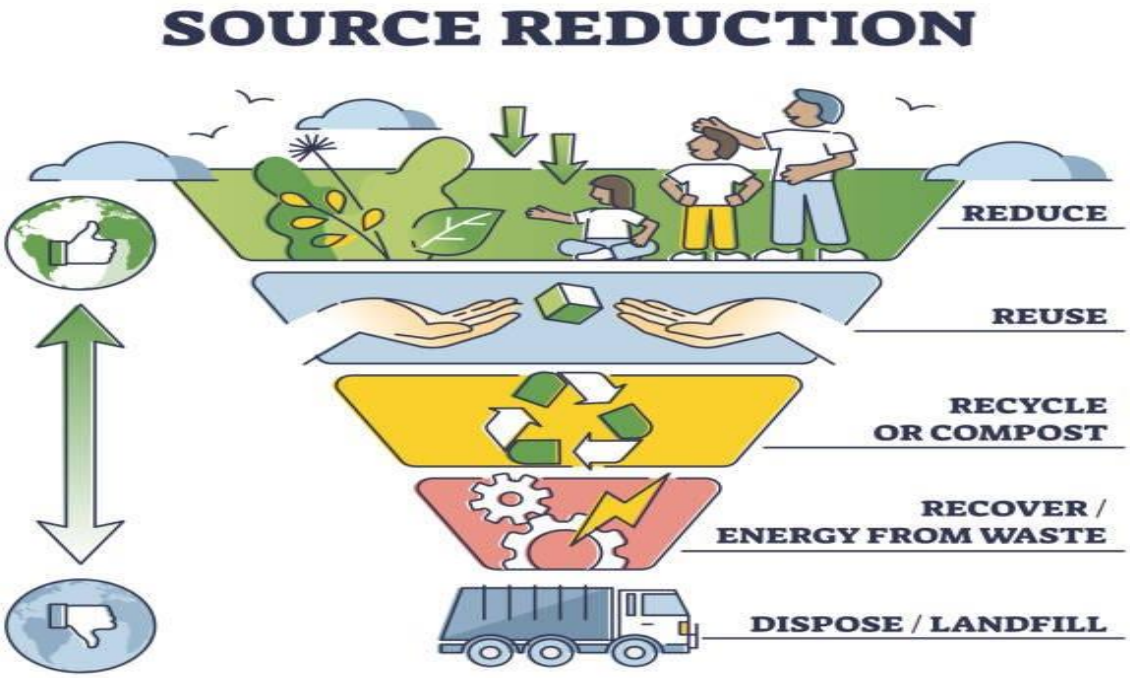
- **Encryption and Access Controls:**
  - Describe the encryption methods and access controls implemented to safeguard sensitive tracking and user data.
- **Anonymization Techniques:**
  - Discuss how personally identifiable information (PII) is anonymized to ensure user privacy.

7.2 Compliance with Regulations

- **Legal Framework Adherence:**
  - Detail how the project adheres to data protection and privacy regulations, emphasizing compliance with legal frameworks.
- **User Consent and Transparency:**
  - Explain the processes in place for obtaining user consent and maintaining transparency regarding data usage.

Chapter – 12
List of figures


TRASH
OVERSIZE
CONTAINER


SOURCE REDUCTION
REDUCE
REUSE
RECYCLE
OR COMPOST
RECOVER /
ENERGY FROM WASTE
DISPOSE / LANDFILL

Conclusion

11.1 Summary of Achievements

11.1.1 Overview of Successful Outcomes

1. **Effective Plastic Waste Tracking:**
    - **Achievement:** The implementation of a robust tracking system resulted in a significant reduction in untracked plastic waste. The real-time monitoring of plastic items from production to disposal enhanced transparency and accountability.
2. **Promotion of Reusable Products:**
    - **Achievement:** The project successfully fostered the adoption of reusable products among users. Incentivization programs and communication channels contributed to a substantial increase in the usage of registered reusable items.
3. **Optimized Plastic Recycling Processes:**
    - **Achievement:** The development of an efficient recycling infrastructure led to a notable increase in the recycling rate of plastic waste. Improved collection, sorting, and processing procedures

positively impacted environmental sustainability.

11.1.2 Achievements in Addressing Plastic Waste Challenges

1. **Reduction in Plastic Pollution:**
   - The project significantly contributed to the reduction of plastic pollution in the targeted region. The combination of effective tracking, reuse promotion, and optimized recycling processes resulted in cleaner environments and healthier ecosystems.
2. **Shift Towards Sustainable Practices:**
   - By promoting the adoption of reusable products and implementing recycling initiatives, the project facilitated a cultural

Refrences

VIDEO

Prefer this video for better clarity

https://youtu.be/v_HG1JCMBjM

https://www.bing.com/ck/a?!&&p=8053053ffd56c31cJmltdHM9MTcwMzExNjgwMCZpZ3VpZD0zMDZiYjVkOC01ZTRiLTZhYjItMDAxOC1hNTE0NWZmOTZiOTImaW5zaWQ9NTUyNw&ptn=3&ver=2&hsh=3&fclid=306bb5d8-5e4b-6ab2-0018-a5145ff96b92&psq=plastic+waste+recycling&u=a1aHR0cHM6Ly9ncmVlbnR1bWJsZS5jb20vaG93LWlzLXBsYXN0aWMtcmVjeWNsZWQtc3RlcC1ieS1zdGVwIzp-OnRleHQ9UGxhc3RpYyUyMHJlY3ljbGluZyUyMHByb2Nlc3MlMjAxJTIwU3RlcCUyMDElM0ElMjBDb2xsZWN0aW9uJTIwVGhlLG9mJTIwcGxhc3RpY3MlMjAuLi4lMjA2JTIwU3RlcCUyMDYlM0ElMjBDb21wb3VuZGluZyUyMA&ntb=1