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Smart Robotic Arm Based Waste Segregation System

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Abstract: **- Waste segregation is a simple method of reducing the amount of waste dumped into our landfills. Large amount of recycle waste in different category are not segregated properly. A solution to this is Automated Waste Sorter and robot waste deliver system are intended to automate the sorting process of wet, dry and metallic waste. In this system at first the IR sensor is used to detect the waste in front of the smart bin. Along with this we integrate a robot system to deliver the process of collecting the waste that is to be sorted by the AWS, to minimize the human interference. The robot arm system is composed of dc motors and gear drivers that is able to mechanically pick up the waste and put it at platform which consists of sensors like moisture sensor to detect dry and wet wastes, also proximity sensor to detect metallic waste and based on coding rotate the slotted bin to dump the waste based on colour coding and colours assigned for different types of wastes. Also ultrasonic sensor placed at lid of bin detects the level of waste inside bin and sends notifications to empty it once it is full via GSM module. Experimental results show that the segregation of waste into metallic, wet and dry waste has been successfully implemented using the Automated waste segregation system.**

1. INTRODUCTION

Rapid increase in volume and types of solid and hazardous waste as a result of continuous economic growth, urbanization and industrialization, is becoming a increasing problem for national and local governments to ensure effective and sustainable management of waste. It is estimated that in 2006 the total amount of municipal solid waste generated globally reached 2.02 billion tones, representing a 7% annual increase since 2003 (Global Waste Management Market Report 2007). The segregation, handling, transport and disposal of waste are to be properly managed so as to minimize the risks to the health and safety of patients, the public, and the environment. Currently there is no such system of segregation of dry, wet and metallic wastes. Numerous research have been reported using various technologies. In [1], the basic Idea is to implement a smart way of handling the garbage by using the IOT protocol for transmitting the dustbin status wirelessly, through e-mail to notify to the concerned person that system is filled with garbage and need to be replaced. In [2], the system aims to schedule trucks by finding shortest path for waste collection. This system set up smart waste bins/ trash cans per society, which will be IoT enabled. It transmits information about dustbin fill status and harmful gas levels. It finds efficient route to collect maximum waste with less cost and fuel. In [3], this paper describes the application of Solar Smart Bin in managing the waste collection system of an entire city. In [4], the proposed model has two dustbins (named as Dustbin A and Dustbin B) which will be kept at public places mostly. Dustbin A can be used but Dustbin B cannot be used until Dustbin A is full. Whenever any dustbin is filled up, a message is sent to the concerned authority. This will avoid overflow of waste in the bin. In [5], it deals with the increased level of environmental pollution due to different kinds of waste, unauthorized landfills and the lack of counting and monitoring of the territories ecological conditions are problems faced by all mega-cities around the world. In [6], the Paper is proposed IOT based smart waste clean management system which checks the waste level over the dustbins by using Sensor systems. Once it detected immediately this system altered to concern authorized through GSM/GPRS. In [7], this paper is to enhance practicality of IoT based solid waste collection and management system for smart city. As soon as dustbin has reached its maximum level, Waste management department gets alert via SMS via GSM module placed at dustbin so department can send waste collector vehicle to respective location to collect garbage. In [8], it is a promising approach to manage the waste with increased cost efficiency. Moreover, the problem related to the spilling of the waste due to overfilling of the trucks is solved. In [9], main objective of this paper is effective and efficient methods of waste collection and segregation at domestic level based on their nature of composition i.e. metal, plastic and biodegradable, the waste is stored accordingly in their respective segments of the dustbin. In [10], it is an automated alert based smart bin to alert the authorities like corporation or local waste

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disposal team. This system can be easily extended to any number of bins. In [11], system aims to develop a smart and green system (SGS) for differentiated collection of urban solid waste with integrated sensor network. Here Differentiated collection is necessary but complicates the current schemes of waste collection. In [12], smart solid waste management system is designed that will check status and give alert of dustbin fullness. Thus it achieves smart solid waste management with the goal of making Indian cities clean, healthy and hygienic. In [13], objective of the paper is to provide a solution for the waste management system. The technology which are suggested in this paper, sensors unit, microcontroller for controlling and GSM module. In [14], the paper uses Senor Cloud Services and integrated Ethernet enabled Arduino microcontroller based sensor network. In [15], the intelligent motion sensing platform is redefining the architecture of sensor and sensor networks. An implementation combining a MEMS (Micro-Electro Mechanical Systems) accelerometer, a microcontroller and architecture dedicated to manage the external sensors. Environment is highly polluted by untreated waste because of absence of smart system in developing country. So, the objective of the proposed work is to provide smart and efficient way of waste management, to control the pollution of environment and alert the waste management authority and to segregate waste to wet, dry and metallic. This paper proposes an Automated Waste Segregator (AWS) which is designed to sort the refuse into metallic waste, wet waste and dry waste cost efficiently. The AWS employs parallel resonant impedance sensing mechanism to identify metallic items, and capacitive sensors to distinguish between wet, dry and metallic waste.

II. MATERIALS AND METHODOLOGY

In this work, ROBOT is designed using DC Motors and Motor Drivers. The ROBOT will sense the presence of waste on conveyor using IR Sensors. After that the gripper will pick the waste and at the gripper there are two types of sensors. The sensors are Moisture, metal proximity and limit switch. The block diagram of the proposed system is shown in fig.1 and its flowchart is shown in fig.2.

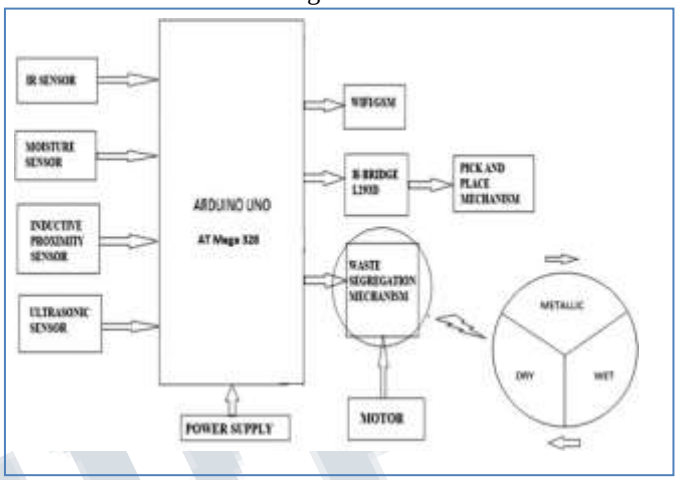

Fig.1 Block diagram of the proposed system

The metal proximity sensors are used to sense the metal type waste and the limit switch are used to sense the other waste except the metal. The Soil Moisture sensors are used to sense the agriculture or wet waste. As the sensors sense the waste, the bin placed at vehicle will move accordingly. ARM will drop the waste in proper section of bin. GSM module used here to send the intimation to concerned authority once the separation is over and even when the bin is completely full. The Block diagram shows the different component used in the Smart Dust bin System is Power Supply, IR Sensor, Metal Sensor, Moisture Sensor ARM. Sensor is connected in dustbin it is used to detect the level of dustbin where dustbin is full or empty. With the help of sensors the system can segregate the waste collected in collection Point. In turn

Controller initiates Robotic arm to collect the waste and segregate accordingly.

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Fig.2 Flowchart of the proposed system

Three Separate storage based dustbin is designed for automatic waste collection and segregation. As soon as the ultrasonic sensor senses that garbage container reached its maximum capacity. The Raspberry pi sends the message through Twillio module to the trash management personnel that trash box is filled completely, so that they schedule there trash collection based on this information. The sensor senses the content of the dustbin and sends the signals or the data to the Raspberry Pi then the microcontroller reads the data from the sensor and process the data received from sensor, and the same data will send to Dashboard section and this section send mail/message to respective Municipal / Government authority person or collection vehicle.

In bin movement methodology, bin moves across the floor, it cleans and backs up right when it bumps into something in its way. It uses collision and infrared sensors for direction control. When collision sensor is trigged the bumper backs up, which means the system has hit an object, thus sensor sends signal to PCB. Basically we use two collision sensors. When both the sensors are triggered it means the obstacle is directly in front of it. If one of the sensors is triggered, which

means there is an obstacle in the side. If the collisions sensors are triggered one after the other, which means the system has hit a corner. It immediately turns and changes its direction. At what distance the obstacle is present is detected by IR sensor. The side (collision) sensors are made up of receiver and a mirror contains diode which emits infrared beams invisible light which bounces off the wall. The mirror is positioned in such way that infrared radiation always hits the wall at the specific angle. When the system is at the idle distance from the wall 2 inches each, IR radiations bounces back to receiver. If IR radiations don‘t reach the receiver which means the system is either too close or too far from the obstacle. Thus the PCB analyses the information and system adjusts the path.

III. EXPERIMENTAL RESULTS

This system provides an Robotic solution for Garbage segregation. A pick and Place mechanism is used for separation. Use of Sensors like Moisture and Proximity for Waste separation such as wet, dry and metallic etc. This checks the waste level over the dustbins by using Sensor. Once it detected immediately this system alert to concern authority through GSM.

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Fig.3 Smart Robotic Bin

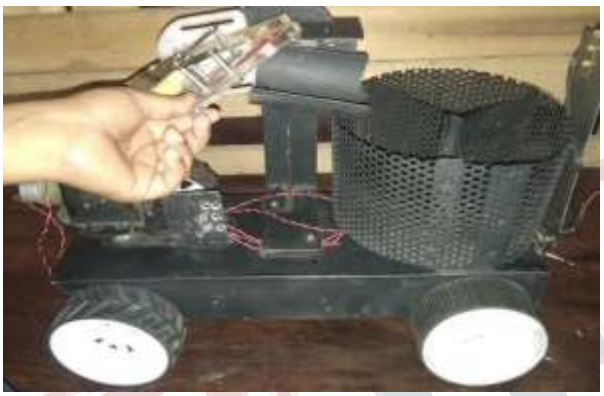

Fig.4. Model of Smart Bin

The side (collision) sensors are made up of receiver and a mirror contains diode which emits infrared beams invisible light which bounces off the wall. Robotic arm to pick the waste Plate consisting of sensors to detect it‘s type (wet, dry & metallic) Bin with three slots to collect waste. The designed waste segregation robotic arm and its dust bins are shown in fig.3 and fig.4. The mirror is positioned in such way that infrared radiation always hits the wall Wheels for motion of system using dc motors connected to H- Bridge.

IV. CONCLUSION

This project reports on Wastes segregation using robotic arm; The robotic arm will able to sort out the three different materials like paper, glass and metals. When the sensors are triggered the motor-powered arm is actuated and the materials are dispensed onto its proper bins. The Trash management system is a step forward to make the manual collection and detection of wastes automated in nature. It would pioneer work for solid waste collection, monitoring and management processes. This segregation system is efficient and time saving process than the currently employing method. Although the final Automatic Garbage Separation Robot was a relative success, the team has created an outline for future improvement in terms of research and theory, implementation, and program management. On a high level, more research should have been done regarding the interfacing between modules so that a specific implementation plan could have been created. In addition, more time should have been spent researching mechanical design of the robotic arm, whose problems led to a limited functionality of the robot.

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