International Journal of Advance Research in Science and Engineering
Volume No. 14, Issue No. 03, March 2025
www.ijarse.com
IJARSE
ISSN 2319 - 8354

Development of Automated Waste Segregation System with IOT based live monitoring

Prof. Shanta Patil[1], Prof. Shrinath Patil[2]

[1]ECE Dept., [2]Maths Dept.

Hirasugar Institute of Technology, Nidasoshi, Karnataka, India

ABSTRACT

The world is becoming increasingly smart, but the garbage management system is still struggling to find solutions to the many problems of garbage and waste management. Government initiatives to separate waste into different categories, such as dry, wet, and metallic, have not been effective. This project develops an automatic waste sorting system using image processing. The system consists of a smart dustbin powered by a NPU Board attached to ESP32 and a camera module that can be used to detect the type of waste that is deposited in the dustbin. The smart system can detect the type of waste that is deposited and automatically separate it. The system can automatically separate dry, wet, and metal waste using in-dustbin segregation mechanisms, automatically sorting the waste into the appropriate categories. The system also includes a shredder that can shred the waste, which can be used as organic fertilizer in the future with some modifications. Additionally, the dustbins are powered by solar energy, allowing them to be deployed in remote locations.

Keywords: *Sorting, Waste, Automatic, Image processing, NPU, ESP32 Board, Shredder Dry, Wet, Metallic, solar powered etc.*

I. INTRODUCTION

Solid waste segregation is a major challenge facing urban areas and metropolitan cities around the world. In India, where environmental regulations are weak, the situation is particularly dire. Smart dustbins are a system that can help to address this problem, or at least reduce its impact.

India's Prime Minister, Narendra Modi, has introduced the concept of 100 smart cities in India. The "Swachh Bharat Abhiyan" (Clean India Mission) was launched to ensure a clean environment. Many viruses and bacterial infections develop in polluted environments. It is essential to protect the environment using technology at this time. Restaurants should be modernized using smart technology to reduce pollution. The amount of waste generated is largely determined by two factors: population and consumption patterns.

This paper discusses one of the most efficient ways to keep our environment clean and green. Dustbins are a common and essential fixture in every community. However, it is often observed that garbage can accumulate in dustbins due to irregular garbage removal. This can lead to a number of problems, including the spread of disease, the breeding of pests, and the unsightly appearance of the community.

In today's world, where technology is constantly evolving, there is a need to find new and innovative ways to address this problem. One potential solution is to use smart dustbins. Smart dustbins are equipped with sensors that can detect when they are full. When a smart dustbin is full, it sends a signal to a central system, which then

dispatches a garbage collection crew to empty the bin. This ensures that garbage is removed regularly, preventing it from accumulating and causing problems.

Smart dustbins are a promising new technology that has the potential to help us keep our communities clean and green. By using smart dustbins, we can reduce the spread of disease, eliminate pests, and improve the overall appearance of our communities. The proposed paper deals with the concept of smart automatic waste sorting dustbins/conveyor using image processing**.**

1.1 BLOCK DIAGRAM

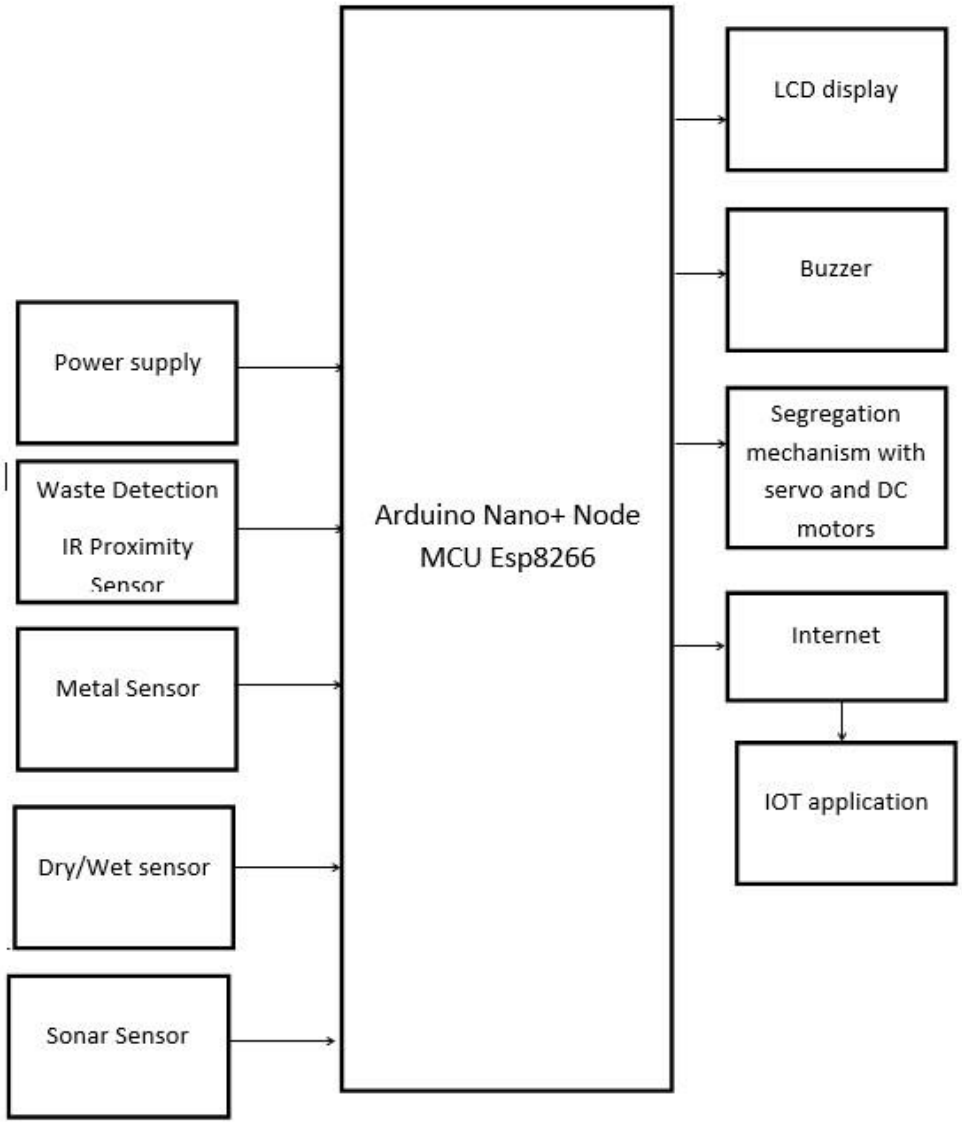

Figure1.1:Block diagram

1.1 BLOCK DIAGRAM DESCRIPTION

The block diagram below shows the working principle of the system to be fabricated. The proposed system consists of a dumping system and a conveyor as shown in the figure. The system developed is equipped with a segregation system which is capable of segregating the waste. As Shown in the figure the total segregation takes

place in two different steps. The metallic Segregation step and the dry/wet segregation step. Once the garbage is dumped the proposed system gets automatically activated which will start segregation of the waste.

The initial part involves the segregation of the total waste into metallic and non-metallic which is done using the inbuilt sensors. Once the first step is processed the further step is to segregate the remaining ones into dry and wet waste. The remaining waste is passed over the second step of segregation where in it is separated into dry and Wet. Once the waste is segregated it gets collected into three different collection chambers which can be emptied separately. The IOT connectivity ensures all the levels from the three bins are updated on the IOT panel developed. The node MCU esp8266 is interfaced with sonar sensor to read the levels of all the three bins and update on IOT Panel

II. LITERATURE REVIEW

Before the start of the project it is very necessary to study the proposed project area in deep to know the problems faced and probable solutions on the same. The number of research papers were studied to arrive at the problem definition and the way around to tackle it. The some of the notable ones are given in the literature review below.

The authors in [1] have made a quantitative analysis between existing dustbins and their serving population. The study first analyses the spatial distribution of dustbins in some areas of Dhaka city using average nearest neighbor functions of GIS. Remarkably, the spatial circulation of the current dustbins has appeared to be dominatingly in clustered pattern. Next, an optimal number of additional dustbins were calculated. It is shown that the number of existing dustbins is insufficient in the study area. The extent of pollution caused by the existing dustbins was calculated using spatial analyst functions of GIS. It is found that all the dustbins are burnt with wastes and causing pollution to the environment. The results thus obtained would help to understand the present situation of the waste management of Dhaka city and to optimally place the required number of dustbins to prevent further pollution to environment.

The authors in [2] have equipped the smart bins with ultrasonic sensors which measure the level of dustbin being filled up. The container is divided into three levels of garbage being collected in it. Every time the garbage crosses a level the sensors receive the data of the filled level. This data is further sent to the garbage analyzer as instant message using GSM module. Placing three ultrasonic sensors at three different levels of the container may be a disadvantage as the cost of the dustbin increases due to the sensors and also the sensors can be damaged due to the rough action by the users.

An IoT-based smart garbage system (SGS) is proposed to reduce the amount of food waste by the authors in [3]. In an SGS, battery-based smart garbage bins (SGBs) exchange information with each other using wireless mesh networks, and a router and server collect and analyze the information for service provisioning. Furthermore, the SGS includes various IoT skills considering user convenience and increases the battery lifetime through two types of energy-efficient operations of the SGBs: stand-alone operation and cooperation-based operation. The proposed SGS had been functioned as a pilot project in Gangnam district, Seoul, Republic of Korea, for a one-year period.

The authors in [4] has built a framework in which a Camera will be set at each garbage collection point alongside load cell sensor at base of the trash can. The camera will take continuous snapshots of the garbage

can. A threshold level is set which compares the output of camera and load sensor. The comparison is done with help of microcontroller. After analyzing the image an idea about level of garbage in the can and from the load cell sensor, weight of garbage can be known. Accordingly, information is processed that is controller checks if the threshold level is exceeded or not. This is convenient to use but economically not reliable.

III. METHODOLGY

The entire code of conduct of the project follows the following methodology. Everything is carried out in phases so that the final project will be complete without any errors. The following methodology is implemented step by step in the project.

1) Material survey and selection:

In this phase the market study is done for the optimal materials available for the purpose of project work. The materials were surveyed and the most optimal ones were chosen for the project.

2) The chassis or the frame fabrication:

In this phase the frame is fabricated onto which the garbage can and the compaction mechanism will be mounted. The fabricated chassis should have adequate amount of space to mount all the components.

3) The garbage Dump Inlet:

In this the garbage dump inlet is fabricated and incorporated onto the chassis. Further the system is made automated so that it can automatically trigger the segregation once the garbage is into it.

4) The metallic segregation mechanism:

The metallic segregation system is fabricated which will separate the waste into metallic and non-metallic.

5) The Dry/Wet segregation system:

In this phase the remaining waste is passed on secondary segregation system, this phase involves development of Dry/ Wet segregation system which will separate the waste into dry and wet

6) The Collection Bin fabrication:

In this phase the collection

In this phase the components fabricated bins for the segregated waste is fabricated. This consists of three separate bins for different category of wastes.

7) The IOT system development:

The IOT system development consists of development of IOT panel for sending the data to the cloud

8) Assembly and testing:

Above are assembled and tested for performance.

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IV. RESULT

4.1 Model of Project:

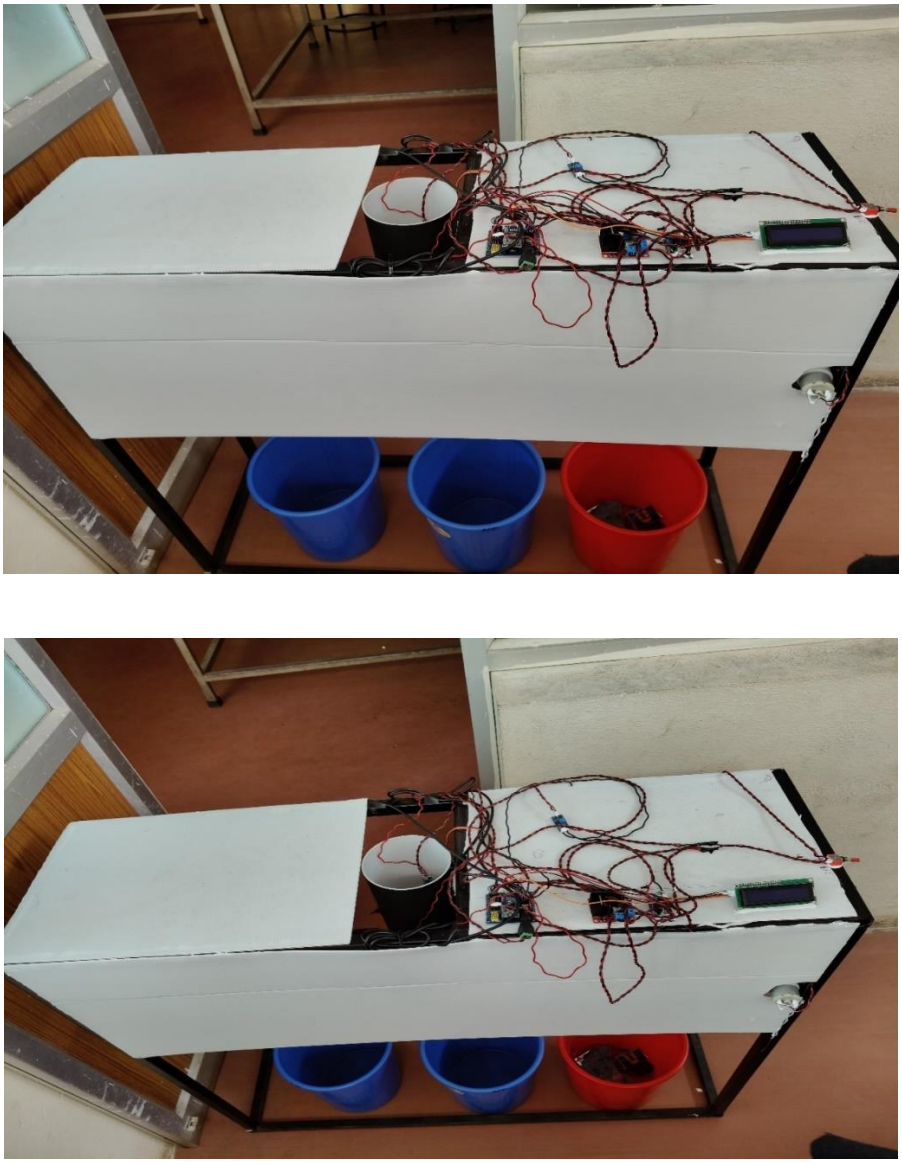

Figure5.2: Working model

V. CONCLUSION

The project deals with the concept of the automatic segregation system. The system designed and implemented will automatically segregate the waste into respective categories using smart bins. The system can automatically segregate dry, wet and metallic waste and collect them into separate segregation bins Thus the developed system can automatically segregate the waste into respective categories using sensor present on the system and rotary segregation bin. From the implemented project we can conclude that:

1. The developed system can automatically segregate different types of waste
2. The system is automatic and conveyor based, hence the man power required is less
3. The system can segregate three categories of waste

4. The system can operate continuously

IOT based monitoring system ensures the Levels of the bins are monitored correctly to check when the level is full. The project has wide scope for future modifications. The project can be in future modified to make conveyor-based segregation system which will continuously segregate it into dry wet and metallic waste. Also, computer vision techniques can be used.

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