REVIEW ON DEVELOPMENT OF SMART DUSTBIN WITH AUTOMATIC SEGREGATION OF DRY AND WET WASTES

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Abstract— **The use of technology is always helping mankind to make life easier. In the current context, waste disposal systems in public areas are improperly implemented because, more often than not, they result in overflow of dust sources. There is a steep growth in prices and levels of solid waste due to urbanization, continued fiscal boom and industrialization. Some estimations by Global waste management market show that 2.2 billion tons of waste is generated globally every year. In this work, an innovative way of waste handling is presented to transform the trash management system and take a leap towards cleaner India. The smart feature is provided to the dustbin by the use of embedded technology which helps to facilitate in continuous monitoring of the dustbin, also provides a pertinent up to date information of the waste buildup in the dustbin compartment. The sensor-based technology senses the quantity of waste in the containers and enables classification of the waste into dedicated compartments for dry and wet waste.**

Keywords— Arduino Uno, Electrical and Electronics Devices, GSM Module Smart Dustbin System, Ultrasonic sensor

I. INTRODUCTION

Lately urbanization has increased with an exponential trend also waste production is also increased in the similar lines. Waste management is a critical issue to be taken for consideration. This paper is one of many ways to achieve this tremendous cause. This paper comprises a smart dustbin that is built on a platform based on Microcontroller and Arduino Uno board, which has an interface of GSM modern and Ultrasonic sensor [1]. We will place an ultrasonic sensor on the dustbin's top to measure dustbin's stature, the stature threshold is 10 cm, Arduino's programming is done to display the stored garbage's

height from the predefined threshold height, once the dustbin is filled, concerned authority/personal will get a continuous alert to squash the dustbin as the ultrasonic sensor triggers the GSM modem if garbage reaches the threshold level and controller checks if the threshold level is exceeded [2]. After squashing the dustbin people can reuse it and this process repeats, if this advanced and smart waste management system is implemented at a substantial scale by replacing our existing dustbins, odoriferous smell which is caused by rotten wastes on roadsides could be avoided. Smart dustbins can also reduce dreadful diseases which are caused by breeding mosquitoes that generally happens on our traditional not squashed dustbins.

Proper garbage disposing and collection mechanism is not designed in the majority of the cities, and towns in India, the rapid expansion of cities is putting a tremendous pressure on the current infrastructure as it is not being scaled at a similar pace of urbanization. Smart dustbin is a diligently designed solution for solving the social issue of waste disposal, it segregates the waste material thrown inside it into bio and non-biodegradable. We can also provide Wi-Fi using this smart dustbin to promote the initiative of throwing garbage in dustbins.

The different parts of smart dustbin are sensing units, GSM Module and Bluetooth for data transmission, mobile app and website monitoring portal for the department concerned to track the whole chain of smart dustbins installed inside their jurisdiction. Sensor node is mounted on the smart dustbin for the data collection and transmission. The sensors are divided into two parts. One part is at the bottom of the bin cover and the other will be mounted on the bin cover, first part id is a smart load cell sensor which calculates the waste's weight and the other sensor is to monitor the level of waste material inside the dustbin.

"Smart City Project" launched by the Government

of India also encourages IT enabled solutions, hence there is definite necessity to ensure cleaner cities [3]. The Smart Dustbin solution ensures the solutions for three interrelated problems:

a. Increased access to the garbage disposing points (Public Dustbins).
b. Optimize both the time and fuel cost efficiency.

c. Facilitate data collection on how much garbage is generated by a city and the disposing process will be planned accordingly.

II. METHODOLOGY

Smart dustbin needs to be setup along with required connections, after the initial installation 5V power supply should be provided to Arduino circuit along with uploading code, After the system is switched On, Arduino with the help of Ultrasonic sensor monitors for any object coming towards it. Controller gets the square wave digital input from ultrasonic sensor [4].

Incase Ultrasonic Sensor detects any object Arduino accurately calculates object's distance and if it is less than a certain predefined threshold, Servo Motor gets activated by the support of the extended arm which will ensure lid gets opened [5].

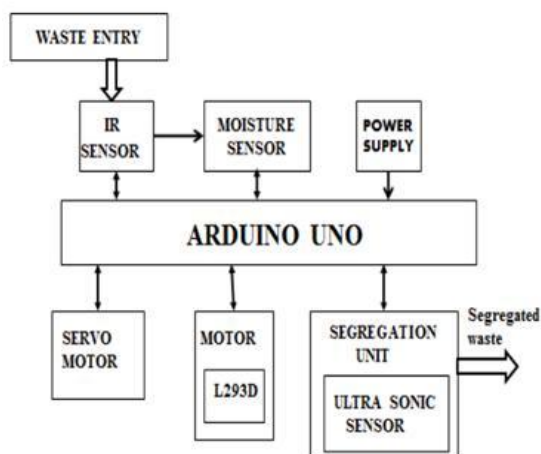Lid gets automatically closed after the configured time.

Fig. 1. Block diagram for the implementation of waste segregation

The Block diagram Fig. 1 depicts the various components used in the Smart Dustbin Development with the automated separation of Dry and Wet Waste System Power Supply, Infra-Red Sensor, and Moisture Sensor. Infra-Red` Sensor is connected to the dustbin, used to detect either dustbin full or empty. With the help of sensors, system isolates the waste collected at the collection point. On the other hand, the

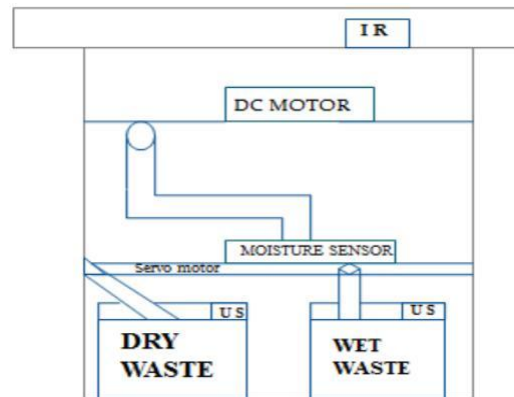controller launches the arm to collect waste separately [6].

Fig. 2. Activity Diagram

Fig. 2 activity diagram is a behavior diagram i.e. indicates the status of the program. The activity diagram presents a control flow from the starting point to the completion point indicating the various decision-making processes that are present while the task is being performed.

We try to differentiate between different types of waste which are present such as dry and wet. We use moisture sensor along with IR sensor to differentiate between the type of waste present and a gear motor to segregate into respective dustbin. Presence of an object is detected by IR sensor and moisture sensor detects the type of waste by the amount of moisture content present in that object. As soon as the moisture senor detects the type of waste, gear motor turns clockwise or anticlockwise for wet waste and dry waste and open its door respectively [7]. In this we also detect the level of waste and the lid of the dustbin closes automatically as the dustbin gets 90% full.

Fig. 3. Collaboration Diagram

Fig. 2 illustrates us about the dry waste and the wet waste i.e., what sort of waste is dry waste and what sort of waste if wet waste, it defines the difference between both the waste.
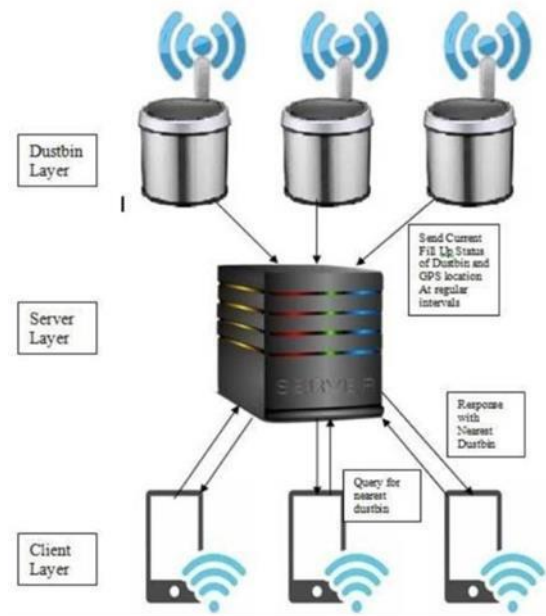
III. SYSTEM DESCRIPTION

Fig. 4. Different Smart-Bin layers

We have divided the proposed system into three distinct layers as shown in figure 4, which as follows:

- Dustbin: Here dustbins are fitted with the internet. Every other dustbin consists of a sensor to sense the level to where the dustbin is filled or used and update the same to servers at regular intervals.
- Server: This layer collects the dustbin's status and its location. Client query is processed by this layer and the nearest dustbin location along with directions are provided to the client.
- Client: A mobile application is used by the client which requests the server for the nearest smart dustbin [8].
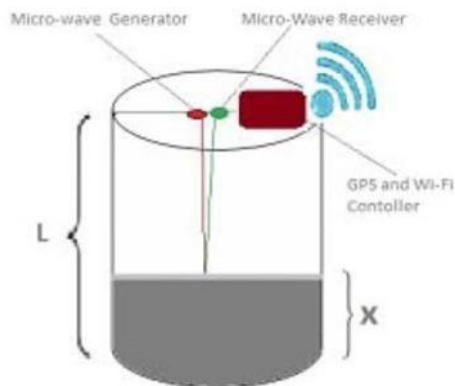
IV. SYSTEM FUNCTIONING

Fig. 5. Functioning of Smart-Bin

X — Current dustbin use status
T — Time duration between generation of wave received by receiver
C — Speed of light

Now X is calculated by using the following Formula,

$$X = L - \frac{C * T}{2}$$

Same way Fill up's percentage is calculated using the following formula,

$$P = \frac{X}{L} * 100$$

An algorithm can be scheduled for garbage collection a. **Fixed**: In this scheduling, collection process takes place at predefined intervals. For example, every alternate day garbage needs to be collected. Travelling salesman algorithms can be used here to plan the route.

b. **Priority**: In this scheduling, the dustbins are collected as per the decreasing order of current fill up status. Let's say we have 4 dustbins with 96%, 91%, 85%, and 98% filled, then collect the dustbins in the following order 98%, 96%, 91% and 85%.

c. **Mean Threshold**: In this scheduling, we first find out the mean of dustbin's fill up status in the locality. If the mean is greater than the predefined threshold like 75%, then the collection process gets scheduled and within that scheduling collect the garbage as per the travelling salesman problem or according to the priority scheduling.

V. SCOPE

a. Sensors used here identifies the current state of the dustbins whether it is filled or emptied.

b. This system can be used by the concerned authority from any place to check the latest fill up status of all the dustbins in his/her area. This waste management system can be as real time as possible.

c. It updates every single dustbin's status in real time to the concerned authority for him/her then the garbage collection vehicle is sent only when the dustbin is full or about to get full.

d. If this system is implemented resource optimization, cost reduction can be achieved.

VI. ADVANTAGES OF SMART-BIN

a. Greater accessibility to the dustbin.
b. Mobility of the dustbin is also taken care of, as the system automatically registers the new location of dustbin with the server using its GPS location.
c. Fuel and time utilization can be optimized by appropriate planning of routes.
d. It can lead to less pollution as fuel utilization will be significantly optimized.

VII. CONCLUSION

One of the major utilities of our smart dustbin is the government can use the data on garbage generation for policy as well as program design. If this smart solution gets into force efficiently, we can see our cities greener and cleaner. It also realizes the government of India's "Smart City" plan. We can further reduce the fossil fuel energy consumption by using solar panels. This model can be implemented across all the cities, and towns in the world. A waste management team can be deployed for garbage collection in the city and can be guided efficiently.

VIII. FUTURE WORK

In future improvement can be done to segregate waste into different categories (not only just two) like plastic, glass, toxic waste, separation of metal waste into different categories [9]. This could be improved to separate all the waste thrown at a time using different high accurate sensors and other technologies and segregation of mix waste can also be achieved with the help of a servo motor to give jerks to conveyor belt so that mix waste gets separated. Size of Development of Smart Dustbin with automatic segregation of Dry and Wet Wastes can be made small using new and different technologies and methods. Additional feature can also be added like generating power or biogas generation from the waste at that point itself [10].

IX. REFERENCES

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