Efficient Waste Collection and Filtration using IOT

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Abstract—In our modern times, waste management in our society plays a significant role to develop our city into a smart city. We are residing in a world that is in a constant state of amelioration, but there is one obnoxious problem that we have not been able to deal with which is hindering our advancement to a hygienic, clean and healthy society, i.e. garbage. Mostly in our day-to-day life, we often encounter excessively full dustbins. This paper provides an effective model of a smart dustbin. The dustbin will have sensors to detect how full the dustbin is; when it exceeds the set limit a notification will be sent to the authorized personnel to collect the waste. It will also have a sensor that will open the lid of the dustbin when a person comes to the proximity of the dustbin to use it; if the dustbin is not full. It will also have 4 different sensors to differentiate the waste into four types Paper, Plastic, Metals, and Organic Waste, and a servo motor to rotate the compartments respectively.

Keywords—IoT, Waste Management

I. INTRODUCTION

Today, with the development of urban areas, the population density in these areas is also increasing. Thus, with the increase in population, the likelihood of a polluted surrounding increase --with

the increase in the amount of garbage and more waste products. The problem with the current society, especially in India, is that most people have less sense of responsibility, and many people in our society revolve around garbage in our environment. To overcome this kind of situation, this project is designed, primarily aimed at the state of cleanliness and cleanliness of any society.

Poor waste management can easily lead to air pollution and soil pollution. They harm a person's health. It is learned from a study conducted in Guwahati, Assam city that littering causes 41% of air pollution. Breeding mosquitoes and flies are mainly from the litter which is a major cause of various diseases such as malaria, dengue, chikungunya, etc. This causes headaches, nausea, and an increase in stress levels. A city with poor sanitation and a smelly environment will never be a healthy place to live. An estimated 235 million people are currently suffering from asthma which is a major cause of bad breath. About 90 percent of chronic obstructive pulmonary disease (COPD) is found in low- and middle-income countries caused by bad breath. More than 3 million people died of COPD in 2005. Waste management is identified as one of the 22 leading causes of premature death each year. The use of this smart bin can prevent long-term waste disposal and thus prevent the spread of disease on a large scale and promise a cleaner environment in the city. Smart dustbin works on the principle of IoT. It consists of 4 compartments with 6 different sensors, a servo motor, a GPS, GSM, and a Wi-Fi module. The proximity sensor detects the presence of an object while the ultrasonic sensor is used to detect the amount of garbage present in the bin at any moment. When the bin fills up to 70% of its total capacity, a notification is sent to the authorized personnel who is within the shortest distance from the bin. This information will be available to us via the App. Each compartment consists of a respective sensor which will help garbage to recycle more efficiently.

II. PROBLEM STATEMENT

At our present times, normal dustbins have prevailed which are usually emptied in a few days by the respective public authorities. The main issue with this methodology is that some dustbins become overloaded and prevail in unhygienic environments. If the truck checks every bin; it leads to more fuel usage and cost. The situation where waste is not disposed of on proper time is very common in India. This occurs due to a lack of knowledge if the bin is full or empty to the public authorities. Not only waste collection is an issue but also recycling waste is important.

III. METHODOLOGY

Automation of smart dustbins is achieved through the use of the power supply. In our model, we will be using 6 sensors, a GSM module, a GPS module, a servo motor, and an Arduino board. In addition, DC motors and IR sensors are used for the incentive.

A. Internet of Things

The Internet of Things (IoT) describes the network of physical objects—"things"—that are embedded with sensors, software, and other technologies to connect and exchange data with other devices and systems over the internet. Here we use Arduino UNO which will be programmed via Arduino ID.

An IoT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors, and communication hardware, to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analyzed or analyzed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices -- for instance, to set them up, give them instructions or access the data.

B. Arduino IDE

The coding environment for Arduino is very much similar to C++. The Arduino IDE or Arduino integrated development environment allows the user to write, compile and upload that code similarly to that of C++.

C. Arduino UNO

Arduino is an open-source electronic prototyping platform. Its key advantage is easy-to-use software and Hardware. It is an Integrated Circuit Board comprised of a microprocessor and I/O pins which are used for purpose of communication and control of various physical items like LED, Server motors, Buttons, etc. It gets its power supply from an external source which it Further uses to power the other physical items.

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino. cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced with various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), and 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

D.   *Sensors*

IR sensors are known as an infrared sensors. They are of two types: Active and Passive. The IR circuit comprises two main sub-circuits, a) the emitter circuit, and b) the receiver circuit. The emitter circuit comprises a simple LED emitting IR light of a particular wavelength. The IR receiver circuit comprises a detector which is an IR photodiode that is sensitive toward that particular wavelength of IR light.

An Inductive sensor is a device that uses the principle of Electromagnetic induction to detect or measure objects. An inductor develops a magnetic field when a current flows through it. This effect can be used to detect metallic objects that interact with a magnetic field.

Ultrasonic sensors are used to measure the distance. It uses ultrasonic waves. The entire process is divided into the emission and reception phases. It has 4 pins. Two pins are VCC, and GND and the other two pins are the information that would be supplied by the TRIG pin, while it would be absorbed by the ECHO pin.

They are capable of detecting plastic. At the center of a new, automated plastic sorting system is a sensor that can detect the different types of detectable plastics namely: PET(Polyethylene erephthalate),PE(Polyethylene), PVC(Polyvinyl Chloride), PS(Polystyrene), and

ABS(Acrylonitrile Butadiene Styrene). The Plastic Sensor detects different grades of plastic based on the resonant frequency of each plastic. Different plastic modules have different resonant frequencies and by turning laser diodes to these frequencies, they excite the module of the plastic and thus are detected.

Any optical simple sensor can be constructed using a simple LED as a light source and the other/photodetector LED. For paper or other similar products emitted light by its surface will be less and its diffracting angle is different.

IV. WORK METHODOLOGY

As per the proposed block diagram, we will be having a proximity sensor that will open the lid as a person comes at a nearby distance from the dustbin to use it. Then the dustbin will go through 4 different types of sensors to differentiate the types of waste i.e. paper, plastic, metals, and organic waste respectively. This helps further in the recycling of waste as per different types. The dustbin is established with a GPS connection and Wi-Fi module.
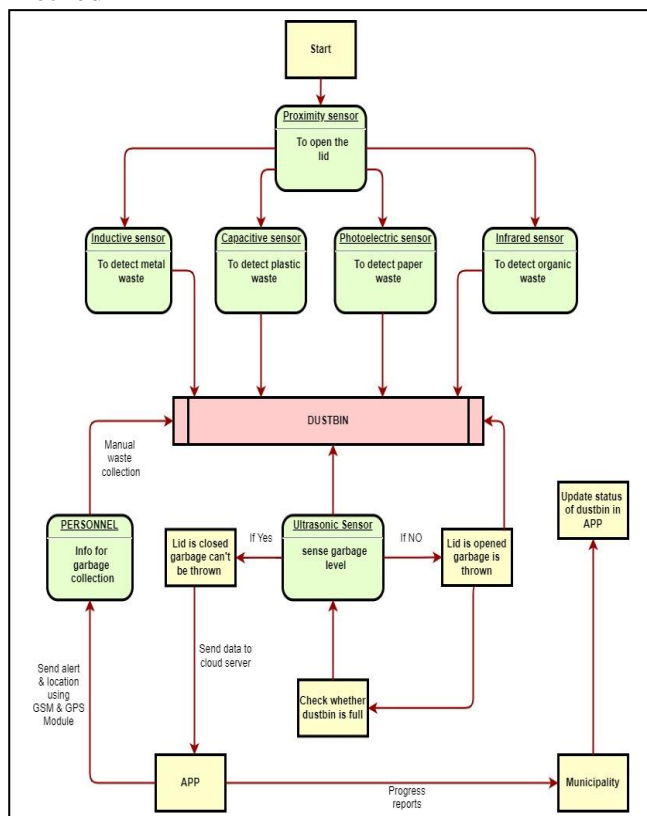
The ultrasonic sensors help to detect the garbage level of the dustbin. When the bin is at its 60% capacity it sends data to the cloud server of the App it then transfers that data to the authorized personnel; thus notifying the status of the dustbin. When the bin reaches 90% of its

maximum capacity it obstructs the proximity sensor thus preventing the lid of the bin to open. Thus preventing the overflowing of the bins. It sends an alert to the nearest garbage collector and uploads the location of the bin to the GPS module it provides different routes to reach the destination and also the shortest possible route and the traffic level on the route.

As the authorized personnel reaches the bin he manually collects the waste. As the bin is cleared out he updates the status of the bin to the cloud server. Then the Ultrasonic sensor is instructed to check the capacity of the bin. Once it provides the output to 0-1% of the dustbin; it updates the status of the dustbin in the App.

Fig. 1.   Block Diagram of the proposed method

V. SCOPE FOR FUTURE WORK

The main aim of this project is to reduce human efforts for waste collection along with the enhancement and development of our society. We often see overflowing bins and waste dumped and not recycled. This was an issue that required immediate attention.

Smart Dustbin helps us reduce pollution and maintain a healthy environment. Not only humans but also animals like dogs, cats, or cows often in search of food enter normal bins thus creating a foul scene. This project can avoid such situations. The message is directly sent to the authorized personnel via a secure connection thus reducing the time taken for delivering the alert rather than the corporation's office. In our system, the Smart dustbins are connected to the internet to get real-time information about the smart dustbins. In recent years, there was a rapid population growth which leads to more waste disposal. So a proper waste management system is necessary to avoid spreading some deadly diseases.

VI. RESULT ANALYSIS

The sensors help various wastes to differentiate among others; thus helping in the process of recycling. As we all can agree that storing waste as well as recycling is an important part of the process of efficient waste management. When the bin is 60% full it sends a notification and its respective GPS Location to the authorized personnel and

when it's 90% its capacity it seals the lid shut thus preventing overflowing. As the map suggests it shows possible routes from the bin's location to the Municipal Corporation and also the shortest possible route.
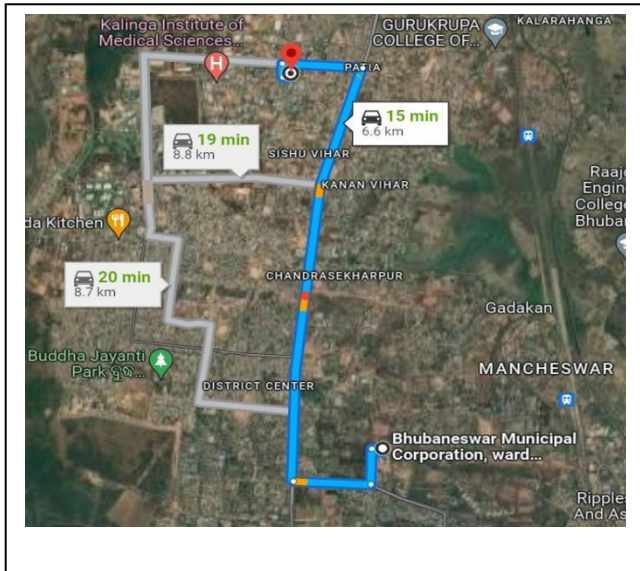

Fig. 2. Possible Routes from Municipality Corporation and bin

VII. CONCLUSION

In this project, the implementation of a smart dustbin management system using IoT as hardware and ionic framework as our software ensures the cleaning of dustbins soon when the rubbish level reaches its maximum.

Using an ultrasonic sensor, each proposes the planning of

smart dustbin system. garbage collection bin vehicles treat a never-ending basis in cities and towns, Concentrating on regional growth, and everyone in every one of those dustbins won't

always be complete. This system also helps to look at fake reports and hence can reduce corruption within the management System. The proverb "Cleanliness is next to Godliness" will be truly achievable within the town with this proposed model by providing an automatic opening for the dustbin lid and by providing the dustbin full status to the concerned worker.

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