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Development of a Smart and Automated Waste Management System

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Abstract:- The level of hygiene with regard to the waste management system has significantly deteriorated as a result of population growth. The accumulation of waste in public spaces causes the neighboring areas to become contaminated. It might make a number of serious illnesses worse for anyone in the area. The evaluation of the impacted region will be degraded by this. Intelligent waste management system is necessary for reducing or eliminating trash and maintaining cleanliness. This paper proposes a smart waste management system, which will be able to differentiate between plastic or non-plastic as well as metallic and non-metallic waste. We use various sensors to compute this model.

Keywords:- *Automated, smart waste management system, Microcontroller.*

I. INTRODUCTION

Recent study conducted on waste management in India suggested that wastes are still not being properly disposed, in our country. There might be several reasons behind this

- Lack of awareness among us.
- Inclusion of large no. of human labor
- Lack of proper machinery or equipment etc.

Now let us look, at the perilous side of this improper practice. If the wastes are not segregated properly and disposed accordingly there is a high risk of increasing pollution and health deterioration. The removal of waste from urban or metropolitan zones is one of the most demanding chores for most of the world's nations. When one of these is polluted with hazardous materials as a result of inappropriate waste disposal, soil, water, or air pollution can all ensue. This has a negative impact on marine life and animals as well as having a large greenhouse gas effect. Again, direct contact with these wastes can brutally affect human well-being. Therefore, we have come with an idea of improving the sanitization system by segregating different wastes with least or no possible inclusion of human labor, by designing and developing a system called Smart dustbin for Garbage Processing to avert the workers (who are dealing with this segregation procedure) from directly touching the waste and lead a hygienic life.

II. EASE OF USE

A. Related Works

Taking reference from the prior successfully completed projects we can conclude that the smart garbage bins have Ultrasonic Sensors placed on the lid which detects the garbage level in the bins. By this, the garbage bins can be monitored and the monitoring information can be obtained through the webpage [1]. Waste management for smart cities is all about the latest technology integration in the waste management solutions specialized for smart cities. The key point in waste management for smart cities is that municipalities who are responsible for waste management in cities have various needs, and latest technologies present efficient and proper waste management solutions for sustainable municipal waste management [2].

In this paper, a system is introduced to manage waste in big cities effectively without having to monitor the parts 24×7 manually. Here, the problem of haphazard and disorganized garbage collection is tackled by developing an embedded Internet of Things system that would monitor the specific waste deposits placed in each container [3]. The main problem with waste management that this article inferred was that the trash cans in public areas frequently overflow well before the next cleaning procedure even starts. It in turn leads to various hazards such as bad odor & ugliness to that place which may be the root cause for spread of various diseases. This work is mounted on a smart waste system to prevent any such dangerous situations and to preserve public cleanliness and health. The primary goal of the endeavor is to create an intelligent alarm system for smart trash for proper waste management [4].

The suggested method uses ultrasonic sensors to collect data on the current waste levels in each bin. This information is then utilized to create dynamic routes for trash trucks that take into account a number of variables, including the level of waste, the distance between bins, and the truck and bin capacities [5]. We surveyed several different papers to get a fair idea of the previously done work. One of the previous models used microcontroller along with GSM (Global System for Mobile communication)/GPRS (General Packet Radio Service) system to monitor and integrate the information to measure the different level of waste in various locations, keeping Swachh Bharat Abhiyan in mind [6].

The use of other approach aids in the general management system's corruption by keeping an eye on the false reports. This lowers the total number of visits made by the waste collection truck and, as a result, lowers the overall cost of rubbish collection. The ultimate benefit is that it keeps society clean. Consequently, the efficient waste collection is made possible by the smart garbage management system [7]. The study proposes an Internet of Things (IOT)-based smart waste clean management system that uses sensor devices to measure the amount of garbage over dustbins. As soon as it identified, the system instantly changed to concern approved by GSM/GPRS [8]. The concept of the IoT and its components, the testing and prototyping tool Cooja Simulator, and ultimately the analysis of the available literature on smart waste management systems employing IOT have all been covered in this paper [9]. The use of Information and Communications Technology (ICT) to accomplish this goal gives a chance for the creation of "smart cities," where the administration and residents have access to a plethora of real-time data on the urban environment to guide their decisions, plans, and actions [10].

B. Contribution

Our model adds on to the existing problem of biodegradable, non-biodegradable waste management. In this model, we have included the usage of capacitive sensor, which enables the detection of metallic as well as not metallic waste.

Areas of contribution-

- This smart dustbin can be easily installed in public places like parks, supermarkets and restaurants.
- These dustbins are easy to install and highly efficient.
- They don’t need any human interference.
- The segregation of biodegradable and non-biodegradable waste can be done efficiently.

If implemented successfully, the time required to process the waste can be minimized.

III. RELATED WORKS

A. System Model

The principle behind the Development of a Smart and Automated Waste Management System is simple and convenient. An ultrasonic sensor is used to measure the height of the trash packed in the stationary part bin, and an RF module is then used to transmit the level to the garbage car part. Following this, computer activities can be carried out using this data.

A distance sensor is connected with the arduino, such that when a person is coming with trash and reaches to a certain distance, the model gets activated. The IR (Infrared) sensor detects if the material in the hand of the person is plastic or non-plastic. If its non-plastic, the dustbin lid will open. Next the capacitive sensor senses if the object is metal or non-metal.

B. Problem Statement

The primary goal of this project is to develop a highly practical and cost-effective waste management system that will make garbage control and collection as simple and convenient as feasible.

Our proposed model consists of simple elements, which can be implemented efficiently.

IV. ARCHITECTURAL IMPLEMENTATION

The design of the circuit is doable, and the setup of the components is very important.

Here we are using an Arduino to realize our idea.

The IR sensor is a common sensor used in day to day scenario. It have various purposes, such as television.

In the Short Wave Infrared (SWIR) (1000-3000 nm), several peaks and dips can be observed which is used in industrial sorting to discriminate plastics from other materials and identify the type of plastic.

A. Hardware

COMPONENTS REQUIRED: Arduino UNO, USB Cable (for Arduino), Few Connecting Wires, Sensors (IR and capacitive sensor), A Laptop with internet connection design.

- Arduino: Different microcontrollers and microprocessors are used in the designs of Arduino boards. A variety of expansion boards, breadboards (for prototyping), and other circuits can be interfaced to the boards' sets of digital and analogue input/output (I/O) pins. As shown in Figure 1.
- Capacitive sensor: This type of sensor is used for detection of metallic objects and non-metallic objects. The applications also consist of the sensors used to detect position or displacement, proximity, fluid level, humidity and acceleration. Capacitive sensors can also replace mechanical buttons. As shown in Figure 2.
- Infrared Sensor: IR is capable of detecting details that are invisible to the naked eye and can therefore accurately distinguish between different types of materials, especially plastics, which in turn ramps up recycling performance. As shown in Figure 3.
- Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. These servos may be controlled by any servo code, hardware, or library. Beginners who wish to move objects without developing a motor controller with feedback and gear box might find it useful. Radio-controlled aeroplanes employ servos to position control surfaces like elevators, rudders, walkers, and grippers. Servo motors are compact, come with integrated control electronics, and pack a punch compared to their size. As shown in Figure 4.
- LCD (Liquid Crystal Display): The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits and devices. Seven segments and multi

segment light emitting diodes are the two major applications for these displays. The primary advantages of utilising this module are the low cost, animations, and the lack of any restrictions on the display of unique characters, special animations, etc. As shown in Figure 5.

B. Software

For the software part, we use Python which is an interpreted language that prioritizes code readability and features a syntax that enables programmers to describe concepts in less code than they could in languages like C++ or Java. The language provides constructs intended to enable writing clear programmers' on both a small and large scale.

In addition to a text editor for writing code, a message area, a text terminal, a toolbar with buttons for frequently used operations the Arduino Integrated Development Environment, sometimes known as the Arduino Software (IDE), is also included. In order to upload programmers' and communicate with them, it connects to the Arduino hardware.

C. Figures

Fig. 1: Arduino board

Fig. 2: Capacitive sensor

Fig. 3: IR Sensor

Fig. 4: Servo Motor

Fig. 5: LCD

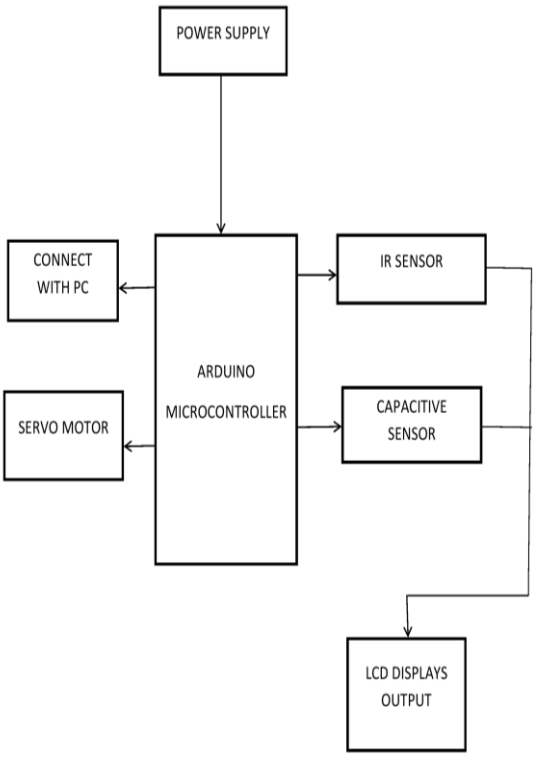

Fig. 6: Block Diagram

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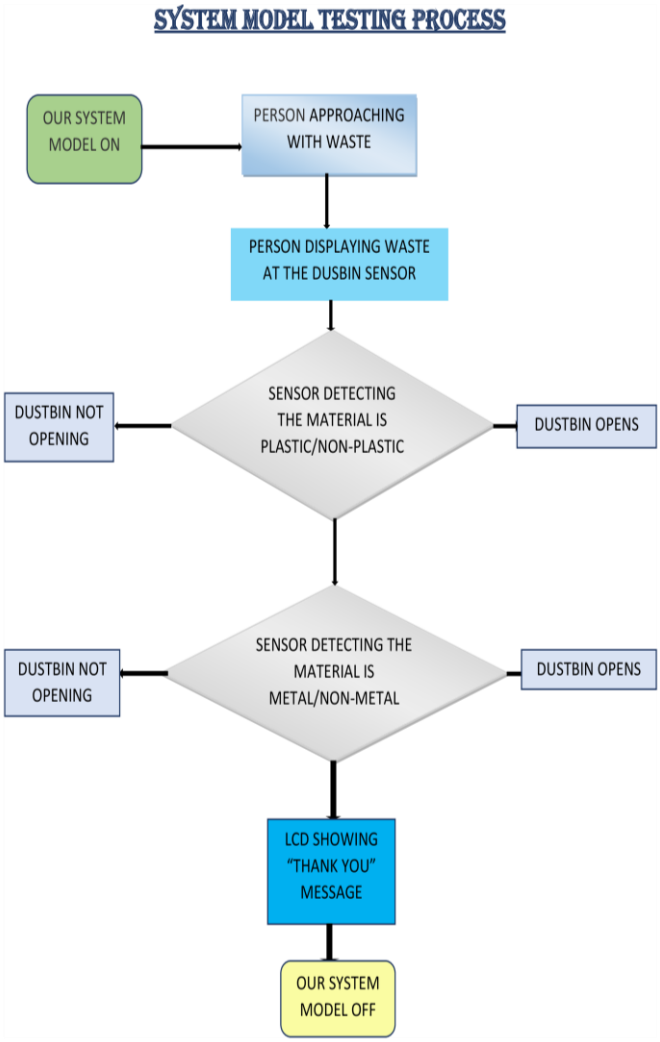

Fig. 7: Flow Chart

V. CONCLUSION AND FUTURE PLAN

Our Model offers a one-stop shop for hazards connected to waste management. Small amounts of money can be used to achieve this model. Time-related problems can also be simplified. Along with this it is also helpful in distinguishing metallic and non-metallic wastes. It is environment-friendly and cost-effective.

Our smart trash can concept is simple to put in public areas like parks, markets, and dining establishments. These trash cans are very effective and simple to deploy. They don't require assistance from people. Waste can be efficiently separated into biodegradable and non-biodegradable materials. Our future plan is to further reduce the amount of time needed to process the garbage with successful implementation.

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