

E-Smart Bin Technology & Waste Segregation System

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Abstract: In the recent decades, Urbanization has increased tremendously. At the same phase there is an increase in waste production. Waste management has been a crucial issue to be considered. This paper is a way to achieve this good cause. In this paper, smart bin is built on a microcontroller based platform Arduino Uno board which is interfaced with GSM modem and Ultrasonic sensor. Ultrasonic sensor is placed at the top of the bin which will measure the stature of the bin. The threshold stature is set as 10cm. Arduino will be programmed in such a way that when the bin is being filled, the remaining height from the threshold height will be displayed. Once the garbage reaches the threshold level ultrasonic sensor will trigger the GSM modem which will continuously alert the required authority until the garbage in the bin is squashed.. At regular intervals bin will be squashed. Another serious peril that follows is the escalating amount of waste generated each minute by an individual. An astounding 0.1 million tonnes of waste is generated each day in India. Sadly, only 5% of this colossal amount of waste is recycled. One possible solution for this problem could be segregating the waste at the disposal level itself. In India, the collection, transportation and disposal of MSW are unscientific and chaotic. This has found to reduce the average life span of the manual segregators. Developing a mechanized system to help save the lives of many and making the world a cleaner and a greener place is the noble objective of this research. Thus the proposed work focuses on an automatic waste segregator that aims at segregating the waste at the disposal level itself.

Index Terms –smart bin, smart city, e-bin, waste management, Audrino UNO

I. INTRODUCTION

Bad waste management can easily result in air pollution and soil contamination. They have an adverse effect on human health. There are about 235 million people currently suffering from asthma for which foul smelling of garbage is also a vital reason. Almost 90% of chronic obstructive pulmonary diseases (COPD) occur in low and middle income countries which are caused by foul smelling. More than 3 million people died of COPD in 2005. Improper management of garbage is identified to be one of the major causes for 22 human diseases causing premature death every year.

As people are getting smarter so are the things. While the thought comes up for Smart cities there is a requirement for Smart waste management. The idea of Smart bin is for the Smart buildings, Colleges, Hospitals and Bus stands. The Smart Bin thus thought is an improvement of normal bin by elevating it to be smart using sensors and logics. It is a new idea of implementation which makes a normal bin smart using ultrasonic sensors for garbage level detection and sending message to the concerned authorities by updating the status of the bin using GSM modem.

The expectation of this work model is to solve the problems of waste management by smoothing the operation of waste collection and make the ease for monitoring the bin. It also becomes the user-friendly bin that can use for all type of people. Waste collector can collect the garbage upon getting the information that, the bin is full. So it will save time for them to navigate the full bins and collect the garbage without fussing around for checking. The design includes the garbage level checking at regular intervals which will also prevent the undesirable waste overflow of the bin. The garbage filling level of the bin and its original height could be sensed by the ultrasonic sensor. Programming is done in Arduino UNO environment in a way that once the level of filling is sensed, a message regarding the same will be automatically sent with a request for clean-up.

II. PROPOSED WORK

Smart bin is built on Arduino board platform. It is interfaced with a GSM modem (SIM 900A) and the bin is equipped with Ultrasonic sensor (HC-SR04). The ultrasonic sensor has two pins: Trigger and Echo, which are used for calculating the distance of the object by generating sound waves and thus calculating the time duration of the echo that is generated. Arduino Uno board is used as microcontroller platform. Interfacing is done between GSM modem and Arduino board by connecting RX pin of modem to TX pin of board and vice-versa. A GSM modem is a specialized type wireless modem that works with a GSM wireless network. It accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. A GSM modem can be an external device or a PC Card / PCMCIA Card. An external GSM modem is connected to a computer through a serial cable or a USB cable. When a GSM modem is connected to a computer, this allows the computer to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS message. GSM Modem sends and receives data through radio waves. However, three sensors can be employed at various heights like $h/3$, $2h/3$ and h , where h is the height of the bin but to make it affordable and to achieve the same results, only one sensor is placed at surface level. Arduino Uno board is used as microcontroller platform. Interfacing is done between GSM modem and Arduino board by connecting RX pin of modem to TX

pin of board and vice-versa. The bins generally placed by civic authorities for garbage collections at various places are prone to many problems like health and environment problems. The “e-bin” resolves this problem completely and presents a manageable system for tracing, identifying, quantifying and collecting the garbage. The idea of using technology enabled bin is not new, but none of the designs have utilized solar power for operation or attempted chemical profiling of garbage. A sample size 200 can be used for this technique. A questionnaire was provided to residents and on the basis of responses, various factors affecting the proper collection and disposal of garbage were studied and the prominent factor was lack of timely collection of garbage from bin installed at public places. This lead to search for possible solution and better method which is technologically capable of addressing this problem which culminated by conceptualization IOT (Internet of Things) based Eco Friendly nicknamed “E-bin”.

III. HARDWARE

III.A. Components Required

Table 1: List of Hardware component

S.No	Name of Item/Component	Specification
1.	Arduino UNO	ATmega328P
2.	Servo Motors	60 rpm
3.	GSM Module	SIM 900A
4.	Battery	9V/655mAh
5.	LED	3V/350mA
6.	Ultrasonic Sensor	HC-SR04
7.	Soil Moisture Sensor	Power: 3 mA @ 5VDC
9.	Capacitors	As per requirement (with different ratings)
10.	Resistors	As per requirement(with different ratings)
11.	Connecting wires	As per requirement(with different ratings)

III.B. Circuit Diagram

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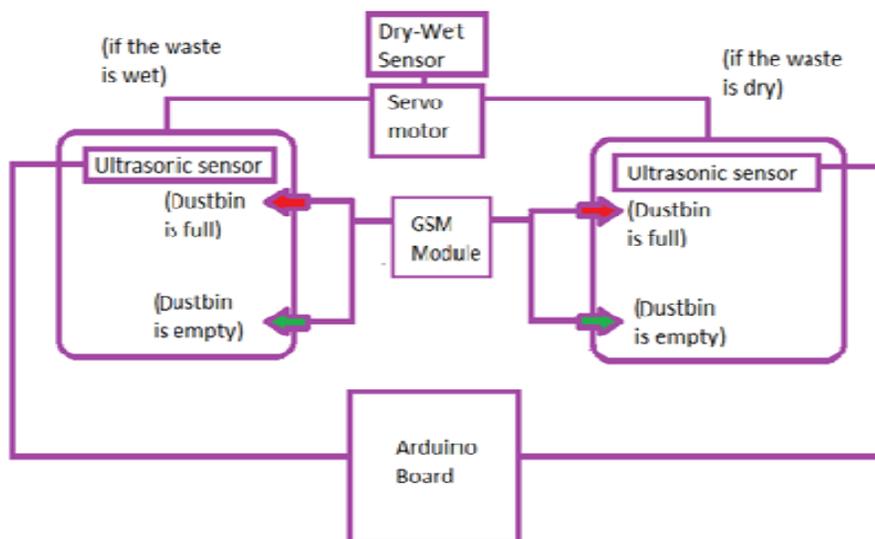


Fig.1: Block diagram of the hardware

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IV. ADVANTAGES

The present methodology being followed for waste collection has many flaws in it so an immediate step has to be taken before it breaks down the whole system. The first major advantage of it is that it will stop overflowing of dustbins along roadsides and localities as smart bins are managed at real time. The filling and cleaning time of smart bin will also be reduced thus making empty and clean dustbins available to common people. Using the prediction and route algorithm it will smartly find the shortest route thus reducing the workforce, the number of trucks required to clean, the amount of fuel consumed by trucks and thus can save a large amount of tax payer’s money as well. It also aims at creating a clean as well as green environment, as it will reduce the fuel consumption and in turn reducing the pollution in the air. As it is being said that the technology which goes parallel with environment is the need of an hour. Smart dustbin is the real solution for all what matters with the domestic and public trash bins. By its name E-Bin performs ecologically, providing benefits to the environment and act as a mate, understanding the user requirements in a wider scope. Stray dogs or animals could not reach and cause pollution by splitting the waste from the dustbin promising a clean environment in the city. It may be in your home, office or public arena smart dustbin implies the smartness over its functionalities.

V. CONCLUSION & FUTURE WORKS

In this paper, implementation is done only for a single bin. Integration of many bins each with a unique ID can be done by implementing the principles of IOT and creating database for each bin which can be maintained by using SQL technology and a login webpage can be created to ensure authorized entries.

Apart from this, differentiation can be made between dry trash bin and wet trash bin collecting plastic dry waste and biodegradable waste respectively. To implement this methane and smell sensors can be used. This helps in distinguishing the waste at the source and hence reducing the requirement of manpower.

To enhance it further, an automated system can be developed which is able to pick up waste in and around the bin, segregate them and put them in respective bins. An efficient waste management system is the need of the hour. This automatic waste segregator is one small step towards building an efficacious and economic waste collection system with minimum amount of human intervention. However as is the case with many automated system, this system also has a few limitations. Inlet section can be incorporated with a crusher mechanism to reduce the size of the incoming waste. Inlet section can also be integrated with a blower mechanism to dehumidify the waste input in the system. Provisions can be made for on spot decomposition of wet waste. GSM contraption to intimate to the nearest industry to use the metals collected. Plastics can be segregated from the collected dry waste and also be processed based on their types, grades and colors. Thus further separation of dry waste can also be done.

ACKNOWLEDGMENT

My deep gratitude intended for the lecturers of our department and concerned people because without their help, it is very difficult to complete the work presented in this paper.

REFERENCES

1. Narayan Sharma, Nirman Singha, Tanmoy Dutta, “Smart Bin Implementation for Smart Cities” , International Journal of Scientific & Engineering Research, vol. 6, Issue 9, 2015,pp-787-789.
2. www.researchdesignlab.com(A n I S O 9001 - 2008 Certified Company)
3. Twinkle Sinha, Mugeshe Kumar, P. Saisharan, “Smart Dustbin”, International Journal of Industrial Electronics and Electrical Engineering, SRM University, India, vol-3, Issue-5, 2015,pp.101-104.

4. Monika K, Nikitha Rao, Prapulla S, Shobha Department Computer Science and Engineering,” Smart Dustbin-An Efficient Garbage Monitoring System” Vol 6 Issue No. 6.
5. Michael Batty , Kay Axhausen, et al., “Smart Cities of the Future,”UCL centre for advanced spatial analysis on working paper series, ISSN 1467-1298, Paper 188 - Oct 12.
6. Foday Pinka Sankoh, Xiangbin Yan, Quangyen Tran on “Environmental and Health Impact of Solid Waste Disposal in Developing Cities: A CaseStudy of Granville Brook Dumpsite, Freetown, Sierra Leone,” on Journal of Environmental Protection, 2013, 4, 665-670. (Journal or magazine citation)
7. K. Vidyasagar, M. Sumalatha, K. Swathi and M. Rambabu, Eco-friendly Environment with RFID Communication Imparted Waste Collecting Robot”, Journal of Academia andIndustrial Research (JAIR) Volume 4, Issue 2 July 2015, pp.43-47.
8. M.T.H. Shubho, M.T Hassan, M.R. Hossain and M. N. Neema, “Quantitative Analysis of Spatial Pattern of Dustbins and its Pollution in Dhaka City--A GIS Based Approach”, Asian Transactions on Engineering (ATE ISSN: 2221 - 4267) vol. 03 Issue 04, September 2013, pp.1-7

