

IoT based Garbage Monitoring System

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Abstract—Garbage monitoring is one of the main concerns that is mostly unattended by the people today. Waste management is a solely required measure that has to be taken care of. This paper introduces a system to monitor and managing waste in metropolitan cities 24*7 effectively, without human intervention. The problem such as unsystematic waste collection is solved through designing an Internet of Things (IoT) based embedded system which monitors each waste bin individually for the volume of waste deposition. For detecting the waste, IR sensor is used and in the subsequent steps, for detecting the type of waste, a rain drop sensor is implemented in the system to separate the thrash as wet and dry waste. In this process, out of two sensors, if only one IR is detecting the waste, servomotor rotates toward the direction of dry dumpster and if, both the sensors are detecting the waste then, it will rotate towards wet dumpster. Ultrasonic sensors are mounted on the top of the dumpsters, which are used for measuring the level of waste deposition in the container. Out of the two containers, suppose any one of the container is also full, then immediately an attentive message will be delivered to the respective authority to take further steps to remove it.

Index Terms— Agricultural Garbage Monitoring, Embedded IoT system, 24x7 manually, automated system.

I. INTRODUCTION

In the present scenario Smart Cities should implement efficient solutions to the number of different challenges forthcoming in the next few years. In Smart Cities, Garbage Monitoring is a major alarming challenge faced by the public authorities. Due to the increasing population in countries like India, garbage management system is facing major setback and hence increasing the pollution level. Many of the cities in our country are still without proper public garbage management system so; the garbage is thrown at the public places like roads, open areas, at the corners in the locality, which creates malice at the corners and spreading out viral diseases. The traditional way of manual collection of waste and monitoring the fullness of waste bins in the public areas is very tedious and compound process. These methods require lot of manual effort, cost and time which is not acceptable with current scenario of large quantity of waste production from different sectors in the country.

Waste is a material which is not in form of use and has no economic value in it. Depending on physical state, the waste is considered as solid (Dry) waste and wet waste. Present day waste management systems involve many employees being appointed by the public corporation to attend a fixed number of areas and the dumpsters. This usual type of monitoring the waste is done on the regular basis. This leads to a very incompetent and polluted system in which some dumpsters will overflow because of waste deposition and some dumpsters might be

empty. This is mainly because of the variation in population density in the cities. This type of situations poses difficulty to determine which sector of the city needs immediate attention. Here in the proposed system smart garbage monitoring system is introduced that sends a notification to the consequent authority once waste in the dumpster reaches to the maximum level.

II. LITERATURE SURVEY

Many researchers carried out the work on design and development of sensors and smart trash tracking system. Some of them are highlighted in this section. According to Padma Nyoman Crisnapat, Komang Agus Ady Aryanto[1], the device implemented in the system sends signal to main server. Once the operator receives the signals from the system through the server indicating the waste must be cleaned from it. The dumpster is monitored into different condition such as empty, moderate, and full. The problems of this system are the battery backup modules and are not quite reliable and would properly work in the daytime because of the solar panels. Twinkle Sinha et al.[2] proposed an automated compressor for compressing garbage in the bin. An electronic circuitry is implemented to control the garbage compressor. An embedded system using microcontroller is implemented for IoT application. The system also consists of the different city locations indicated by different LEDs that show the locations of corresponding smart dustbins which are placed in the system. This method is cost consuming and requires a lot of circuitries built for the operation of the bin. Prof. R.M.Sahu, Akshay Godase, Pramod Shinde, Reshma Shinde[3] used load cell is placed at the bottom of garbage bin to sense the weight of the garbage. The main problem of using this system is sensitivity is too low and hence not suitable for small scale measurements, and they are costly. Shilan Abdullah Hassan [4] used Arduino Uno interfaced with transmitter module consisting of radio Frequency (RF) which is mounted on top of the dumpster for monitoring the waste in the bin. A short message (SMS) will be delivered to the smart phone of the concerned person about the location of the dumpster and unique allotted ID of the bin whenever the bin is full. This system doesn't sort the type of garbage.

III. METHODOLOGY

The current existing garbage management system, where different type of wastes are collected from the streets, hotels, houses, and from other sectors on routine basis is not the effective way to manage the waste generated. Manual segregation is not good for human's health. There are several problems related to mixed waste. To name a few, the unsegregated waste badly affects human health giving rise to different viral infections and diseases. The appointed people who collect the garbage or people who live near the surroundings where mixed waste is piled up in the open area are at a great risk. They can suffer from diseases like asthma, tuberculosis and potentially fatal diseases like Dengue, Malaria, and Japanese Encephalitis. Mixed waste reduces the probability of recycling the waste which is very important nowadays. One of the main problem in mixed waste is it cannot be subjected to proper disposal path. Hence leads to additional land filling which is a very hazardous way of managing the waste. In the system proposed we have used smart way of managing waste in big cities effectively without human intervention. The problem which is highlighted in this section is solved by designing and implementing an Embedded Internet of things system which are programmed to monitor each dumpster independently for the waste deposition. The sensors are used for separating wet and dry waste.

Figure 1 shows the detailed block diagram of the IoT based garbage monitoring system. The micro controller module ESP 32 is used as the WI-FI(Wireless Fidelity) module and it takes the input from the InfraRed sensor and the moisture/rain sensor.

The Ultrasonic sensor is used for the distance measurement. After sensing the trash, it is separated based on their physical state to wet or dry. The output can be observed in LCD display that will show an increase in the bin percentage. The module is configured to set the location first using the GPS module installed in the system. Later the module tries to connect to the WIFI network that is pre-configured using the program dumped in the ESP32 Node MCU using Arduino IDE software. The module starts working whenever there is trash object placed on the sensor. As soon as it detects the trash the IR sensor is enabled and the rain/moisture sensor detects whether there is wet content in the trash. If it detects the wetness in the waste the trash is put into the wet bin else it is detected as dry waste and it is put into dry bin. The second part of the working includes the ultrasonic sensor which calculates the distance between the top of the sensor to the bottom of the bin installed. As the bin fills up, the difference in height (between ultrasonic sensors to the bottom of bin) is reduced this in turn implies that the bin is filling up. As soon as either of the bins reaches 100%, the notification to take out the trash is sent to the concerned coordinators/authority using a mobile application called as "BLYNK". The person who arrives to take

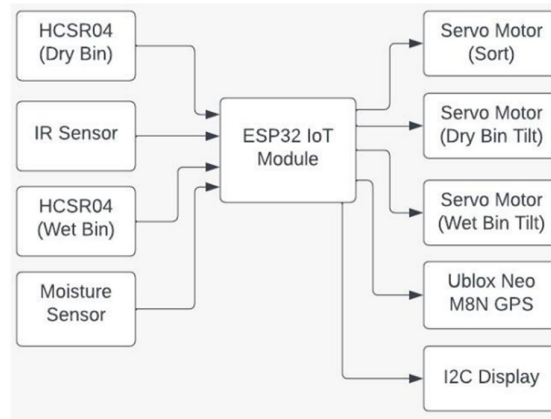


Figure1: Block diagram of the system

out the trash can use the momentary switches installed near the bins for tilting the bins to unload or also can control the same with the application. Figure 2 shows the flowchart of the work carried out.

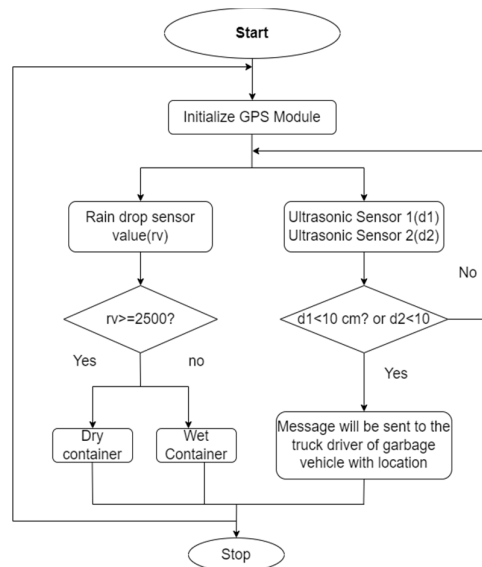


Figure2: Flowchart of the work

IV. RESULTS

The module segregates any type as wet and dry waste based on its physical state and moisture content present in the waste. The results obtained after the bins are entirely filled up were tabulated .Table 1 shows the input and output of the work carried out. Table 1 also shows the message received by the concerned authority.

TABLE I: RESULTS OF THE WET AND DRY BINS

Inputs		Outputs	
Ultrasonic Sensor 1(wet level)	Ultrasonic Sensor 2(Dry waste)	Message	Mobile
10cm	18cm	Wet container is full	Receive location with message
18cm	10cm	Dry container is full	Receive location with message
18cm	18 cm	No message	No message
10cm	10cm	Wet container is full Dry container is full	Receive location with message

After executing the module, results are obtained as represented in table 1. Once garbagebin (dry or wet) is filled, notification about the bin filled, Location of bin, percentage of bin filled is shown in user mobile as depicted in figure 3.

Figure 4 shows the experimental setup used for conducting the experiment

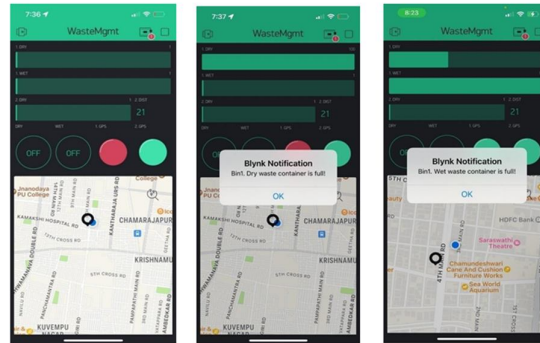


Figure3: Notifications in the Blynk app

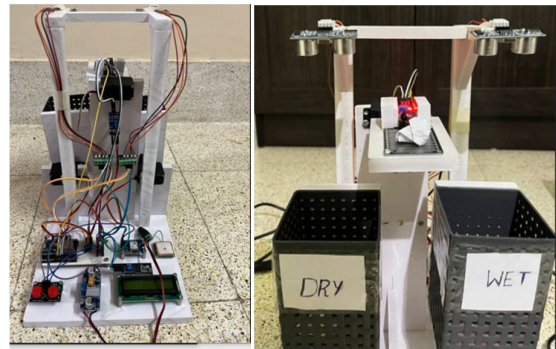


Figure4: Experimental setup of the work carried out

V. CONCLUSION AND FUTURE SCOPE

In the paper presented, the real time garbage monitoring system by using sensors to separate wet and dry waste and check the filled level of dustbins is implemented. The following conclusions were drawn from the work carried out.

1. The information of all dumpsters can be accessed from concerned person/authority 24*7.
2. Authorities can take a decision accordingly to empty the dumpster.
3. This proposed work is very efficient in managing and organizing waste in any large cities rather than using conventional periodic collection approach.
4. The work can be enhanced to include adding the odour sensors to lessen the bad smell given out by the trash. Also, many mechanical supports such as a shaft can be given from inside to push the trash completely out without any human intervention.
5. The proposed model works on the power supply but solar panels are the best idea for energy source to get this model running to a larger extent.
6. The work can be improved to segregate mix waste using different suitable high accurate sensors and other smart technologies.
7. Some additional features can also be included like generating power, biogas generation at root source itself. Automation for covering up the dumpster can also be included

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