

IoT based Automatic Waste Segregator

¹Nimish Jain, ²Sourav Kumar Jain

^{1,2}Department of Electronics & Communication, Teerthanker Mahaveer University, Moradabad

nimish942jain@gmail.com

souravjain489@gmail.com

Abstract - One of the main reasons that led to increase in quantity of waste produced daily is population growth. For national and the local government, continuous increase in waste generation due to increasing population and industries now become a severe problem. Local authorities facing serious problems while for managing the wastes. To make sure that there must be minimum risk to human health and the environment. Now it is necessary to take appropriate step for segregating the waste. Separate waste in a proper way, which can give full play to the real economic value of the waste. In early time in India, the method used for garbage sorting was to pick up garbage, which was time-

consuming and would have a serious impact on the health of people who come into contact with such garbage. Here, we recommend using the Automatic Waste Segregator (AWS), which requires a lower cost and also household waste sorting can be done easily. It will classify waste into three types, namely; metal, wet, dry. This system uses humidity sensors to separate dry and wet garbage, and inductive proximity sensors to detect metal garbage. It can be proved from earlier reports that the use of automatic waste separators to separate waste is successful.

Keywords - Segregator, metal detection, waste segregation, IoT

I. INTRODUCTION

In today's world, huge cause of concern is waste disposal. The methods of disposal of the massively generated waste cause an unpropitious effect on environment. For waste disposal, common method of used by the municipal department in the dump is an unplanned open dumping. This method will affect human health, animal and plant life.

Hazardous methods used in waste treatment produce hazardous chemicals that can pollute the groundwater as well as surface water. Can cause bacteria or germs from which harmful diseases can spread. Natural environment beauty will also reduce due to these wastes.

Unless it is fully recycled, economic value of generated waste cannot be realized. Waste can be processed into useful entities using several technologies, like "turning garbage into treasure", where garbage used to produce syngas (synthetic gas) which is composed of CO (Carbon Monoxide) as well as H₂ (Hydrogen). Then gas is burned to generate steam, electricity; garbage or waste is turned into fuels, and waste can used to produce biofuels.

When garbage or waste is divided into different basic categories such as dry, metal, wet, it can be recycled and reused because it has higher recycling potential. Wet waste is usually converted into compost or methane gas (CH₄) or both. The demand for biogas,

and chemical fertilizers can be replaced by compost and can used as energy. Metal scrap can be reused or recycled. The objective of the project is to implement a user-friendly, compact, and low-cost system for segregation which simplifies the process of management of waste.

II. TECHNICAL BACKGROUND

According to the following methods, mixed waste is classified at industrial level. By manual sorting, larger items are removed. Then a large rotating drum with holes of certain size used to sort the garbage according to its size. Materials only smaller than the hole diameter will pass, and other particles will remain in the drum. For metallic objects, electromagnets or eddy currents, current-based separators can be used. Near-infrared scanners are used to distinguish various types of plastics based on material's ability to reflect light. X-rays can also be used to separate materials based on their density. The method used in this article to solve waste classification problem is to automate the entire process and reduce costs in order to adjust at household level.

III. LITERATURE REVIEW

The document pointed out that there is no system at the household level to classify waste into various categories i.e., metallic, dry and wet. An AWS (automatic waste segregator), at the household level, can be

used so that waste can be sent directly for processing. Using inductive sensors AWS identify metal objects, and to distinguishment between dry and wet garbage, capacitive sensors used based on a set threshold. However, it cannot separate ceramics into dry waste because as compare to other separated dry wastes it has a higher relative permittivity. We can eliminate noise by improving accuracy and overall efficiency. [1]

This shows that even PLCs can be used in AWS. Its advantage is that it reduces manpower and improves the speed and accuracy of management of waste. It also decreases the working risk in risky locations. Using robotic arms, work can be done to pick and place certain reusable materials in the future. On the top of each trash can, by placing limit sensors on trash cans it can be unloaded. [2]

According to the above survey, we will use Arduino UNO with feedback system to implement AWS. The system will be implemented using ultrasonic ranging sensors, & when the trash reaches the level of the sensor connected in the trash can, it will send an interrupt to the microcontroller on the LCD A message will be displayed saying that the bin full. And microcontroller enters a low-power mode until it is not reset. They say that for monitoring the garbage collection ultrasonicsensors are used. When the garbage reaches the level of sensor, an interrupt is sent to the microcontroller. [3]

This article describes the many upgrades that can be made to existing projects like Advanced processing technology can be used after garbage classification, a separate material feeding method used locally so that it can be continuously sorted after dumping the garbage, and for classifying materials image sensing can done through image processing technology. [4]

They said that mixed waste is classified according to conventional methods at the industrial level. Usually from discarded and unused materials maximum are dry, wet, metallic, etc. These materials which are

discarded and unused can be recycled and reused. Garbage sorting is the first step in recycling. Main goal of proposed work is to isolate metal, dry, wet materials. Inductive proximity sensor and a humidity sensor-two sensors are used here. For detecting level of liquid, infrared sensors are used to tell that trash can is empty or not. [5]

They showed Arduino Uno microcontroller based smart system for monitoring the garbage, which can determine the garbage level in the garbage bin or dustbin. The system will sense and remind the garbage bin to be get emptied and the garbage or waste must be collected immediately through the SMS municipal system before the garbage bin overflows. For estimating the waste level, ultrasonic sensor is used. For sending text messages, the GSM module is used and for controlling the operation of the system the Arduino UNO is used. [6]

This article proposes an economical and efficient method that can use PLC to quickly and accurately segregate different types of metal cans, glass bottles, plastic bottles, and tetra packaging. The only thing in this system is that at a single time it can only separate one type of waste because the solid waste objects move behind each other one at a time on the conveyor belt. For getting better results, object should be stable and can be done by placing entire sensing module on a single platform. Taking into account various factors, such as reducing manpower, avoiding risks in hazardous locations, improving accuracy, speeding up waste management, etc., waste automated sorting can be used in large numbers in various municipal companies. [7]

In this system, they apply radio frequency identification to the online classification of groups of consumer waste, which can meet the important requirements of an efficient waste management system. The system is not only robust, as well as accurate also, and can handle large amounts of electronic and plastic waste. The disadvantage of this system is that RFID is considered to be affixed to each type of material during the

manufacturing process, just to solve the sorting problem in product processing stage. [8]

With cities development, amount of garbage or waste generated is also increasing. Many cities in the world still lack waste management, to be precise, collecting waste in cities. Therefore, waste tends to accumulate in a certain area. This is not only danger for health of nearby communities, but also creates an unwelcome environment for peoples living there. In order to solve this problem, a smart method is proposed i.e., garbage monitoring. The system will allow city agencies to improve the management of garbage collection resources and make recommendations to establish a qualified garbage collection system. [9]

The system uses ultrasonic sensors. The indoor and outdoor positioning schemes based on signal strength in the ZigBee sensor network provide us with ideas for dealing with outdoor and indoor environments, so schemes for two positioning are proposed. Based on the strongest signal received, indoor solution clusters the positioning area into many sub-areas while outdoor solution uses the estimated (approximate) distance to determine most likely location of sensing node. [10]

The proposed smart dustbin prototype includes three dustbins (white, green and red) fixed in wooden compartment, a Logitech C240 webcam and a Model B Raspberry Pi 3. For detecting waste placed in front of camera, image processing was done using Logitech webcams and Raspberry Pi. The user is directed to the correct trash can through blinking LEDs. A smart trash can system based on a wireless mesh network has been reported. This smart can of trash detect the fullness of the trash can, through wireless mesh network data was send to the control centre. [11]

IV. WORKING

Our project fulfills the basic requirement of segregating the wastes in the single dustbin as if we segregate the waste in

source level only so then there will be no need of segregating it in big levels.

This project segregates the wastes in three types by using sensors of different types that are metallic, wet and dry waste.

Sensors used are-

- Inductive proximity Sensor
- Soil moisture Sensor
- Ultrasonic Sensor

In this we have used Arduino UNO as an operating system all the sensors and motors are controlled using that board. In a bin, four sections are created in -which different types of waste will be added after getting sensed. At the base of bin those four sections will rotate using a servomotor. At top of a bin an entrance loop is created through which waste will be added to the bin in that loop we will be adding all the three sensors so that the waste can be sensed using the sensors before entering the bin. Just below that loop a lid will be attached with a servomotor which will open when instructed. This lid will act as an opening of the segregator. Both the servomotors and all the sensors will get power using a battery and we can power our operating board using laptop or power bank.

As a result, when any waste materials appear in close to opening the sensors will start working and they will detect the type of material it is for example if it is any wet waste then it will be detected by the soil moisture sensor then the first servomotor will rotate and bring the section below the opening of the bin which is fixed for wet waste and then second servomotor will open the lid and we can leave that waste in that allocated section.

The table below shows the logic of separation used in this segregator:

TABLE 1: SEPARATION LOGIC

Inductive Proximity Sensor	Moisture Sensor	Ultrasonic Sensor	Decision
1	-	-	metallic

			(non-recyclable)
0	0	1	plastic, paper, etc. (recyclable)
0	1	0	biodegradable

V. FUTURE SCOPE

The products of this type can be used in houses, offices, societies etc. for the better management of waste. This is not much expensive so this can be implemented in large number and can be used. Some more modifications can be made to make it more effective. We can work on the working time of the device as we can make it fast. We can use robotic arms to make it more efficient. And more sensors can be used to segregate other types of waste too like bio-degradable, e-waste etc.

VI. CONCLUSION

By using this system, we can reduce the burden and save time of local authorities. Automatic Waste Segregator, basic step toward developing an economic as well as efficient waste segregation system with very less human engagement. Using segregating system make system cost-effective, more accurate and even easy to install. This system can also be used at domestic level. It's also a time saving by segregating waste at initial level itself. While implementing this segregator we came across with main problem i.e., sensing range, accuracy, adjusting of infrared (IR), moisture and

inductive proximity sensors. We tried to make the system reliable as possible by doing some modifications.

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