

# **HOUSEHOLD WASTE MANAGEMENT SYSTEM**



## **A PROJECT REPORT**

*Submitted by*

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*in partial fulfillment of requirements for the award of the course*

**AGB1211 – DESIGN THINKING**

*in*

**ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY**

**(An Autonomous Institution, affiliated to Anna University Chennai and Approved by**

**AICTE, New Delhi)**

**SAMAYAPURAM – 621 112**

**DECEMBER, 2024**

# **K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY (AUTONOMOUS)**

**SAMAYAPURAM – 621 112**

## **BONAFIDE CERTIFICATE**

Certified that this project report on “**HOUSEHOLD WASTE MANAGEMENT SYSTEM**” is the bonafide work of **JANANI.V (2303811724322042)**, **JEEVITHA.S (2303811724322045)**, **JOYNURSINGH.J (2303811724322047)**, **KARKUZHALLS (2303811724322052)** who carried out the project work during the academic year 2024 - 2025 under my supervision.

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Submitted for the viva-voce examination held on 5.12.24

**INTERNAL EXAMINER**

**EXTERNAL EXAMINER**

# DECLARATION

I declare that the project report on “**HOUSEHOLD WASTE MANAGEMENT SYSTEM**” is the result of original work done by us and best of our knowledge, similar work has not been submitted to “**ANNA UNIVERSITY CHENNAI**” for the requirement of Degree of **BACHELOR OF TECHNOLOGY**. This project report is submitted on the partial fulfillment of the requirement of the award of the **AGB1211 – DESIGN THINKING**.

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**Place:** Samayapuram

**Date:** 5/12/2024

## ACKNOWLEDGEMENT

It is with great pride that I express our gratitude and indebtedness to our institution, **“K. Ramakrishnan College of Technology (Autonomous)”**, for providing us with the opportunity to do this project.

I extend our sincere acknowledgement and appreciation to the esteemed and honourable Chairman, **Dr. K. RAMAKRISHNAN, B.E.**, for having provided the facilities during the course of our study in college.

I would like to express our sincere thanks to our beloved Executive Director, **Dr.S.KUPPUSAMY, MBA, Ph.D.**, for forwarding our project and offering an adequate duration to complete it.

I would like to thank **Dr.N.VASUDEVAN, M.TECH., Ph.D.**, Principal, who gave the opportunity to frame the project to full satisfaction.

I thank **Dr.T.AVUDAIAPPAN, M.E.,Ph.D.**, Head of the Department of **ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**, for providing her encouragement in pursuing this project.

I wish to convey our profound and heartfelt gratitude to our esteemed project guide **Mrs.S.GEETHA M.E.**, Department of **ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**, for her incalculable suggestions, creativity, assistance and patience, which motivated us to carry out this project.

I render our sincere thanks to the Course Coordinator and other staff members for providing valuable information during the course.

I wish to express our special thanks to the officials and Lab Technicians of our departments who rendered their help during the period of the work progress.

## **VISION OF THE INSTITUTION**

To serve the society by offering top-notch technical education on par with global standards.

## **MISSION OF THE INSTITUTION**

- Be a centre of excellence for technical education in emerging technologies by exceeding the needs of industry and society.
- Be an institute with world class research facilities.
- Be an institute nurturing talent and enhancing competency of students to transform them as all- round personalities respecting moral and ethical values.

## **VISION AND MISSION OF THE DEPARTMENT**

To excel in education, innovation and research in Artificial Intelligence and Data Science to fulfil industrial demands and societal expectations.

Mission 1: To educate future engineers with solid fundamentals, continually improving teaching methods using modern tools.

Mission 2: To collaborate with industry and offer top-notch facilities in a conducive learning environment.

Mission 3: To foster skilled engineers and ethical innovation in AI and Data Science for global recognition and impactful research.

Mission 4: To tackle the societal challenge of producing capable professionals by instilling employability skills and human values.

## **PROGRAM EDUCATIONAL OBJECTIVES (PEOS)**

**PEO 1:** Compete on a global scale for a professional career in Artificial Intelligence and Data Science.

**PEO 2:** Provide industry-specific solutions for the society with effective communication and ethics.

**PEO 3:** Hone their professional skills through research and lifelong learning initiatives.

## **PROGRAM OUTCOMES**

Engineering students will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

#### **PROGRAM SPECIFIC OUTCOMES (PSOs)**

- **PSO 1:** Capable of working on data-related methodologies and providing industry-focussed solutions.
- **PSO2:** Capable of analysing and providing a solution to a given real-world problem by designing an effective program.

## **ABSTRACT**

This application is an organized framework designed to manage the collection, segregation, storage, recycling, and disposal of domestic waste in an efficient and environmentally responsible manner. This system aims to reduce the negative environmental impact of waste, promote resource recovery, and ensure public health and hygiene. The system also emphasizes community participation and awareness to encourage responsible waste disposal practices and recycling habits among households. By implementing sustainable strategies, the household waste management system contributes to reducing landfill dependency, conserving natural resources, and mitigating pollution.



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# CHAPTER 1

## INTRODUCTION

### 1.1 INTRODUCTION

Modern waste management systems aim to minimize environmental impact by promoting waste reduction, resource recovery, and recycling. They encourage individuals and communities to adopt practices such as segregating biodegradable and non-biodegradable waste at the source, composting organic waste, and responsibly disposing of hazardous materials. Additionally, innovative technologies, such as smart waste bins and real-time monitoring systems, have emerged to streamline operations and improve efficiency.

### 1.2 PROBLEM STATEMENT

Household waste is increasing due to urban growth, rising populations, and changing lifestyles, creating major problems for the environment, public health, and waste management systems. Many households do not properly sort their waste, which leads to recyclable, organic, and hazardous materials being mixed together. This makes it harder to recycle and causes more waste to end up in landfills, which are filling up quickly and harming the environment.

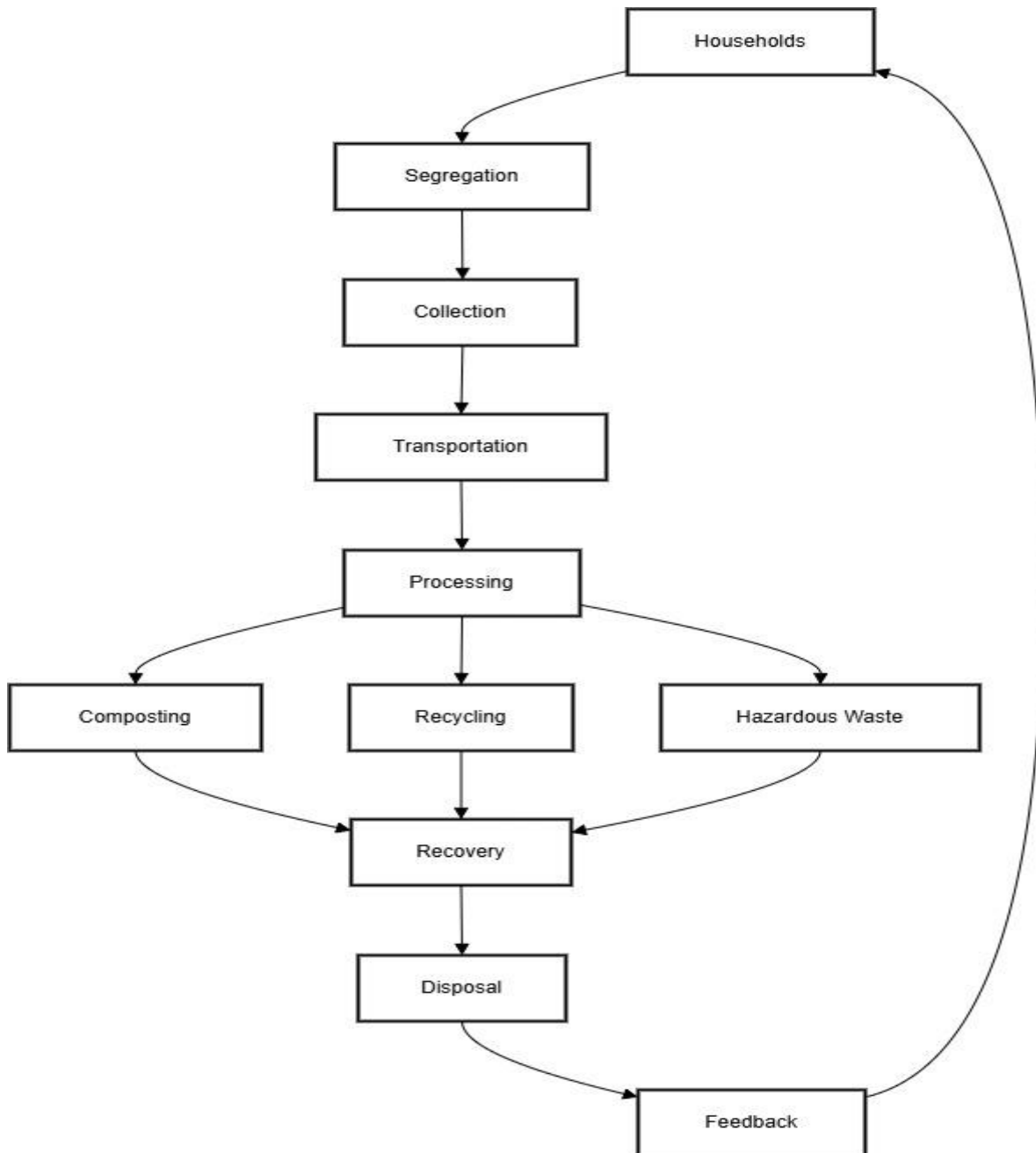
### 1.3 OBJECTIVE

- **Waste Reduction:** Encourage practices that minimize the generation of waste at the source, such as reducing, reusing, and recycling.
- **Source Segregation:** Promote the separation of waste into biodegradable, recyclable, and hazardous categories to facilitate proper disposal and resource recovery.
- **Efficient Collection and Transportation:** Implement systems for timely and efficient collection and transportation of household waste to minimize littering and pollution.
- Resource Recovery:** Maximize the recycling and reuse of materials to conserve natural resources and reduce landfill dependency.

## CHAPTER 2

### PROJECT METHODOLOGY

#### 2.1 BLOCK DIAGRAM



## CHAPTER 3

### KEY PHASES OF DESIGN THINKING

#### 3.1 EMPATHIZE

**Objective:** Understand the needs, behaviors, and challenges faced by households in managing waste.

**Actions:**

- Conduct interviews or surveys with household members to learn about their waste habits.
- Observe how waste is generated, sorted, and disposed of in homes.
- Identify pain points, such as confusion about recycling rules or inconvenience in waste segregation.

#### 3.2 DEFINE

**Objective:** Clearly articulate the problem you aim to solve.

**Actions:**

- Analyze insights from the empathize phase to uncover root causes of poor waste management.
- Frame the problem as a user-centered statement. For example: *“How might we make waste segregation easy and engaging for households?”*
- Prioritize key issues, such as lack of awareness, inefficiencies in disposal, or lack of infrastructure.

#### 3.3 IDEATE

**Objective:** Brainstorm creative solutions to address the defined problem.

**Actions:**

- Host brainstorming sessions to generate diverse ideas, such as:
  - Smart bins that guide users on what to recycle.
  - Educational campaigns or gamified apps for waste management.
  - Community-based waste collection initiatives.

- Encourage wild and unconventional ideas to foster innovation.
- Narrow down ideas to a few feasible and impactful ones.

### 3.4 PROTOTYPE

**Objective:** Develop tangible representations of your ideas to test and gather feedback.

**Actions:**

- Create prototypes like:
  - A simple version of a smart bin.
  - Mockups of an app for tracking household waste.
  - Educational materials or a prototype recycling guide.
- Ensure prototypes are inexpensive and quick to build for testing purposes.

### 3.5 TEST

**Objective:** Evaluate the effectiveness of the prototypes with real users and iterate based on feedback.

**Actions:**

- Pilot the prototypes in select households or communities.
- Collect feedback on usability, practicality, and overall impact.
- Identify what works, what doesn't, and why.
- Refine the solution based on insights, possibly returning to earlier phases for further adjustments.

## **CHAPTER 4**

### **MODULE DESCRIPTION**

#### **4.1 WASTE GENERATION AND SEGREGATION MODULE**

This module focuses on waste generation at the household level and encourages proper segregation of waste into categories such as biodegradable, recyclable, and hazardous materials. It may include the use of separate bins and awareness programs to guide households in segregating their waste correctly.

#### **4.2 COLLECTION AND TRANSPORTATION MODULE**

The collection module ensures that segregated waste is gathered from households regularly. Waste is then transported efficiently to processing or recycling centers. This module includes scheduling, routing, and waste handling mechanisms to ensure timely and clean collection and transportation.

#### **4.3 WASTE PROCESSING AND TREATMENT MODULE**

This module handles the processing of waste at central facilities. It includes composting for biodegradable waste, recycling of recyclable materials, and safe disposal or treatment of hazardous waste. Advanced technologies like biogas plants or waste-to-energy systems may be part of this module.

#### **4.3RESOURCE RECOVERY AND RECYCLING MODULE**

Focused on the recovery of valuable resources from waste, this module deals with sorting, cleaning, and processing recyclable materials. It aims to reduce the amount of waste sent to landfills and recover materials like metals, plastics, and paper to be reused in manufacturing or for energy production.

#### **4.5 DISPOSAL AND FEEDBACK MODULE**

The disposal module manages the final step where non-recyclable and processed waste is either sent to landfills or incinerated. The feedback system monitors the effectiveness of the entire waste management process, collecting data to improve operations, identify trends, and encourage better waste practices through community engagement and technology.

## **CHAPTER 5**

### **CONCLUSION**

In conclusion, an effective household waste management system is crucial for promoting environmental sustainability, public health, and efficient resource utilization. By focusing on waste generation, segregation, collection, processing, and disposal, such systems help minimize environmental impact, reduce landfill usage, and encourage recycling and resource recovery. Integrating modern technologies and fostering community awareness can significantly enhance the system's efficiency and effectiveness. Ultimately, a well-designed waste management system not only addresses immediate waste disposal challenges but also supports long-term sustainability goals by conserving resources, reducing pollution, and promoting responsible consumption and waste practices.

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Link: [Watch on YouTube](#)
- **Waste Management and Recycling** - YouTube Video.  
Link: [Watch on YouTube](#)
- **Waste Management eBooks** - A collection of books on waste management and recycling practices.  
Link: [Best Waste Management eBooks](#)
- **Framework of Smart and Integrated Household Waste Management System** - MDPI article.  
Link: [Read on MDPI](#)



## APPENDIX A – SCREENSHOTS

