

# RFID Based Waste Management System

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**Abstract:**The most promising problem for governments to ensure sustainable and effective management of waste. Now a day, due to rapid increase in quantity and types of waste becoming major problem. In solid waste, glass bottles, plastic bottles, metal can are separated manually and recycled. To minimize the risks of the safety and health of the public it is important to properly managed disposal and partition of waste. Currently there is no such system which automatically segregates. This paper proposes a system which automatically segregates metal, glass, plastic as well as dry and wet waste.

**Keywords:** Automation, waste segregation, proximity sensor, metal detection

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## 1.0 Introduction

The rising population of India poses serious threats with regard to the availability of living space, utilization of natural resources and raw materials, education and employment. But another serious peril that follows is the escalating amount of waste generated each minute by an individual. Every city is grappling with the menace of ever increasing waste. An astounding 0.1 million tons of waste is generated each day in our country. Sadly, only 5% of this colossal amount of waste is recycled. In India, the collection, transportation and disposal of MSW are unscientific and chaotic. Uncontrolled dumping of waste on outskirts of towns and cities has created overflowing landfills which are not only impossible to reclaim because of the haphazard manner of dumping but also has serious environmental implications. One possible solution for this problem could be segregating the waste at the disposal level itself. When the waste is segregated into basics streams such as wet, dry, metallic, plastic, the waste

has higher potential of recovery, and consequently, recycled and reused. The wet waste fraction is often converted either into compost or methane-gas or both. Compost can replace demand for chemical fertilizers, and biogas can be used as a source of energy. The metallic waste could be reused or recycled.

Even though there are large scale industrial waste segregators present, it is always much better to segregate the waste at the source itself. The benefits of doing so are that a higher quality of material is retained for recycling which means that more value could be recovered from the waste. The occupational hazard for waste workers is reduced. Also, the segregated waste could be directly sent it to the segregation plant then to the recycling plant.

In garbage collection system, there are multiple dustbins located throughout the city or the Campus, these dustbins are provided with low cost embedded device which helps in tracking the level of the garbage bins and an unique ID will be provided for every dustbin in the city so that it is easy to identify which garbage bin is full. When the level reaches the threshold limit, the device will transmit the level along with the unique ID provided. These details can be accessed by the concern authorities. [1]

## 2.0 Literature Review

**1. Normal Waste Segregation method:** - In India, rag pickers play an important role in the collecting, disposing of urban solid waste. This process has its limitation and it was time consuming as well .Rag pickers and conservancy staff have higher morbidity due to infections of skin, respiratory, gastrointestinal tract and multisystem allergic disorders, in addition to a high prevalence of bites of rodents, dogs and other vermin .This system is still at large in most parts of India .also there was no emphasis on waste segregation, so segregating recyclable items from amongst other became a tedious task.

**2. RFID based Segregation System:** - In this system which applies radio frequency identification for on-line sorting of consumer waste groups can satisfy very important requirement of an efficient waste management system. Not only is the system robust, it is also accurate , can handle vast quantities of plastic and e-waste.the drawback of this system is that the RFID is considered to be attached to each type of material during manufacturing only to resolve the problem of sorting during the disposal stage of the product. Each waste material will have identical types of RFID tags that stores the information about the object along with which travels

on conveyer belt. So whenever waste comes near the RFID reader it sends the vital information to the RFID reader. Commands and information are exchanged between the RFID reader and RFID tags. This information is used to drop the each waste material in their respective bins. Later this information is conveyed to the arduino microcontroller for further processing. After interpreting the data received from the RFID reader it will be forwarded to remote master embedded system wirelessly. The zigbee receiver is interfaced with the personal computer which the corresponded Waste material having the RFID tag which contents the all information about the product to be coded during manufacturing in the passive tag placed as there are a variety of the tags available to be attached with the material.

It is not viable as not all companies would add to their cost of applying RFID tags to their products thus implementation of such system is difficult and not economical. Also we are dealing with waste products so to use RFID scanner like devices in such harsh and non-suitable condition would only add to the difficulty.

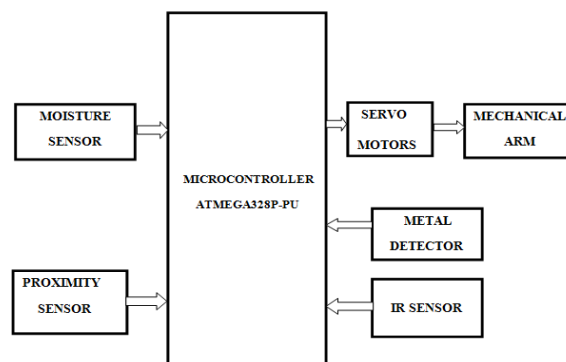
### 3. Microcontroller based Waste Segregation:-

A simple 8051 microcontroller forms the heart of the system. It controls the working and timing of all the subsections so as to sort the waste. Inductive proximity sensor is used to detect the metallic waste.

The signal from the proximity sensor initiates the push mechanism to discard the metallic waste. The timing and movement of the conveyor belt is controlled by 8051 microcontroller. Continuous and unnecessary operation of any particular section is thus avoided. The main limitations in this type of system are that the waste segregator device or equipment is more rightfully is used in harsh and rough conditions. Different parameters such as heat, dust etc. The microcontroller may be more prone to damage. Also the scope for expansion of this equipment may not be possible due to circuit constraints unlike PLC. Some other limitations are: 1. Segregation of the waste consumes time. 2. E-waste, Sanitary waste and medical waste cannot be segregated by the proposed system as there are certain rules and regulations specified by government to be followed for their segregation [3]

### 3.0 Materials And Methods

The figure shows the block diagram of our project Garbage Collection and Segregation System. It includes 3 sensors Proximity, Moisture and Metal detector, DC motor, GPRS, GPS controlled by ARM micro controller. As shown in Figure Microcontroller ATMEGA328P-PU is the heart of this project. All the devices here are controlled using Microcontroller ATMEGA328P-PU. The IR sensor after sensing or detecting the level sends the notification to mobile.



#### IR SENSOR:

An Infrared (IR) sensor is used to detect level in the dustbin whether the dustbin is full or not. An IR sensor consists of an emitter, detector and associated circuitry. The circuit required to make an IR sensor consists of two parts; the emitter circuit and receiver circuit. Emitter is

simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, its resistance and correspondingly, its output voltage, change in proportion to the magnitude of the IR light received. This is the underlying principle of working of the IR sensor

### IR TRANSMITTER

Infrared Transmitter is a light emitting diode (LED) which emits infrared radiations. Hence, they are called IR LED's. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye. There are different types of infrared transmitters depending on their wavelengths, output power and response time.

- A simple infrared transmitter can be constructed using an infrared LED, a current limiting resistor and a power supply. When operated at a supply of 5V, the IR transmitter consumes about 3 to 5 mA of current. Infrared transmitters can be modulated to produce a particular frequency of infrared light. The most commonly used modulation is OOK (ON – OFF – KEYING) modulation. IR transmitters can be found in several applications. Some applications require infrared heat and the best infrared source is infrared transmitter. When infrared emitters are used with Quartz, solar cells can be made.

### IR RECEIVER

Infrared receivers are also called as infrared sensors as they detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photo diodes as they detect only infrared radiation. Different types of IR receivers exist based on the wavelength, voltage, package, etc. When used in an infrared transmitter – receiver combination, the wavelength of the receiver should match with that of the transmitter.

### MOISTURE SENSOR



The voltage that the sensor outputs changes accordingly to the water content in the soil.

When the soil is:

Wet: the output voltage decreases

Dry: the output voltage increases

The output can be a digital signal (D0) LOW or HIGH, depending on the water content. If the soil humidity exceeds a certain predefined threshold value, the module outputs LOW, otherwise it outputs HIGH. The threshold value for the digital signal can be adjusted using the potentiometer.

### **Metal Detection System**

The object moves over the incline and falls on the inductive coil. The inductive coil is a part of a parallel inductance and capacitance (LC) circuit. The circuit is connected to the LDC1000 inductance to digital convertor. This measures the parallel resonance impedance of a parallel LC circuit and returns data as a proximity value. This data changes whenever another metallic object is introduced in the vicinity of the coil. When an alternating current is passed through a coil it generates a magnetic field. When a metallic object is introduced in the vicinity of the coil, eddy currents are induced on its surface. The eddy currents are a function of the distance, size, surface area and composition of the target. This generates a magnetic field which opposes the original magnetic field which is generated by the coil. The inductive coupling between the coil and the object creates a mutual inductance effect on the coil which decreases the parallel resonant impedance of the circuit which in turn is reflected by an increase in the proximity count value. Magnetic fields do not affect the metal detection system. It can detect any conducting material irrespective of its magnetic properties.

An average of base count is set up by using LDC1000 in data ready mode which generates an interrupt every time the proximity value is ready to be read. After a base count is established the LDC1000 is switched to threshold mode which generates an interrupt once the proximity data crosses a set threshold. Hence, the object is inferred as metallic. The waste continues down the second incline towards the apex. If the type of garbage is not metallic then the capacitive sensing module continues to sense the object, else the sensing module is stopped and the actuators are activated. [4].

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