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Eco Sort- Dry and Wet Waste Separator using Arduino

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ABSTRACT

Efficient waste segregation has become a critical concern in contemporary urban development, especially as India faces a 7% annual increase in waste generation due to industrialization and urbanization. This trend necessitates the adoption of sustainable waste management practices, community awareness, and innovative technologies to reduce waste. Our project, 'ECO SORT', utilizes state-of-the-art Arduino technology to manage waste efficiently, mitigate environmental hazards, and optimize resource recovery. Advanced sorting algorithms categorize different types of waste for recycling, employing ultrasonic and soil moisture sensors to automate and optimize the process, thus reducing disposal costs and promoting sustainability.
'ECO SORT' employs Atmega microcontrollers as central processing units, processing and analyzing sensor data to inform waste sorting decisions. Mechanical sorting, carried out by sensors and Atmega microcontrollers, enhances the efficiency and precision of waste segregation. This technology has made the sorting process more streamlined and effective, ensuring proper waste separation and disposal. The high accuracy and reliability achieved through these advanced systems reduce errors and significantly improve the overall effectiveness of waste management.

KEYWORDS: Eco Sort, Atmega microcontrollers, Waste Segregation, Arduino, Sensor Technology

1.INTRODUCTION

In recent years, the rapid increase in waste production has become a significant concern due to inefficient waste management systems. Research by the World Bank indicates that annual waste generation is expected to reach 3.40 billion tons, up from the current 2.01 billion tons. Waste segregation is essential but often inefficiently handled through manual sorting into bins for dry, wet, and metal waste. Our goal is to develop a waste separation mechanism that minimizes landfill waste, enhances resource recovery, and fosters environmental sustainability. ECO SORT strives to create a cleaner future by merging technology and environmental care.

Previous research work related to automated waste management has been extensively documented. Rajapandian et al. (2019) developed a "Smart Dustbin" for efficient waste collection, published in the International Journal of Engineering and Advanced Technology. Patil et al. (2017) focused on household-level automated waste segregation using Arduino and Atmega microcontrollers, published in the International Journal of Innovative Research in Science, Engineering and Technology Namratha et al. (2021)

proposed an IoT-based automatic waste management system, featured in the International Journal of Engineering Research & Technology. Additionally, Karuppiah et al. (2018) introduced the "Wastage Pay Smart Bin" in the International Journal of Engineering & Technology. Lastly, Vijay et al. (2019) presented a smart waste management system using Arduino in the International Journal of Engineering Research & Technology. These studies collectively highlight advancements in waste management technology, emphasizing automation and smart systems to enhance efficiency and sustainability.

The segregation of waste is crucial but poses significant health risks. Using waste separators offers a viable solution by sorting materials based on their composition for recycling or disposal. This reduces human contact with waste and ensures proper management. This document analyzes a sensor-based mechanism for waste segregation, highlighting its benefits. Automating segregation with sensors enhances efficiency and accuracy, reduces human intervention, and provides real-time data for optimizing recycling. Incorporating sensor-based mechanisms in waste segregation can revolutionize waste management, promoting a more sustainable future.

2. METHODOLOGY/EXPERIMENTAL

Components

1. Moisture Sensor: The moisture sensor serves as a critical component for measuring soil moisture levels, providing essential data for informed watering decisions.

2. Ultrasonic sensor: The HC-SR04 Ultrasonic Sensor is a frequently employed electronic tool crafted for precise distance measurement. Its functionality revolves around emitting ultrasonic sound waves at a 40 kHz frequency via a transmitter.

3. Microcontroller: Arduino UNO Microcontroller

Here are key points about the Arduino Uno:

a. The Arduino Uno centers on the ATmega328P microcontroller, serving as the core of its operations. This microcontroller executes programmed instructions and interfaces with connected components.

b. Being an open-source platform, the Arduino Uno provides unfettered access to both hardware and software designs, enabling users to freely modify, share, and distribute them.

c. With its built-in USB interface, the Arduino Uno facilitates convenient connection to a computer for programming and power supply. It can be powered via USB or an external power source.

d. Featuring a range of digital input/output (I/O) pins and analog input pins, the board enables control over various electronic components, such as sensors and actuators.

e. Programming the Arduino Uno is accomplished through the Arduino IDE (Integrated Development Environment), streamlining the coding process and enabling easy program uploads to the board.

f. The Uno offers flexibility in power sources, supporting USB, external DC power, or batteries. An onboard voltage regulator ensures consistent power delivery to the microcontroller.

4. Servo motor: A servo motor is a type of motor that is commonly used in robotics, automation, and control systems to precisely control the angular position of its shaft. When used with an Arduino, servo motors can be controlled to rotate to a specific angle, making them highly useful for tasks requiring precision and repeatability.

5. Battery: The battery component offers a portable and self-sufficient power source for the system, guaranteeing continuous operation and enabling flexible deployment.

Method

Our task involves integrating advanced sensor technology into a waste management system for enhanced efficiency. We will test individual sensors and create a cardboard platform with two subdivisions to assemble the circuit. A servo motor, controlled by an Arduino Uno microcontroller, directs waste automatically. The system includes a soil moisture sensor and a proximity sensor that send crucial signals to the microcontroller for accurate waste segregation. Additionally, a buzzer alerts users when the bin is nearly full. The system analyzes waste using sensors to determine moisture content and directs it to the appropriate section of the bin via a chute mechanism.

The servo motor adjusts the bin cover to guide waste correctly. This automated sorting process reduces environmental impact, promotes recycling, and exemplifies the effective use of technology for improved waste management.

3. FUTURE SCOPE

This project involves using Arduino and Atmega microcontrollers as the main components. However, in real-life applications, more powerful processors can be utilized to enhance input and output speed and efficiency. Additionally, the project can be expanded to separate different materials such as plastic, metal, and glass. Future improvements could involve perfecting the waste separation process and developing a system for the immediate decomposition of organic waste. This would enable households to process wet waste on-site, alleviating pressure on municipal waste systems and promoting environmentally friendly waste management.

4. CONCLUSION

In conclusion, the development of an Arduino-based smart dustbin capable of segregating dry and wet garbage presents a promising innovation in the field of waste management. This research has demonstrated that such a system can significantly enhance the efficiency and effectiveness of waste segregation, contributing to improved recycling rates and reduced environmental impact . Despite the obstacles of cost and user adoption, ongoing innovation and community involvement can propel the use of smart dustbins, fostering cleaner cities and more sustainable waste management practices. As an integral component of broader smart city initiatives, this technology not only meets current waste segregation demands but also supports the long-term objective of developing environmentally aware and resource-efficient urban areas

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Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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