Smart Bin for the Separation of Waste using IOT

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Abstract — Nowadays garbage collection is a major problem in all cities. Even though there are big garbage bin in each street, it overflows and bad odour makes that area very uncomfortable. The concept of IOT is used in various applications. Here this paper uses IOT for the separation of waste by keeping different types of smart bins for plastics, glass or iron and organic wastes in each street. So that at the time of disposing the waste the bin senses the waste material through the sensor. There is a motor and sensors on the top of it that identify the type of waste. Here one moisturizer sensor is used for segregating the dry and wet waste. Once selection is decided the robotic arms push the wastes to the respective box in various methods. Through this the disposal of garbage can be made efficiently according to the various types of waste materials.

Keywords: Smart Bin, Sensors, Segregation, IOT (Internet of Things)

I. INTRODUCTION

Today even though government is taking all the measures to make our city as smart city, we are able to see most of the road sides are polluted by overflow of waste in the garbage bin. This is not only polluting the land but also polluting the environment. Waste collection truck for collecting wastes comes once or twice in a week and collects the waste. After collecting there will be a manual separation of wastes according to its types. This makes the persons fall sick while working under that area. In this we are going to study for the separation of waste using an IOT based smart bin. So the waste is also separated by automatic waste segregator system. Here IR sensors are used for detecting what type of garbage is present. And one moisturizer sensor is used for segregating the dry and wet waste. For making the clean India this system is very innovative and makes the hygienic environment. It can be installed anywhere in the world such as home, colleges, company, industry etc.

II. LITERATURE STUDY

The waste management in cities has to be effectively and efficiently implemented. Many proposals were put forward and some of them already implemented. But it cannot be considered as an effective one. So a survey was done among different proposals and this survey paper includes different methods for smart bins for the separation of waste in cities using IOT.

Smart bin with colors:
Smart bins will contain a container at the top in which we need to put the waste. The sensors will sense the type of waste in the container and accordingly the container will be moved to the appropriate bin and empty the waste. People will not have to manually separate the waste as the smart bin will be doing it by detecting the type of waste and putting it in concerned bins.

Already some of the smart bins are available in some of the foreign countries such as Australia, U.S.A, etc. for the separation of waste. Those smart bins vary according to the quantity of waste disposed in that bin. There are smart bins in malls, theatre, restaurant, company etc. These type of smart bins separates by keeping track of different types of wastes like plastics, glass or iron and organic wastes.

There is a common box with a hole for putting the waste. There are four compartments under that common box with the lids closed. When we put a plastic waste inside the hole of the common box, the sensor fixed inside the smart bin detects the waste and the box alone gets rotated to throw the waste in its appropriate compartment. Here each compartment is given a color light like red, blue, green and yellow. Once the smart bin detects the waste the color light glows and throws the waste according to the matched color of the compartment.

Smart bin with robotic arms:
But some smart bins use hydrophobic coating on the robotic arms that pushes the waste into the bin since there may be chances of liquid waste sticking to it. The sensors like capacitive sensors, resistive sensors, inductive proximity sensor & ultrasonic sensors are placed. All these sensors give the data regarding the waste for eg. If it is a paper, it goes into one box, if it is plastic, it goes into another box, for wet waste there is another and for metal & glass different one is there. An application is designed to monitor the materials related to the different type of waste for different locations.

Robotic arm: A robotic arm is a type of mechanical arm, usually programmable, with similar functions to a human arm. It is fixed in the central part of the garbage bin. Coding controls the robotic arm by rotating individual servo motors connected to each joints. This arm picks and place the waste in the bio-degradable and non bio-degradable bin.

Servo motor: It is rotary actuator that allows for precise control of angular position. Four servo motors are connected to control the robotic arm movements. The actions controlled by servo motor are rotating , front and back , ups and downs and gripping of waste.
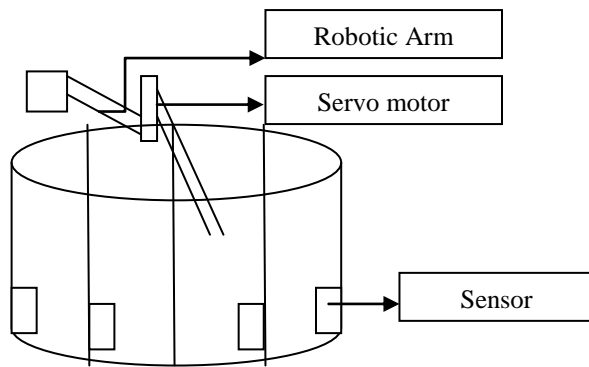

Figure 1.   Example of a Smart bin with robotic arms

Garbage ATM:
Four Young men from Nasik developed Garbage ATM, a smart automated waste bins. The whole system is composed of two dustbins and one LCD screen. The user will be provided with a card with which it should be swiped for the dustbin to work.   Once the card is swiped, a general knowledge question will be generated automatically which will have two options: A & B are used for the two dustbins. Suppose user has given option B as his/her answer, then the lid of dustbin B will be opened and the user will throw the garbage in that dustbin.

In this way, the system is keeping the record of the number of correct answers given by the users.   The user with maximum correct answers will be rewarded in the forms of coupons or money. This method also reaches the people in order to win the reward and make them to throw the garbage in the dustbin.

Reverse Vending Machine:
This type of smart dustbins is already implemented in the countries like Australia, U.S.A, Germany, Norway etc. Sometimes along with other wastes, plastic wastes are also thrown which we all know it is non-biodegradable. So it is recycled which is a costly method.

Separation of plastic bottle from the garbage requires labour work which produces cost and effort. Sometimes, uncrushed

water bottles thrown in garbage are collected by poor children who in turn fill that bottle from nearby tap which contains contaminated water. The water bottles are sold by these children in railway stations, bus terminals etc. Drinking water from these bottles is very unhealthy. Due to this reasons, reverse vending machine is very helpful. These machines will be placed at public places.

Instructions of usage of these machines will be indicated on the body of the machine.   Using this machine, manual collection and selling of uncrushed plastic bottles can be avoided fully. Easier collection of plastic waste and proper disposal of plastic waste will take place. After disposal of plastic waste, users will get the opportunity to get rewards in money or coupons according to the weight of the plastic bottle.

Smart bin using Microcontroller:
This type of smart bin is used to segregate waste at source level to wet, dry and metallic wastes. So that waste is not wasted but can be converted to a source of energy, in a cost effective way. When waste is dumped IR sensor detects the entry of the waste and is tuned using the potentiometer in both the directions.

Microcontroller AT89S52 is used which is a low-power, high-performance CMOS in turn activates DC motor by executing program to rotate the motor in the forward direction. Microcontroller continuously checks the status of sensor. If sensor is detecting metal then it selects particular bin using stepper motor. If the waste is not metallic then it passes through the moisture sensor. Metal waste is connected in such a way that it contact with every type of waste. If there is a short in metal sensor then waste is of wet type.
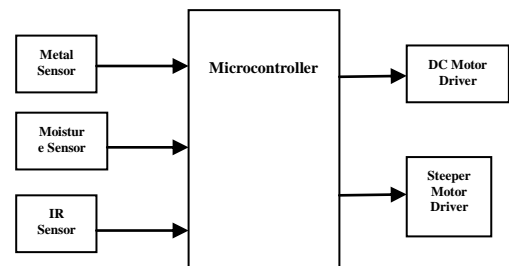

Figure 2.   Example of a Smart bin using Microcontroller

Continuously microcontroller checks for the status of moisture sensor and selects the bin for wet waste using stepper motor otherwise by default it is dry waste. Three bins are placed in circular manner so that the stepper motor rotates in clockwise and anticlockwise direction to select a particular bin. Buzzer produces beep sound when any one of the wastes in sensed by any one of the sensors.

This mainly concentrates on separating waste at a less cost which have made use of AT89S52 compared to MSP430 that

is costlier. Here a moisture sensor is used instead of a capacitive sensor which makes it difficult to differentiate between dry and wet waste.

Degradable and Non-degradable Wastes Separation Using Pick & Place Robot :
The trash will be placed on the top of the Smart Bin which contains at the an opening on the top. Once the trash is placed the sensors will detect the type of waste and drop that waste into the moving box. The moving box is driven using stepper motors. The function of the moving box is to take command from the microcontroller and accordingly move to the intended bin and empty the trash.

The waste is detected and separated using robotic image processing. The challenge in this paper is capturing the image and detecting the waste.

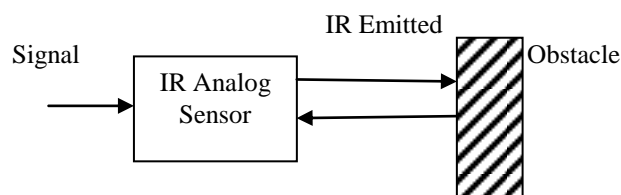Analog IR sensor is used for segregation of biodegradable and non bio-degradable waste.

Figure 3. Example of an Analog IR sensor

III.   ADVANTAGES

- Better performance in wireless network
- Simple system & reliable Real-time object monitoring & segregation.
- Reduces manpower, cost and time.
- Reduces spreading of diseases

IV.   APPLICATIONS

- Industries
- Public places
- Residence
- Hospitals
- Schools and colleges etc.

V.   CONCLUSION

Taking into account of the waste separation management using smart bins in our country there can be managing of the waste properly as well as using the latest technology IOT in malls, theater, company, etc. But in India mostly populated cities should also use the smart bins in each street because

here people through the collection of wastes enclosed in large plastic bags or paper bags or clothe bags. These bags may consist of all types of waste.

There should be smart bins with more advanced features for the separation of the each and every bag without leaving out any type of wastes contained in those bags. Though Smart bin may be a major change in the case of waste management, maintaining it for a long run might be a difficult task for the local authorities.

There might be a case of theft or damaging of smart bins by notorious people in the society. But with the growing awareness about its importance, the above mentioned remedies could be beneficial for the society. At least it will lead to one step closer towards "Clean India".

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