

Smart Bin for Segregation of Household Wastes

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Abstract—In this paper we have presented a smart waste bin for segregation of house hold wastes . To recognize the type of waste whether it is degradable or non degradable or metallic waste for efficient waste management system. In urban India the total municipal waste generated is very large, Segregation of this bulk waste is a tedious process and costly. In order to find solution to such a problem we step into a product “Segregating bin”, which would separate the wastes right from house could be an effective solution to avoid burden over large scale.

Index Terms— Smart bin, Waste Management, Bio-degradable, Non-Biodegradable, Metallic.

I. INTRODUCTION

Waste management or Waste disposal is all the activities and actions required to manage waste from its inception to its final disposal A Smart City is a city development to manage multiple information and communication technology (ICT) in order to make a solution for any problem in the city. Smart city includes many information such as, local department information system, schools, libraries, transportation system, hospital, power plants, law, traffic system, waste management, and others city services. The goal of a smart city is to improve an efficiency of services and connect all information into one system. In this context, compact segregating bins which can be installed in houses. The top of the bin is mounted with IR sensor, when an object is dropped into the bin the IR sensor detects it and sends the information to the microcontroller, The microcontroller then commands the motor to open up the cap of the bin. Later the waste gets inside the bin and falls on a slider plate. The slider plate is a movable one. Nearby the slider plate Induction sensor and Soil moisture sensors are placed. The main intention to use Induction sensor is to Detect whether the entered waste is metallic or Non-metallic. The primary process of the bin is to categorize the type of wastes .The Induction sensor senses the waste first and if the waste is recognized as metallic waste , then it is made to fall into Corresponding sub-bin. If the sensed waste is found to be non- metallic waste ,then it is sensed by Soil Moisture sensor to find whether it is dry or wet waste. The wet waste and dry waste fall into their corresponding bins after segregation.

II. LITERATURE SURVEY

Daniel Hoonweg et al (2012) launched “WHAT A WASTE” global review of Solid Waste Management , Urban Development and Local Government Unit World Bank, Washington. His findings are as follows. This paper shows the introduction of a system combined with an integrated combination of Radio Frequency Identification, Global Position System, General Packet Radio Service, Geographic Information System and web camera that will solve the problem of solid waste They also analyzed the actual performance of the system. Narayan Sharma, “Smart Bin Implemented for Smart City”, International Journal of Scientific & Engineering Research, September 2015, Vol.6, No.9.This paper describes the application of a model known as “Smart Bin” in managing the waste collection system of an entire city. The network of sensors enabled smart bins connected through the cellular network generates a large amount of data, which is further analyzed and visualized at real time to gain insights about the status of waste around the city. This paper also aims at encouraging further research in the topic of waste management.

III. PROPOSED METHODOLOGY

Segregation of waste from source makes the process easy. The waste separation takes place with the help of inductive and capacitive sensor. Doesn’t require much space, can be installed in each house and is a cost effective.

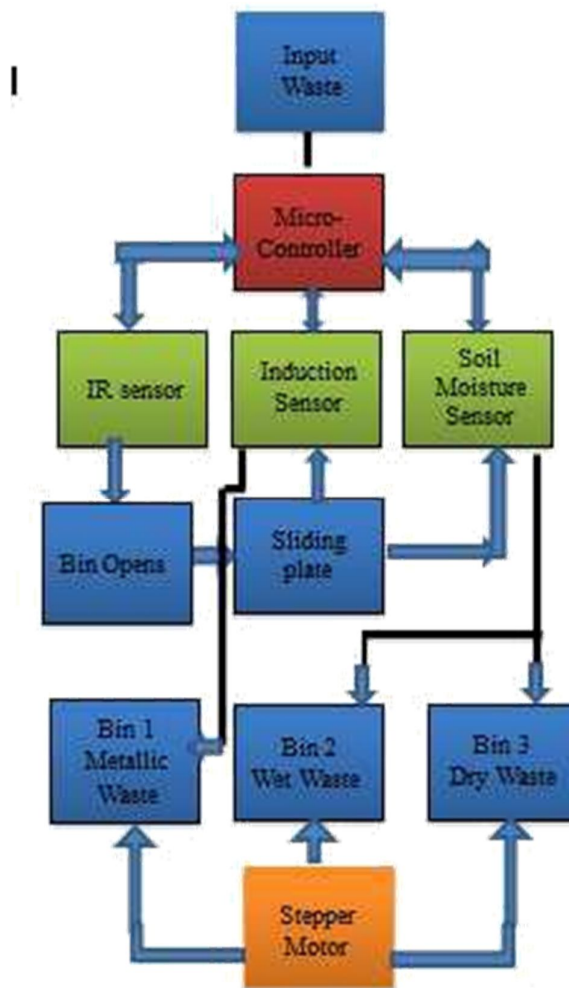


Figure.1. Block diagram of smart bin

A. Graphical Representation of Smart Bin

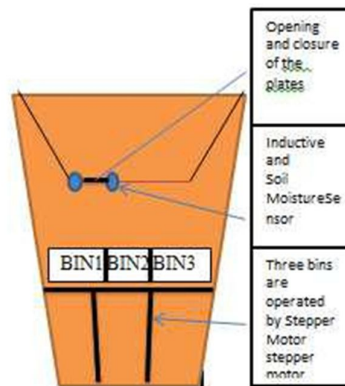


Figure .2. Smart Bin

B. Description of Block Diagram

The input is fed and input feeder switch is turned ON. The **Sliding edge** activates and the waste is pushed to the sensing area **IR** sensor is used to detect the incoming waste. Sensor block consists of **inductive and Soil Moisture sensor** which would identify the type of waste. **The moving arm** opens and the waste is dropped into the lower half of the bin. Three sub bins one each for metallic, dry and wet mounted on a disc driven by a **stepper motor**. The motor rotates on the basis of type of waste detected catches the waste falling.

IV. IR SENSOR



Figure.3.IR sensor

An infrared sensor circuit is one of the basic and popular sensor module in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real time.

V. INDUCTIVE SENSOR

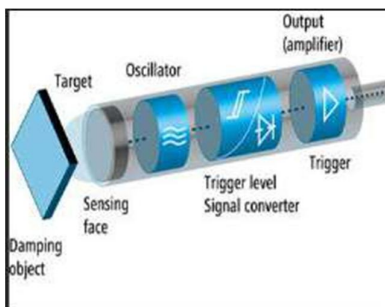


Figure.4. Inductive sensor

Inductive sensors use currents induced by magnetic fields to detect nearby metal objects. The inductive sensor uses a coil (an inductor) to generate a high frequency magnetic fields shown in below. If there is a metal object near the changing magnetic field, current will flow in the object. This resulting current flow sets up a new magnetic field that opposes the original magnetic field. The net effect is that it changes the inductance of the coil in the inductive sensor. These sensors will detect any metals, when detecting multiple types of metal multiple sensors are often used. These sensors will detect any metals, when detecting multiple types of metal multiple sensors are often used. The magnetic field of the unshielded sensor covers a larger volume around the head of the coil. By adding a shield (a metal jacket around the sides of the coil) the magnetic field becomes smaller, but also more directed. Shields will often be available for inductive sensors to improve their directionality and accuracy.

VI. SOIL MOISTURE SENSOR

The soil moisture sensor consists of two probes which are used to measure the volumetric content of water. The two probes allow the current to pass through the soil and then it gets the resistance value to measure the moisture value. When there is more water, the soil will conduct more electricity which means that there will be less resistance. Therefore, the moisture level will be higher. Dry soil conducts electricity poorly, so when there will be less water, then the soil will conduct less electricity which means that there will be more resistance. Therefore, the moisture level will be lower. This sensor can be connected in two modes; Analog mode and digital mode. First, we will connect it in Analog mode and then we will use it in Digital mode.

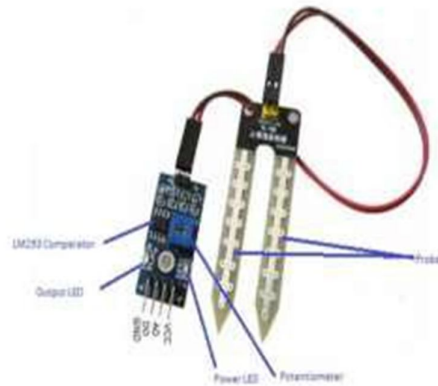


Figure .5. Soil Moisture Sensor

VI. ARDUINO ATMEGA

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode. Revision 3 of the board has the following new features.1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The second one is a not connected pin that is reserved for future purposes. .Atmega 16U2 replace the 8U2. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards. The Arduino hardware and software was designed for artists, designers, hobbyists, hackers, newbies, and anyone interested in creating interactive objects or environments. Arduino can interact with buttons, LEDs, motors, speakers, GPS units, cameras, the internet, and even your smart-phone or your TV



Figure.6.Arduino atmega2560

VII. EXPERIMENTAL SETUP

The Hardware setup of Smart bin for segregation of household wastes is shown in Fig.9 The three sub- bins segregates metallic, dry and wet waste



Figure.7. Hardware setup of Smart bin

Based on the programming in microcontroller the signals are transmitted between microcontroller, stepper motor, servo motor and sensors. Sensors are mounted on the smart bin the sensors are soil moisture sensor, IR sensor, Inductive sensor.

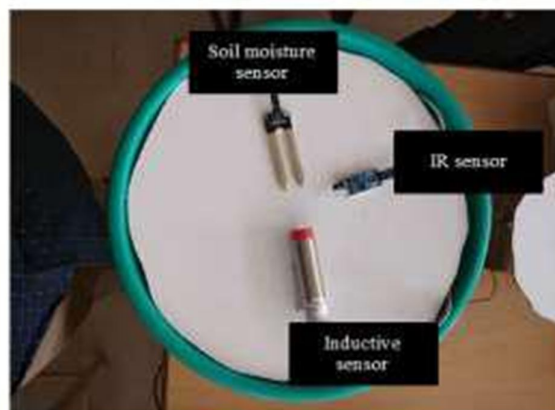


Figure. 8. Types of sensors mounted in the smart bin

The stepper motor is used to turn the bins to place in their corresponding position



Figure.9.Role of Stepper motor in the bin

VIII. RESULTS AND DISCUSSION

The below figure shows the results of various materials moisture level . we can infer that positive results are shown for wet waste and negative for dry and metallic waste. This experimentation is done using soil moisture sensor.

TABLE I. THE SEPARATION OF WASTE BASED ON MOISTURE CONTENT OND METALLIC PROPERTY

SL.NO	ITEM	MOISTURE LIMIT	METALLIC WASTE	TYPE OF WASTE
1	Nail	negative	positive	Metallic Waste
2	Paper	negative	negative	Dry Waste
3	Cotton	negative	negative	Dry Waste
4	Cotton dipped in Water	positive	negative	Wet Waste
5	Peel of grape	positive	negative	Wet Waste
6	Ball pen	negative	negative	Dry Waste
7	Copper wire	negative	positive	Metallic Waste

IX. OUTPUT OF PROPOSED METHODOLOGY

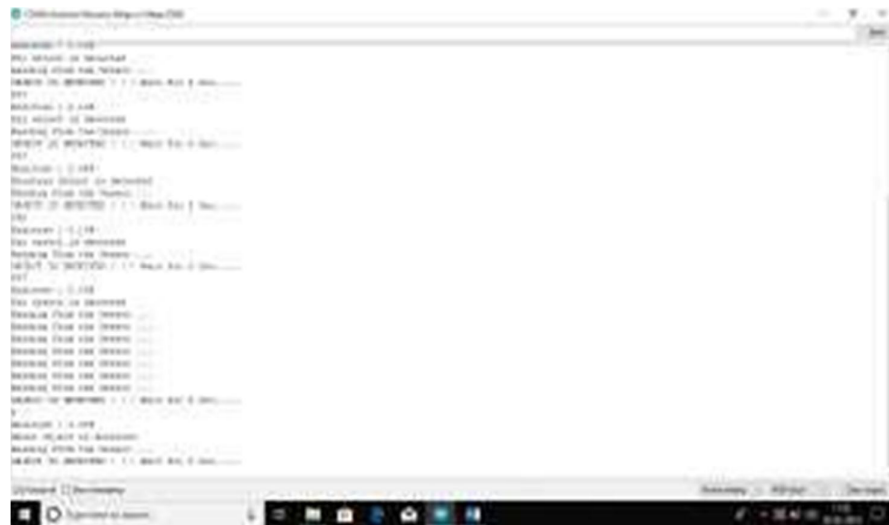


Figure.12.output of various detected objects

X. CONCLUSION

Waste management or waste disposal are the activities and actions required to manage waste from its inception to its final disposal. A large portion of waste management practices deals with municipal solid wastes which is the bulk of the waste that is created by household ,industrial and commercial activity.Our work reduces the pressure to segregate large amount of deposited municipal wastes by segregating them in house itself.The future scope is to perform bin level monitoring and in the present work one waste can be detected and processed at a time and so the future work is process multiple wastes at a time.

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