RASPBERRY PI BAESD AUTOMATED WASTE SEGREGATION SYSTEM

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Abstract - *Rapid increase in volume and types of solid and hazardous waste as a result of continuous economic growth, urbanization and industrialization, is becoming a burgeoning problem for national and local governments to ensure effective and sustainable management of waste. The Economical value of waste is best realized when it is segregated. Segregation of waste at dumping sites consumes more time and manpower. This work proposes an Automatic Waste Segregator (AWS) which is a cheap, easy to use solution for a segregation system at households. The AWS uses an inductance sensing mechanism to identify metallic items and resistive sensors to distinguish between wet and dry waste.*

Key Words: Raspberry pi 3, Ultrasonic sensor, Inductive Proximity sensor, Servo Motor.

1. INTRODUCTION

The economic value of the waste generated is not realized unless it is recycled completely. When the waste is segregated into basic streams such as wet, dry and metallic, the waste has a higher potential of recovery, and consequently, recycled and reused.[1] The wet waste fraction is often converted either into compost or methane-gas or both. 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 the material is retained for recycling which means that more value could be recovered from the waste.

The occupational hazard for waste workers is reduced.[2] Also, the segregated waste could be directly sent to the recycling and processing plant instead of sending it to the segregation plant then to the recycling plant. The purpose of this project is the realization of a compact, low cost and user friendly segregation system for urban households to streamline the waste management process.[4] As we move towards a more digitalized future, it is directly proportional to increase in urbanization and industrialization. This is the main cause of generation of large amount of waste. As per the report published by World Bank, approximately 1.3 billion tons of municipal waste is generated every year and it is expected to rise to approximately 2.2 billion tons per year by 2025.[3] Due to this waste lies littered in the surrounding, dumped on open lands and this becomes major problem for various types of disease causing bacteria and viruses which is why waste management is of vital importance. Segregation makes it possible to reuse and recycle the waste effectively. So the waste management becomes an important concern for the health and well-being of the society. Presently, the waste segregation is done manually by installing different bins for collecting different type of waste such as wet, dry and metal etc.[2] But this method has lot of discrepancy; one is being the Unawareness of most people towards waste management.

Due to lack of proper segregation methods, a large amount of untreated waste is dumped as landfills. So our idea is to make a garbage segregator which can identify the type of waste and put them in different bins accordingly and automatically.[4] Implementing our project at household level will reduce the expenditure on waste disposal, manual effort required for waste segregation and the waste could be easily being recycled, reused and reduced.

2. OBJECTIVE

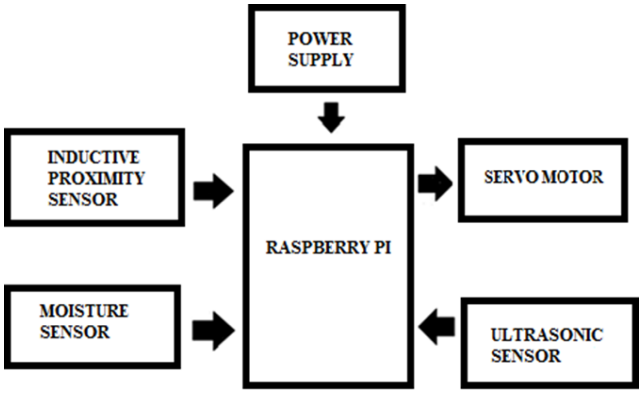
A trend of significant increase in municipal solid waste generation has been recorded worldwide. This has been found due to over population growth rate, industrialization, urbanization and economic growth which have ultimately resulted in increased solid waste generation. Final destination of solid waste 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 segregation.

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 segregators 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.[4] This is the objective of our project. The collection of Waste Segregator is taken in reference with concept of microcontroller based waste sorting system. In these methods we are using this is easy to use even portable and user friendly.

3. SYSTEM DESIGN

The main goal of the project is to design and develop a sorting system that sorts and waste automatically into two categories namely dry waste, wet waste. The proposed system we will going to design is consists of Raspberry pi 3, Servo motor, Ultrasonic sensor, Moisture sensor, Inductive proximity sensor. Here Moisture sensor is used to identify the waste is

dry or wet. The block diagram of the proposed system is as belows.



3.1 Raspberry Pi 3

The Raspberry Pi 3 is the third generation Raspberry Pi. It replaced the Raspberry Pi 2 Model B in February 2016.It has 1.2GHz 64-bit quad-core ARMv8 CPU, 802.11n Wireless LAN, Bluetooth 4.1.As pi 2 raspberry pi3 also has some similar features like 1GB RAM, 4 USB ports, 40 GPIO pins, Full HDMI port, Ethernet port, Combined 3.5mm audio jack and composite video, Camera interface, Display interface Micro SD card slot, Video Core IV 3D graphics core. Raspberry Pi is somewhat equivalent to the chip used in first generation smartphones (its CPU is an older ARMv6 architecture) which includes a 700 MHz ARM1176JZF-S processor, Video Core IV graphics processing unit (GPU) and RAM. It has a level 1 (L1) cache of 16 KB and a level 2 (L2) cache of 128 KB. The level 2 cache is used primarily by the GPU. The SoC is stacked underneath the RAM chip, so only its edge is visible. The Raspberry Pi 2 uses a Broadcom BCM2836 SoC with a 900 MHz 32-bit quad-core ARM Cortex-A7 processor (as do many current smartphones), with 256 KB shared L2 cache. [5] The Raspberry Pi 3 uses a Broadcom BCM2837 SoC with a 1.2 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB shared L2 cache. The Raspberry Pi Foundation has just recently released a new model, the Raspberry Pi 2, which supersedes some of the previous boards, although the older boards will still be produced as long as there is a demand for them. It is generally backwards compatible with previous versions of the board, so any tutorials or projects you see which were built for a previous version of the board should still work. There are two Raspberry Pi models, the A and the B, named after the aforementioned BBC Micro, which was also released in a Model A and a Model B. The A comes with 256MB of RAM and one USB port. It is cheaper and uses less power than the B. The current model B comes with a second USB port, an ethernet port for connection to a network, and 512MB of RAM. The Raspberry Pi A and B boards been upgraded to the A+ and B+ respectively. These upgrades make minor improvements, such as an increased number of USB ports and improved power consumption, particularly in the B+. The A+ and B+ have been reviewed on Opensource.com here.

3.2 Servo Motor

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system. A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft.

3.3 Inductive Proximity Sensor

The inductive sensor is based on Faraday's law of induction. An inductive proximity sensor is a type of non- contact electronic proximity sensor that is used to detect the position of metal objects. [2] The sensing range of an inductive switch is dependent on the type of metal being detected. Ferrous metals, such as iron and steel, allow for a longer sensing range, while nonferrous metals, such as aluminum and copper, can reduce the sensing range by up to 60 percent. Since the output of an inductive sensor has two possible states, an inductive sensor is sometimes referred to as an inductive proximity switch.

3.4 Ultrasonic Sensor

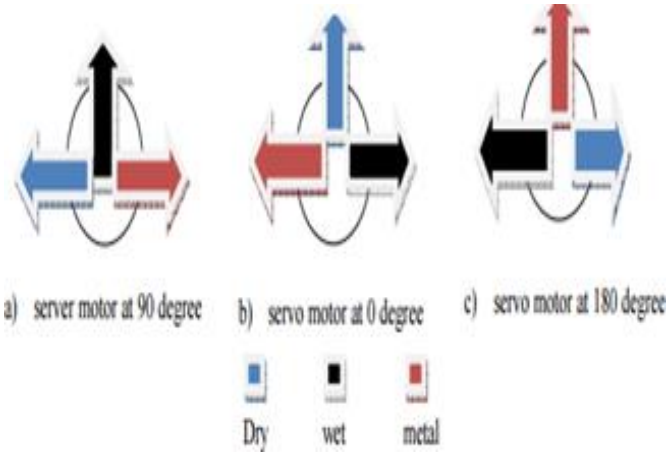
Ultrasonic sensors are based on measuring the properties of sound waves with frequency above the human audible range. They are based on three physical principles: time of flight, the Doppler effect, and the attenuation of sound waves.

3.5 Moisture Sensor

Moisture sensors measure the volumetric water content in object by using some properties, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content .This makes it ideal for performing experiments in courses such as soil science, agricultural science, environmental science, horticulture, botany, and biology. Use the Soil Moisture Sensor to measure the loss of moisture over time due to evaporation and plant uptake. Soil moisture sensors measure the water content in soil. A soil moisture probe is made up of multiple soil moisture sensors. One common type of soil moisture sensors in commercial use is a frequency domain sensor such as a capacitance sensor. Measuring soil moisture is important in agriculture to help farmers manage their irrigation systems more efficiently. Not only are farmers able to generally use less water to grow a crop, they are able to increase yields and the quality of the crop by better management of soil moisture during critical plant growth stages. Besides agriculture, there are many other disciplines using soil moisture sensors. Golf courses are now using sensors to increase the efficiencies of their irrigation systems to prevent over watering and leaching of fertilizers and other chemicals offsite.

4. METHODOLOGY

The main goal of the project is to design and develop a sorting system that sorts the waste automatically into three categories namely metal waste, wet waste, and dry waste. The system mainly consists of Raspberry Pi 3, inductive proximity sensor, ultrasonic sensor, moisture sensor and servo motors. The waste is dumped into the Automatic Waste Segregator which marks the entry of the waste and starts up the system. It then initializes the sensor modules. The initialization of all modules ensures that any dynamic changes in the environment do not affect the sensing. As soon as the waste is dumped in to the system the ultrasonic sensor gets activated and recognizes that the waste is dumped. The object then moves over the incline and falls on the inductive proximity sensor which contains an inductive coil. If the metal waste is dumped the inductive proximity sensor detects the metal and the waste is dumped into metal bin. The waste continues down the incline towards the moisture sensing module. Moisture sensor identifies whether the object is dry or wet. If the moisture level of the object is high then the object is identified as wet waste or else dry waste. To achieve the segregation, a servo motor is used. The containers are placed on a circular base which is mounted on the axle of a servo motor. The circular base rotates as the axle of the servo motor rotates. The servo motor is given three different positions or angles for the three types of wastes detected. The motor thus always comes to the required position according to the signal obtained. The default bin at the circular base is the dry bin. To avoid overshooting of the container due to the momentum of the base, the servo motor is rotated at lower speeds by using pulse width modulation (PWM) which is generated from the Raspberry pi. Thus the segregation is completed.



5. CONCLUSION

Automatic Waste Segregator has been successfully implemented for the segregation of waste into metallic, dry and wet waste at a domestic level. [3] The system can segregate only one type of waste at a time with an assigned priority for metal, wet and dry waste. The experiment has been conducted for wet, dry and metallic wastes. It is found that the change of moisture value is greater for wet waste and very less for dry waste. Other objects like glass and wood have intermediate relative dielectric constant and thus are detected as dry waste. Experimental result shows that the waste has been successfully segregated into metallic, wet and dry using the Automatic Waste segregator.

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REFERENCES

[1] M.K.Pushpa, Aayushi Gupta, Shariq Mohammed Shaikh, Stuti Jha, Suchitra V, "MICROCONTROLLER BASED AUTOMATIC WASTE SEGREGATOR", IJIREEICE, Volume 3, Issue 5, May 2015.

[2] http://www.ijrat.org/downloads/Vol-4/july-2016/paper% 20 ID-47201638.pdf

[3] http://www.ijireeice.com/upload/2015/may-15/IJIREEICE % 029.pdf , Ruveena Singh, Dr. Balwinder Singh, "DESIGN AND DEVELOPMENT OF SMART WASTE SORTING SYSTEM", IJRECE, Volume 3, Issue 4, October December 2015

[4] "AUTOMATED WASTE SEGREGATOR USING ARDUINO", IJAERD, Volume 5, Issue 05, May -2018, e-ISSN (O): 2348-4470 ,p-ISSN (P): 2348-6406

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