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Automatic Separation and Storage of Dry and Wet Garbage

Shankar Gosavi[1], Sachin Bharate[2], Prof. Y. H. Sawant[3]

UG Student, Department of Mechanical Engineering, SMSMPITR, Akluj, Maharashtra, India[1-2]

Asst. Professor, Department of Mechanical Engineering, SMSMPITR, Akluj, Maharashtra, India[3]

Abstract: Waste management is a significant challenge faced by both developing and advanced countries. It involves three main entities: users who generate waste, waste collectors and city administration, and stakeholders. A smart waste management system is crucial to notify users in real-time about waste status and keep stakeholders informed about the type and quantity of waste. The increasing human population and urbanization have led to an increase in waste, causing unhygienic environments. To address this issue, an Automatic Waste Segregator system has been developed to separate waste into three categories: wet, dry, and metallic. This system is not only cost-efficient but also productive in waste management. Sensors detect waste and segregate it into designated bins, with regular updates on waste disposal amount on the server.

Keywords: Segregation, motor, IR sensor, Metal detector, Moisture sensor, pic microcontroller

I. INTRODUCTION

The world is facing a pressing issue of garbage, which contributes to diseases and overflowing bins. Solid waste management is a significant challenge in urban cities, particularly in India, and other countries worldwide. To address this issue, a smart city concept has been proposed, with the aim of building 100 smart cities. The primary need for a smart lifestyle is cleanliness, and dustbins play a crucial role in proper waste collection. In India, the current waste management system is primarily unhealthy, with dustbins being a major issue.

This paper aims to upgrade the dustbin component of the urban waste management system, integrating analytics and electronics to create optimal changes in waste collection methods. By integrating analytics and electronics, the paper aims to create optimal changes in waste collection methods, utilizing the vast amount of data produced by smart bin networks.

The increasing population has led to improper waste disposal, consuming time and manpower. Unplanned waste disposal methods, such as landfills, can cause harm to living beings and pollute surface and underground water. This also accelerates harmful bacteria, deteriorating the environment's aesthetic value. In India, solid waste recycling is primarily done by rag pickers, who face health issues like skin infections and respiratory problems. To reduce their dependence, automatic waste segregation in dustbins can be implemented. Waste is segregated into metallic, dry, and wet streams, with potential for recycling and reuse. Segregating waste at the source is preferable over using multiple industrial waste segregators. This method eliminates the need for rag pickers and directs the segregated waste to a recycling plant. Currently, there is no automatic system for segregating dry, wet, and metallic waste. The project aims to create a compact, low-cost, and user-friendly waste segregation system for urban cities, streamlining the waste management process.

II. LITERATURE SURVEY

A. Smart Waste Management System:

Authors Tejashree Kadus, Pawankumar Nirmal, Kartikee Kulkarni has discusses the concept of automation in waste management systems for cleanliness and hygiene. In developing countries, garbage dumps often cause environmental issues and unhygienic conditions. Smart net bins, a combination of hardware and software technologies, connect Wi-Fi systems to dustbins, providing free internet facilities for a specific period. This innovative approach aims to address these issues and promote a more sustainable waste management system.

B. Waste Management Improvement in Cities using IoT

Shivam Jagtap, Aditya Gandh, Raviraj Bochare, Ashwinkumar Patil has discussed that garbage collection is one of the most critical problems faced by Municipal Corporation. While implementing the waste management in cities the biggest challenge is the management of waste in cost optimal way with high performance. The current process of collecting the

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waste, separating it and transporting the containers everyday which is a complicated process. This paper deals with the concept of waste management and the smart system for waste management with higher benefits to the society.

C. Smart Waste Management using Internet-of-Things

Authors Chitluri Sai Srikanth, Tadivaka Bhupathi Rayudu, Javvaji Radhika, Raju Anitha concluded that to avoid each such condition, we plan to propose a reaction for this issue "Sharp Garbage Bin", which will alert and set up the maintained individual when the waste compartment will fill. By then message will be send to the gotten a handle on individual to amass the hardship from the specific territory. The announced individual will send the message from his web application to the waste specialists by sending a SMS. In this undertaking we use strain check to know the burglary of the report. This will diminish the flood of the waste compartment and suitably keeping nature clean.

III. SYSTEM DESIGN

D. Existing System

Garbage is collected daily from streets, houses, and other establishments, but this system is ineffective and inefficient. India generates 1.3 pounds of garbage per person per year, and developing countries generate over 62 million tonnes of municipal solid waste annually. Only 43 million tonnes are collected by municipalities, leaving the rest scattered in the streets due to poor bin maintenance. The traditional manual monitoring process is complex and requires more human effort, time, and cost. The current system lacks proper planning and updates the level and odour of garbage bins only through SMS alerts, making cities unhygienic. RFID tags and readers are used in some systems to update the status of garbage bins to workers when they come near them. However, this method has disadvantages such as increased fuel consumption and time consumption. Additionally, workers are not responsible for cleaning dustbins, making the system worse in urgent cases. Proper waste monitoring is essential for maintaining a clean and green city. Current manual garbage monitoring systems are limited, and labourers cannot always monitor dustbin height and scent. Internet technology-oriented systems are more systematic, cost-effective, and energy-efficient.

E. Proposed System

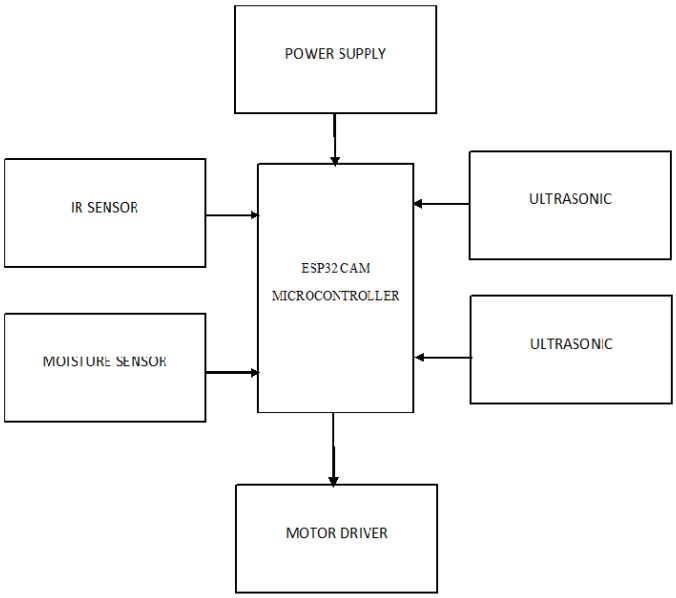

Figure 1: Block Diagram of Proposed System

Waste bins often overflow with excess waste, leading to health issues for humans. To address this issue, an IoT-based waste segregation and monitoring system has been designed to keep cities clean and healthy. This model for Smart Cities aims to automatically segregate waste and perceive dustbin levels through a wireless mesh network. The system uses IR sensors to identify objects, moisture and metal sensors to detect wet and metal waste, and an ultrasonic sensor to monitor bin levels. Waste is dropped into the bins, where the sensor identifies the waste type. The bins consist of three partitions, each collecting waste separately. The motor rotates the bins, opening them and collecting waste. The status of the bin is displayed on the Thing Speak server. This innovative approach aims to keep cities clean and hygienic, ensuring a better life for the growing population.

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F. Methodology

The waste management system consists of two separate layers of sub-bins, which are removable for cleaning purposes. The design utilizes a motor and tray mechanism, with waste disposed into a common waste tray. The IR sensor detects waste, activates a moisture sensor, and a pre-set threshold value for classification as dry or wet waste. The three bins for dry, wet, and metal waste are fixed on the left and right sides of the tray. The ultrasonic sensor senses garbage levels in the bin, and the data is sent through a C-programmed microcontroller. The status of the waste is then notified in the Blynk app, an open-source IoT application and API for storing and retrieving data over the internet or local area networks.

IV. COMPONENTS USED

G. Hardware Components

The required hardware components are

- Microcontroller,
- Infrared sensor,
- Moisture sensor,
- DC motors,
- ESP 8266

1. Infrared Sensor:

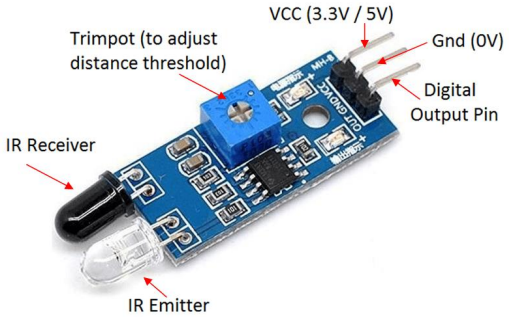

Figure 2: IR Sensor

An infrared sensor is an electronic device that senses surroundings by emitting infrared radiation. It measures object heat and motion, detecting invisible thermal radiations. The emitter is an IR LED, while the detector is an IR photodiode sensitive to the same wavelength. The resistances and output voltages change proportionally to the IR light's magnitude.

2. Moisture Sensor

Figure 3: Moisture Sensor

The Moisture Sensor measures soil water content, indicating water shortages and monitoring soil moisture content. It uses capacitance to measure dielectric permittivity, which is proportional to water content. The sensor averages water content over its entire length, with a 2 cm zone of influence. It is widely used in agriculture, land irrigation, and botanical gardening to measure moisture loss, plant uptake, and control irrigation in greenhouses.

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3. ESP8266:

Figure 4: ESP8266

The ESP8266 is a low-cost Wi-Fi microchip with a full TCP/IP stack and microcontroller capability, developed by Express if Systems in Shanghai, China. Introduced in 2014 with the ESP-01 module, it initially had limited English-language documentation. The low price and minimal external components attracted hackers to explore the module, software, and translate Chinese documentation.

H. Software Implementation

Arduino IDE is a cross-platform Java application designed to introduce programming to newcomers. It includes a code editor with syntax highlighting, brace matching, and automatic indentation, and can compile and upload programs with a single click. No command-line interface is required, but third-party tools like Ino can be used for command-line building.

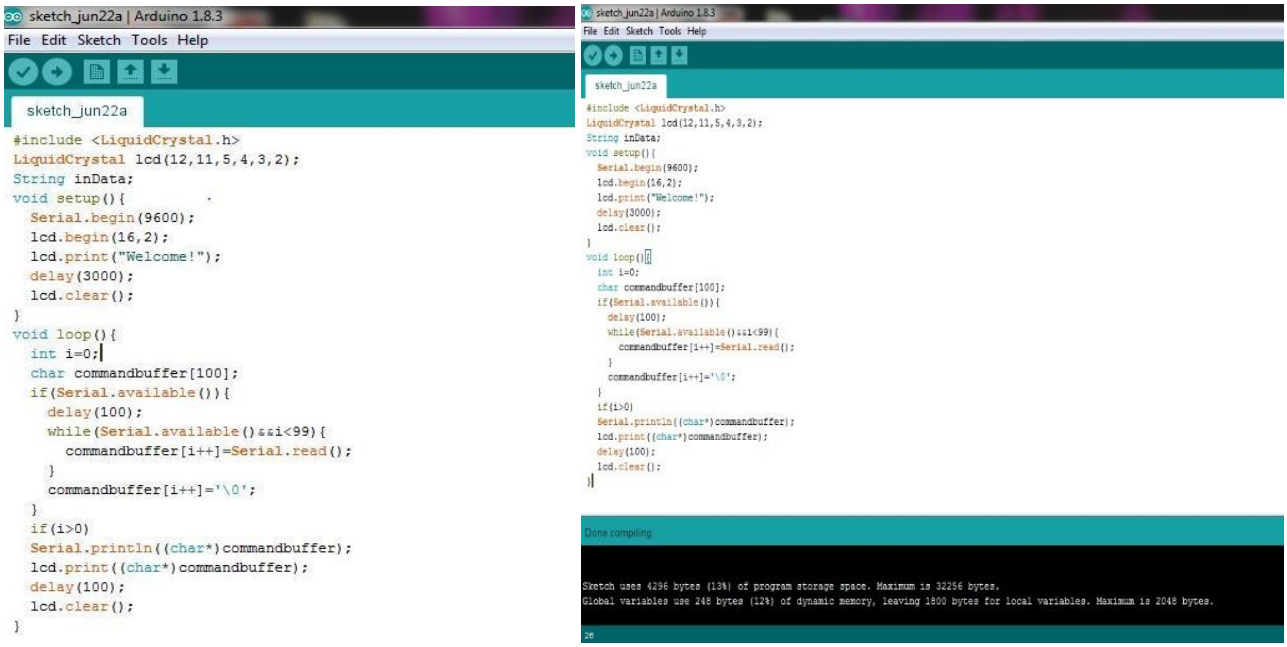

Figure 5: Use of IDE for Installation

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V. RESULT AND DISCUSSION

Figure 6: Actual Implementation of System

VI. CHALLENGES AND LIMITATIONS

Implementing a smart waste segregation and monitoring system comes with its own set of challenges and limitations. These include:

I. Technical Challenges

Deploying and maintaining a large-scale IoT infrastructure requires significant investments in hardware, software, and connectivity. Integration with existing waste management systems and interoperability between different vendors' solutions can be complex. Additionally, ensuring the reliability and accuracy of sensor data and addressing issues such as battery life and sensor calibration pose technical challenges.

J. Privacy and Data Security Concerns

Smart waste management systems involve the collection and processing of large amounts of data, including location information. Ensuring data privacy, protecting against data breaches, and obtaining consent from citizens for data collection are critical concerns that need to be addressed to build trust among stakeholders.

K. Infrastructure and Implementation Challenges

Deploying smart waste management systems requires adequate infrastructure, including waste bins with sensors, connectivity networks, and data processing capabilities. Retrofitting existing waste bins and vehicles with IoT-enabled devices can be a logistical challenge. Moreover, obtaining buy-in from multiple stakeholders, including waste management authorities, citizens, and recycling facilities, is crucial for successful implementation.

VII. CONCLUSION

Smart waste segregation and monitoring systems using IoT are revolutionizing waste management practices by offering a data-driven approach to waste collection, segregation, and recycling. These systems offer efficient waste management, reduced environmental impact, cost savings, and citizen engagement.

Despite challenges, ongoing technology advancements and successful implementations demonstrate the transformative potential of these systems in creating a cleaner and more sustainable future. The Smart bin system, proposed in this paper, is an efficient and cost-effective solution for waste segregation, requiring no human intervention to separate dry and wet waste. This system can be deployed on domestic or large-scale scales, making it a cost-effective and efficient solution for waste management.

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