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Technology Computer

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Hardware Graduation Project

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Contents

Acknowledgment 2
Chapter 1 4
1.1 Introduction 4
1.2 Objectives 4
1.3 Scope 4
1.4 Importance 4
1.5 Organization of the report 4
Chapter 2 5
Constraints 5
2.1 Limited time: 5
2.2 Technical problem: 5
2.3 Project Adjustments through the developing process: 5
Chapter 3 6
3.1 Literature Review 6
Chapter 4 7
Methodology 7
4.1 Technical Preference 7
4.1.1 Arduino Platform: 7
4.1.2 Weight Sensors: 7
4.1.3 Ultrasonic Sensors: 7
4.1.4 Motors: 7
4.1.5 Tools 7
4.2 System Features Implementation 9
Chapter 5 10
5.1 Results and discussion 10
Chapter 6 10
6.1 Conclusions and Recommendations 10
6.2 Future work 10
Scalability: 10
Chapter 7 11
7.1 References 11

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Abstract

In recycling operations, the process of separating metals from mixed garbage is prone to mistakes, takes a lot of time, and relies on manual labor, which results in significant contamination and the loss of recoverable materials. The EcoBin project makes use of Arduino technology to create an intelligent recycling bin to improve waste management. This bin is specifically designed for use in public areas and aims to simplify the recycling processes.

Chapter 1

1.1 Introduction

1.1 Problem

Metal waste causes significant environmental concerns as it has the potential to penetrate the soil and groundwater due to inadequate disposal practices, ultimately resulting in elevated environmental pollution and health hazards. Address

ing these issues through efficient recycling is crucial, yet conventional recycling methods can be inefficient and costly. Therefore, we opted to utilize advanced technologies to segregate metal waste from other materials.

1.2 Objectives

The EcoBin project's main aim is to enhance the effectiveness of waste management in public areas by building an intelligent recycling bin that can recognize and sort automatically metal items. This project tries to ensure precise sorting by using sensors with Arduino technology. EcoBin goals are to increase recycling rates and convert the sorting process to an automatic one.
The project built to be a user-friendly bin that can be used in a variety of public venues, including parks, offices, and schools, as well as to increase awareness about appropriate garbage disposal procedures and minimize pollution.

1.3 Scope

we design EcoBin to be used in public places like parks, schools, and offices.

1.4 Importance

The EcoBin project is important for several reasons. First, it addresses a significant issue of waste management by automating the separation of metal from other types of waste. This improves recycling efficiency and reduces pollution. This is particularly crucial in public spaces where traditional sorting methods are not effective, especially for large volumes of metal waste. Additionally, the project demonstrates the practical application of Arduino technology and sensors in solving real-world problems, which may inspire further solutions in smart waste management.

1.5 Organization of the report

The next chapter will show the constraints that were faced while building this project. Then next, it will show the procedures that have been followed to finish the work, as well as the technologies and tools that have been used to build this project. And in the end, we will discuss the conclusion and the recommendations.

Chapter 2

Constraints

2.1 Limited time:

It takes time to learn how to use some of the tools and how they work and find resources that can give us the desired benefits; because we did not use them before, we faced some challenges in creating some features using them.

2.2 Technical problem:

One of the problems we faced during the development of the EcoBin project was the reliability of the components. Initially, we had issues with the Arduino board overheating at first and eventually burning out, which disrupted the functionality of the entire system and a delay in our workdays. Additionally, the motors used in the sorting mechanism were not of the required performance, leading to inaccurate sorting of metal objects. These problems required us to do more experiments and try different types of components.

2.3 Project Adjustments through the developing process:

While developing this bin, we made every effort to ensure that everything was working well from the metal detecting and sorting to the motion of each motor. We have focused also on the speed of the detection and modified some features based on feedback from the supervisor to make the bin more accurate and useful.

Chapter 3

3.1 Literature Review

The integration of generation in waste manipulate, specifically for recycling purposes, has been the concern of severa studies and development efforts. Traditional recycling methods are tough work-in-depth and vulnerable to mistakes, leading to inefficiencies and infection of recyclable substances. Numerous research has explored the usage of automation and clever technology to deal with those traumatic conditions.

One huge area of studies includes the use of microcontrollers, which include Arduino, for developing automated recycling structures. Arduino's simplicity of programming makes it a famous desire for imposing smart recycling answers. Studies have validated the feasibility of the use of Arduino for responsibilities such as object detection, fabric sorting, and information collection in waste management structures.

One massive area of studies entails using microcontrollers, which include Arduino, for developing automated recycling structures. Arduino's versatility and ease of programming make it a famous desire for prototyping and enforcing smart recycling solutions. Studies have validated the feasibility of the use of Arduino for tasks which includes object detection, cloth sorting, and information collection in waste management systems.

Incorporating sensors for detecting recyclable substances is another nicely-documented technique. Research has shown that numerous sensors, inclusive of infrared, ultrasonic, and weight sensors, can effectively pick out and kind unique materials. For example, weight sensors had been used to categorise metals based on their weight, enhancing the precision of the sorting method.

The EcoBin venture builds upon this frame of studies via integrating Arduino era with an inductive proximity sensor and weight sensors for precise sorting of met

Chapter 4

Methodology

The EcoBin project follows a structured methodology starting with requirement analysis to define objectives and identify necessary components like Arduino, a metal detector, and weight sensors. The hardware is assembled and integrated, ensuring proper wiring and stability, and the software development includes coding for object detection, weight classification, and motor control. Then testing and optimization are conducted to ensure accuracy and efficiency. and last thing user-friendly interface is designed for public use.

4.1 Technical Preference

The EcoBin project is a combination of reliable and durable technologies to achieve efficient and accurate waste sorting.

4.1.1 Arduino Platform:

Chosen for its simplicity, flexibility, and support for almost all the sensors and components.

4.1.2 Weight Sensors:

Essential for measuring the weight of detected metal objects to ensure precise sorting.

4.1.3 Ultrasonic Sensors:

- used to monitor the fill level of the waste basket.

- Ensures the main door only opens when the basket is not full, preventing overflow and maintaining system efficiency.

4.1.4 Motors:

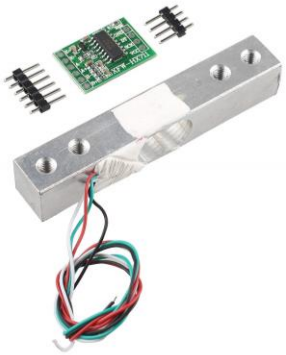
Selected for their strength and ability to handle frequent use.

4.1.5 Tools

SN04-N-NPN-Inductive-Proximity-Sensor

we used this sensor to detect the metal material.

Load sensor 1kg.



we used this sensor for weight measurement, and it’s a device that measures the amount of force or load applied to a particular object or surface.

Servo motor

We used different types and sizes of this motor and each is used for controlling several things like doors, baskets, and others.

Ultrasonic sensor.

it's an instrument that measures the distance to an object using ultrasonic sound waves, and we used it to detect if the basket is full.

4.2 System Features Implementation

metal detection:
As we mentioned before we used an inductive proximity sensor to detect the metal materials from other.
Weight measurement:
by using a load sensor when the user throws any object into the basket this sensor will measure the weight and sort the metal depending on it.
controlling with the main door:
Controlling with the main door which is open only when the basket is not full and the sorting process is complete.
alert when any basket is full:
By using an ultrasonic sensor, we measure the distance between the sides of the basket to detect if it is full or not.

Chapter 5

5.1 Results and Discussion

The EcoBin project has succeeded in improving recycling efficiency through automation, using Arduino technology, metal sensors, and weight sensors to detect metal objects and sort them from mixed waste. Ultrasonic sensors effectively monitored the basket's fullness level, ensuring that the main door was opened only when appropriate.

Chapter 6

6.1 Conclusions and Recommendations

The EcoBin project presents the effectiveness of combining Arduino technology with sensors for automatic waste management. By detecting and sorting metal objects from mixed waste, EcoBin enhances recycling efficiency and reduces pollution. The system's reliability and user-friendly interface make it suitable for general use.

6.2 Future work

Scalability:

Expand the system to handle larger volumes of waste and additional material types.

Durability & Reliability:

Enhance the durability of components to withstand harsh outdoor conditions and heavy usage. Improve the reliability of sensors and motors for consistent performance.

Centralized System:

Build a full server to connect all EcoBins into a centralized system,to enable coordinated monitoring and management to make waste collection more organized and systematic.

User Interface and Experience:

Continuously refine the outer design based on feedback to ensure ease of use.

Chapter 7

7.1 References

1-YouTube: https://youtu.be/Th6GQiSHfKk?si=GAkMoeFRvx8FDEby

2- https://youtu.be/ZNKq81ZZ5nM?si=D_2HZGIkitxf6Cx