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Automated waste separation and Disposal unit

Padmaraj Annaji, Assistant Professor, SDMIT, Ujire, India, padmarajannaji@gmail.com

Abstract Technologyalways help mankind in making life easier. Now presenting an innovative way which revolutionizes the waste management system through this we are taking step towards clean india. To properly manage waste it has to be handled, segregated, transported and disposed, so as to reduce the risk of public lives and sustainable environment. There is a rapid increase in capacity and categories of solid waste as a result of urbanization, constant economic growth, and industrialization. Global Waste Management Market reported that the amount of waste generated worldwide produced is 2.02 billion tones. This method is easy and simple solution of segregation of three types of wastes dry, metal and wet

Keywords —Seperation, Segregation,Metal detector, Sensors

I. INTRODUCTION

In recent times, garbage disposal has become a huge cause for concern in the world. A voluminous amount of waste that is generated is disposed by means which have an adverse effect on the environment. The common method of disposal of the waste is by unplanned and uncontrolled open dumping at the landfill sites. This method is injurious to human health, plant and animal life. This harmful method of waste disposal can generate liquid leachate which contaminate surface and ground waters can harbor disease vectors which spread harmful diseases and can degrade aesthetic value of the natural environment and it is an unavailing use of land resources. In India, rag pickers play an important role in the recycling of urban solid waste. 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. Dependency on the rag-pickers can be diminished if segregation takes place at the source of municipal waste generation.

. The purpose is to realization of a compact, low cost and user friendly segregation system for urban households to streamline the waste management process.

II. PROBLEM DEFINITION

A. Problem formulation

The greatest problem regarding waste management in developing countries begins at the very starting point of the process. Due to lack of proper systems for disposal and collections, wastes and garbage's end up in the roads and surrounding. According to a report Zurburg 2002, the amount of waste generation in 2010 was around 20,000 tons per day, and it is estimated that by 2025 the amount will be no less than around 47000 tons per day. With the existing methods of collecting and disposal it is near impossible to manage such amount of waste in the future as around 30% of waste end up on the roads and public places due to ineffective disposing and collecting methods. Not only that, there is even no systematic methodology for the collected garbage for treating and recycling thus most of them end up in land filling and river water, making the environment unhealthier

The prime impediment of implementing "Automated Waste Separation and Disposal Unit" in a developing country is the social and economic infrastructure of the country itself. The initial stage of this system comprises of proper disposal and collection, which is the biggest challenge. In addition, to motivate and influence people to follow proper waste disposal methods is also important.

B. Objectives of work

A trend of significant increase in municipal solid waste generation has been recorded worldwide. This has been found due to over population growth rate, industrialization, urbanization and economic growth which have ultimately resulted in increased solid waste generation. Final destination of solid waste in India is disposal. Most urban solid waste in Indian cities and towns is land filled and dumped. Our Project deals with the most blistering topic i.e. waste separation.

An efficacious management needs to be materialized for better planet to live in. Hence, with our cost effective project proposal, we try to bring in the change. It deals with the minimization of blue-collar method utilization for exclusion of waste into an automated panache. An automation of this style not only saves the manual separators of the numerous health issues, but also proves to be economical to the nation. Besides, this system utilizes low cost components for the successful segregation of most types of waste. When installed in apartments or small colonies, it proves to be beneficial in sorting the waste at the site of disposal itself.

C. Design of the system

The main objective is to separate the waste properly. The Figure 1.1 shows the block diagram of the project. When

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the waste is dumped into the smart dustbin, the IR sensor detects the waste and activates microcontroller .Generally IR sensor is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiations. Then microcontroller activates DC motor which is used for rotation of the conveyor belt. Here we have used AT89S52 microcontroller which is low power, high performance, 8-bit µC and it is compatible with all µC of 8051 family.

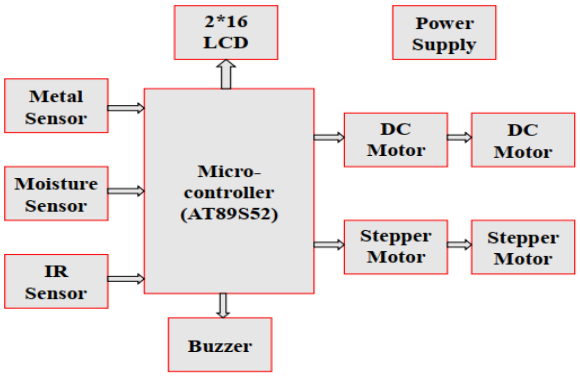

Fig. 1.1: Block diagram

DC motor contains current carrying armature which is connected to the supply end through commutator segments and brushes and placed within the north south poles of a permanent or an electromagnet.

When waste is dumped into the smart dustbin, it falls onto the conveyor belt where different sensors are connected to identify the type of waste. The first sensor is the metal sensor which transmits electromagnetic field. Any metal object within the electromagnetic field will become energised and retransmits an electromagnetic radiation of their own. The sensor's coil receives retransmitted field and alerts the user by producing a target response. Next sensor connected is the moisture sensor which uses capacitance to measure dielectric permittivity of the surrounding medium. Wet waste has higher relative dielectric constant than that of dry waste because of presence of moisture, oil and fat. By this we come to know whether the waste is wet or dry. According to the waste being sensed the bin is selected using a stepper motor. Stepper motor has a rotor with permanent magnets mounted on it, while the stator has minimum of two windings. When the rotor magnet aligns with the stator winding the second winding is energized. The two windings are turned on and off alternatively. This causes the motor to lock on to the desired position. A 2*16 LCD is used to display the type of waste being sensed by the sensors. Buzzer is used indicate when any of the waste is detected by any one of the sensor. Separate drivers are used for both DC motor and Stepper motor to enhance the voltage level since output from microcontroller is 5V and motors require voltage of 12V.

The initialization of all modules ensures that any dynamic changes in the environment do not affect the sensing.

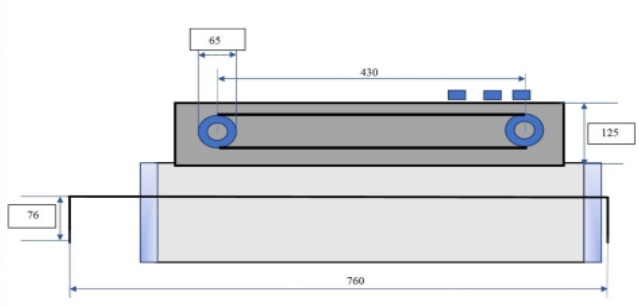

Fig. 1.2 Model Dimensions (mm)

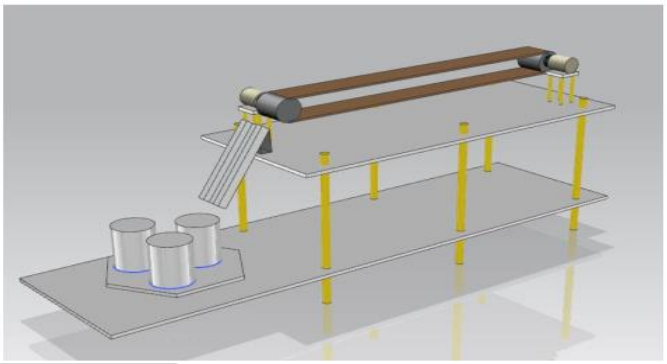

Fig.1.3 CAD Model

III. COMPONENTS IN THE SYSTEM

The components and their salient features are as follows

1. Acrylic Sheets – Acrylic is a transparent thermoplastic homo-polymer known more commonly by the trade name "plexiglass". The material is suitable for use as an impact resistant alternative to glass. Acrylic in general is used for a variety of applications that typically take advantages over other materials like

a) Eliminate corrosion
b) Easy recyclability
c) Skip the paint
d) Improved aesthetics
e) Lighter weight

2. Microcontroller AT89S52 controls the entire operation. It is Atmel series microcontroller. The AT89S52 is Atmel's derivative of the 8052.[1]

3. IR sensor is used which detects the entry of waste into the system and sends a signal to the controller.

4. Proximity sensor is used for the detection of metallic waste, when any metallic particle is introduced into the system proximity sensor gets activated.

5. Rain Drop (Moisture) sensor is used for the detection of wet waste, this sensor measures the moisture content to differentiate between wet and dry wast

6. DC motor along with a driver is used for the rotation of a conveyor belt, the speed of rotation of the motor is controlled by using PWM.

7. Stepper motor is used for the rotation of bins which collect wet, dry and metallic waste.

8. A 2x16 liquid crystal display is used to display the kind

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of waste whether it is wet, dry or metallic.

9. Buzzer is used which produces beep sound when any one sensor gets activated detecting waste.

10. A conveyor belt is the carrying medium of a belt conveyor system (often shortened to belt conveyor). A belt conveyor system is one of many types of conveyor systems.

11. Embedded C program is used to develop applications for microcontrollers. It is popularly known as IDE i.e. Integrated Development Environment, because it provides a single integrated environment to develop code for embedded microcontrollers.

12. Keil µVision3 is a software used by a programmer to burn the code into the controller

IV. SPECIFICATIONS OF THE COMPONENTS

A. Microcontroller AT89S52

he AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8Kbytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU wit0h in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM,32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

B. IR obstacle sensor

An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion. An Infrared (IR) sensor is used to detect obstacles. An IR sensor consists of an emitter, detector and associated circuitry.

Table 1: Specifications of IR sensor

Operating Voltage	3 – 5 V
Power Source	DC Type
Detection Range	0 – 3 cm
Board Size	3.2 x 1.4 cm
Hole required for mounting	0.3 cm

C Rain drop sensor

1 Output format: Digital switching output (0 and 1) and analog voltage output AO.

2 Uses a wide voltage LM393 comparator

Table 2: Specifications of Rain drop sensor

Operating Range	3 – 5 V
Operating Temperature	10 – 30 deg
Operating Current	< 20 mA
Board Size	5 x 4 cm
Material Type	Nickel Plated Surface

D.Metallic (Proximity) sensor

The sensors provide excellent results even with difficult-to-detect objects, e.g. small or thin parts, wires or bright metals. A variety of types cover a wide range of individual requirements and installation situations. Thus, devices are available with N.C. or N.O. functions, with NPN or PNP switching outputs, and cable or plug connection. The enclosure rating is IP66.

Table 3: Specifications of Metallic sensor

Operating Ran	6 – 24 V
Detection Range	0 – 2 cm
Operating Current	30 mA
Board Size	2.2 x 6 cm
Size of Mount	M12 Inductive 4mm

E.Conveyor Belt

A conveyor belt is the carrying medium of a belt conveyor system (often shortened to belt conveyor). A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two or more pulleys (sometimes referred to as drums), with an endless loop of carrying medium, the conveyor belt rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley.

Table 4: Specifications of Conveyor Belt

Belt Length	1063 mm
Belt Width	20.32 mm
Material	Rubber
Maximum Weight that can be applied	40 gm
Pulley Wheel Diameter	63.5 mm

V. METHODOLOGY

Step1: When waste is dumped IR sensor detects the entry of the waste. The sensitivity of the IR Sensor is tuned using the potentiometer. The potentiometer is tune-able in both the directions. Initially tune the potentiometer in clockwise direction such that the Indicator LED starts glowing. Once that is achieved, turn the potentiometer just enough in anticlockwise direction to turn off the Indicator LED. At this point the sensitivity of the receiver is maximum. Thus,

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its sensing distance is maximum at this point. The transmitter continuously transmits the signal to detect the presence of obstacle. When the waste is dumped into the bin the receiver receives the reflected signal from the waste and starts the entire process by the activation of microcontroller.

Step 2: Microcontroller AT89S52 is used which is a low-power, high-performance CMOS 8-bit microcontroller with 8Kbytes of in-system programmable Flash memory. The microcontroller in turn activates DC motor by executing program to rotate the motor in the forward direction. Two DC motors are used for the smooth rotation of the conveyor belt. Both DC motors rotates in forward direction allowing the waste to be detected by the sensors connected in series near the conveyor belt.

Step 3: A belt conveyor system consists of two or more pulleys (sometimes referred to as drums), with an endless loop of carrying medium—the conveyor belt—that rotates about them. One or both of the pulleys are powered, moving the belt and the waste on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley.

Step 4: Sensors are connected near conveyor belt to detect different types of waste. First sensor connected is the proximity sensor to detect metal waste and which is having highest priority among the two sensors connected. This sensor gives accurate results even for smaller. Objects. Proximity sensor continuously emits electromagnetic waves and if any metallic object is passing over the belt within the range of proximity sensor, the metallic object gets energized and retransmits electromagnetic field of its own to the sensor. Microcontroller continuously checks the status of proximity sensor. If sensor is detecting metal then program is written to select that particular bin using stepper motor. If the waste is not metallic then it passes through another sensor connected near belt itself called the moisture sensor. Metal waste is connected in such a way, so that it makes a contact with every type of waste. If there is short in metal sensor then waste is of wet type. Microcontroller continuously checks the status of moisture sensor and if it is getting activated then bin for wet waste is selected using stepper motor otherwise by default it is dry waste.

Step 5: Three bins are placed in circular fashion with 120 degree spacing between them. Based on the waste detected microcontroller activates stepper motor and the program is written for the stepper to rotate 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.

1. Platform was build to install the conveyor, sensors and embedded systems using Acrylic sheets and supporting rods

2. Top layer holds the conveyor system and sensors

3. Bottom layer is for holding embedded system

4. Sensors are installed beside the conveyor so that the waste can be detected

5. The transfer board will be fixed at one end to transfer the waste detected, from belt to bins.

6. Based upon the waste detected the corresponding bin rotate and stops near the transfer board

Fig.1.4 Segreggation Process

VI. CONCLUSION

Waste Segregation using smart dustbin has been successfully implemented for the segregation of waste into metallic, dry and wet waste at root source.

The method presented provides a fruitful way to come out of this problem by making entire system automated. The components used in smart dustbin are economical, environmental friendly and gives accurate results for separating three different types of wastes which are generally produced at places like shopping malls, offices, houses, schools/colleges etc. Presently there is no device/product available for segregation of waste at root source other than manual separation probably the biggest advantage of smart dustbin is the safety it provides.

This device carefully separates all three types of waste and not only increases the economic value of waste but also gives a healthy and beautiful environment at lesser cost. Segregating waste manually is not accurate and many of us don't like to do that. Due to open dumping of solid waste, it emits bad smell due to presence of dead animal waste and biodegradable components.

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