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Self-Compressing Smart Trash Bin

Sachin K N[1*], Tejaswini D S[2], Suraj N R[3], Rajshekar S A[4]

[1,2,3,4]Department of Computer Science, East West Institute of Technology, Bengaluru, India

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Abstract— As urbanization is spreading quickly, there is an expansion in the creation of waste. Squander the board is a vital issue to be considered at open spots where squander is flooded from the containers and may cause distinctive ailments. The present work centers to build up a model of shrewd dustbin which can be viably utilized at open places in smart cities. The model has a self-compressing system which compresses the trash when the trash can gets filled up thus it creates more room for further disposal. At whatever point any dustbin is topped off, a message is sent to the concerned authority and to the trash collecting truck that garbage bin is completely crowded and needs obligatory attention. This might facilitate to manage the rubbish assortment with efficiency. This will avoid the flood of waste in the container and it avoids the disposal of the wastes around the disposal site which are the main aims of this paper. In our System, the refuse level in the dustbins will be detected with the assistance of the Ultrasonic sensor and it has GPS module which provides the exact location of the smart bin and communication to the authorized control room is done through a GSM using Arduino Mega 2560 and the Blynk framework.

Keywords—Self-compressing system, Ultrasonic sensor, GPS, GSM, Arduino Mega 2560, Blynk.

I. INTRODUCTION

Due to the quick pace of urbanization, waste management is turning into a greater issue every day in each developed and developing nations. Fast urbanization and industrialization progress have changed the solid waste characteristics[1]. The waste from different sources will be lead to ecological contamination. In addition, this can likewise bring to genuine wellbeing danger and lead to the spread of irresistible sicknesses.

A powerful solid waste administration rehearses should be refreshed to suit the present waste amount and structure. Municipal waste administration has experienced a few transitions. In the approach of smart city, the goal is to furnish a city with a fundamental foundation to give a tolerable personal satisfaction, a spotless and supportable condition through the utilization of some keen solutions[3]. One of the essential frameworks is sanitation and solid waste administration. Web of Thing [IoT] can assume an essential job in giving a brilliant answer for waste administration that will lessen expenses and increment productivity[2].

Creating a financially savvy activity is imperative to waste management companies. As opposed to crossing all the course to clean the waste canister, it is progressively productive if the waste administration framework ready to caution the authority just the waste receptacle requires to be discharged[3]. Hence, this ready to enhance accumulation directing and spare time and fuel. A framework that ready to process, RFID is being used for auto-detection of the status gather and break down information are essential as a choice help apparatus to support the neighborhood specialist or waste administration temporary worker to improve their administration. Numerous examines in waste administration center around the arrangement execution instead of how to convey an item with aggressive cost with less support cost[5]. This paper proposed another structure for waste administration framework. The planned structure includes three principle parts: Checking trash level, Compressor, and SMS notice frameworks.

SMS notice framework is a daemon program to naturally recognize the full waste bin and help to send ready notice to city worker progressively, at that point updates the waste container status. After the waste container has been emptied the smart waste bin container will update the waste bin status.

This proposed framework ready to diminish the advancement cost since the segment utilized is cheap.

II. RELATED WORK

In paper [1], for the intelligent garbage collection, a smart alert system has been proposed wherein an alert signal, generated through an Ultrasonic sensor (interfaced with Arduino UNO), is provided to the municipal web server. On receipt of such alert, the driver visits the particular location and performs the task of emptying the dustbin. In this

of dustbin i.e. empty or filled. Once the task of emptying is

done, signals are sent back to the server about the accomplishment of the task. An integrated module with RFID and IOT has been designed and proposed in this work. In paper [2], the mechanism to prioritize the collection based on the location e.g. schools or hospitals have been integrated together and, in that way, a dynamic waste management system has been proposed. Further, the similar priorities have been identified for the dangerous waste (i.e. causing the quick health impact on people living areas). The mentioned goal is achieved by means of novel algorithms which optimizes the priority and related cost. In the current method, data is evaluated with real-time and synthetic data is retrieved by the municipality and developed models like dedicated trucks model, detour model, minimum distance model, and reassignment model.

In paper [3], the goal defined here is to reduce the power consumption and increase the operational time by designing a system which collects the data and deliver the data through a wireless mesh network. The architecture considered for this expands over three-tier namely, outdoor nodes (to sense the fullness of bin through sensor node), analytics (to analyze the data, process them, tag the metadata and then interface with the external system) and workstation (which works as the graphical interface for user). This system operates with the data delivery ratio of 99.25% and can be effectively used for litter bin daily seasonality information.

In paper [4], the present system is configured as 'pre-separated waste' for differentiating the database of waste collected obtained from the sensor with respect to its category i.e. organic, plastic, paper, bottle, metal, etc. This enables to have an efficient waste management system and has been adopted in Korea. In the description of such a system, a generic workflow has been provided, wherein, on receipt of alert message, the collection is to be arranged and once the task is done the status in the system is updated accordingly. While the types of smart bins and cloud architecture are configured, the real implementation methodology which takes care of the different variables of the system has not been described.

In paper [5], with the additional incorporation of 'real-time' information on the status of the bin, expected fill-up time of the bins, and level of harmful gases, the IoT system proposed here can be employed by municipal administration for society level waste collection system. In the architecture, it comprises devices embedded with microcontroller, sensors, and communicator to the workstation (located at the municipal office). However, the algorithm based shortest path determination and thereby saving on cost and time has not been exercised.

III. METHODOLOGY

In recent decades, Urbanization has multiplied tremendously. At this phase, there's a rise in waste production. Waste management has been a vital issue to be thought about. This project may be a way to attain a good cause. During this project, an intelligent bin is constructed by a microcontroller-based platform Arduino Mega that is interfaced with GSM(Global System for Mobile) modem and the ultrasonic sensing element and a GPS(General Packet Radio Service) system. An ultrasonic sensor is situated at the lid of the garbage barrel which can screen the status of the junk barrel. Arduino is going to be programmed in such a way that it monitors the trash level periodically. When the junk reaches 90% ultrasonic sensor can trigger GSM modem and GPRS through that the location of the trash can and the level of the trash in the bin with an alert message will be sent to the respective phone number of the user.

This system has a Blynk framework so as the trash bin fills up, the latitude and longitude value of the trash bin location and an alert notification will be sent to the Blynk App installed in the truck driver mobile. Thus by using the latitude and longitude value truck driver can track the exact location of the trash bin and it helps him to take the shortest path to reach the trash bin.

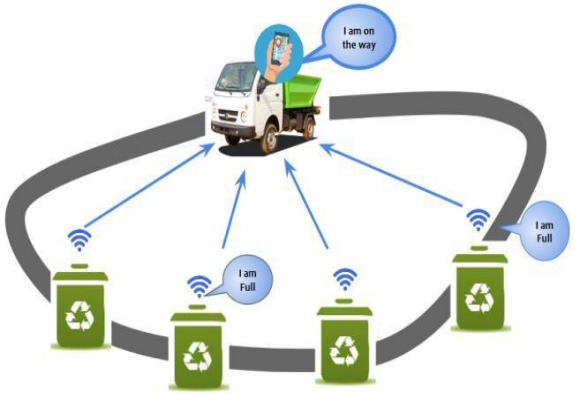

Fig1: Truck driver tracking the location of the overflowing trash bin

This scale backs the overall range of journeys of trash collection vehicle and therefore reduces the expenditure related to the rubbish collection. It final helps to stay cleanliness within the society. Therefore, the sensible garbage management system makes the rubbish assortment a lot of economical. Furthermore, the rate is calculated i.e. the number of times a particular waste bin is stuffed on a daily basis. When the occurrence is extreme the municipal corporation will add another waste bin in this location. This can be done to manage garbage in a cost-effective method.

Trash bin will consist of an LCD display which always

displays the level of the waste in the bin in percentage form. This system consists of a compressor which compresses the trash when the trash level reaches 90% thus it creates more room for further disposal. The purpose of using the compressor in the trashcan is to save time and fuel, so waste collectors no need to collect trash immediately.

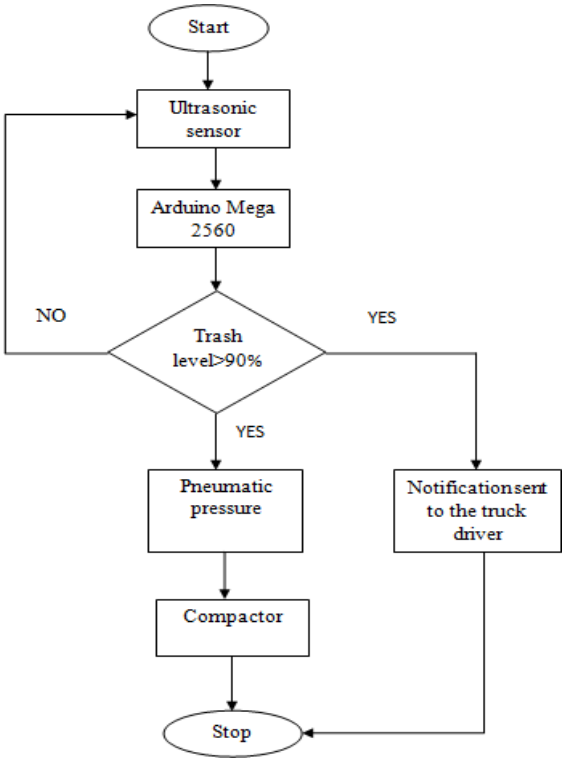

Fig 2: Flowchart of the proposed smart system

NodeMCU is used for the wireless connectivity which connects to the Blynk cloud. Through this NodeMCU data will transfer to the Blynk cloud and receives from the Blynk cloud.

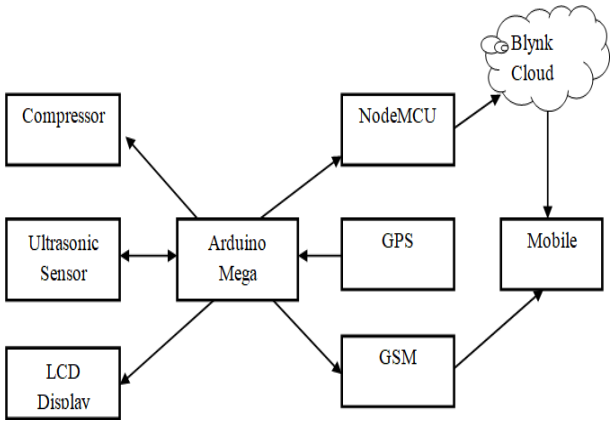

Fig 3: Simple Architecture model of the system

IV. RESULTS AND DISCUSSION

To test the proposed system, a 30 cm tall trashcan equipped with an ultrasonic sensor, of the trash within the can. Fig.6 shows the system prototype and the experimental setup used to test the sensor, while Table 1 contains the results obtained from the sensor testing.

Table 1: Different Levels of trash

	%	Level of Trash within Trash can (cm)	Level of Empty space within Trash can (cm)
1	0	0	30
2	40	12	18
3	80	24	6
4	90	27	3

To test the system, the 30 cm tall trashcan was filled with papers to reach the desired levels of 0cm (0% full), 12cm (40%), 24cm (80% full), 27cm (90% full) as in Table 1. The results obtained from the ultrasonic sensor when the trash can was empty and 90% full is shown in the fig 4.

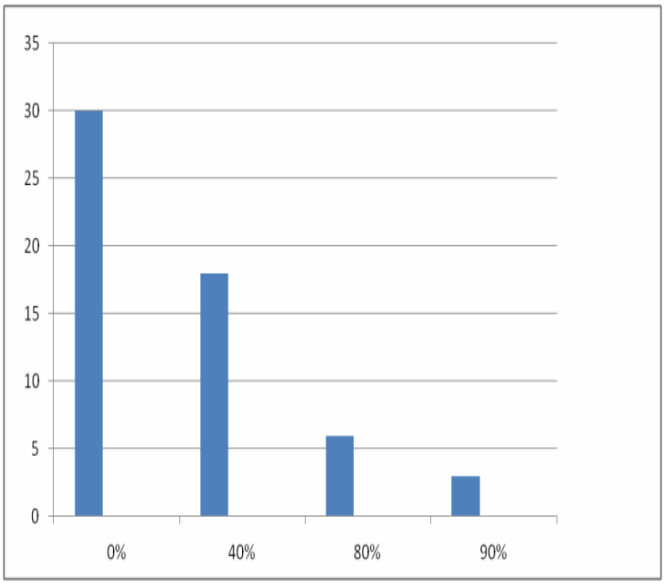

Fig 4: Level of empty space within trash can when trash level are 0% , 40%, 80% and 90%

When the trash can is empty, the sensor detects the level of empty space within the can be 30cm and when it is 90% full, the empty space within the can be detected as 3cm,then the compactor would activate and compress the trash and it will deactivate once the level of the trash is below 90% and it will send an alert message and location of the trash can which obtained from GPRS module through GSM fig 5.

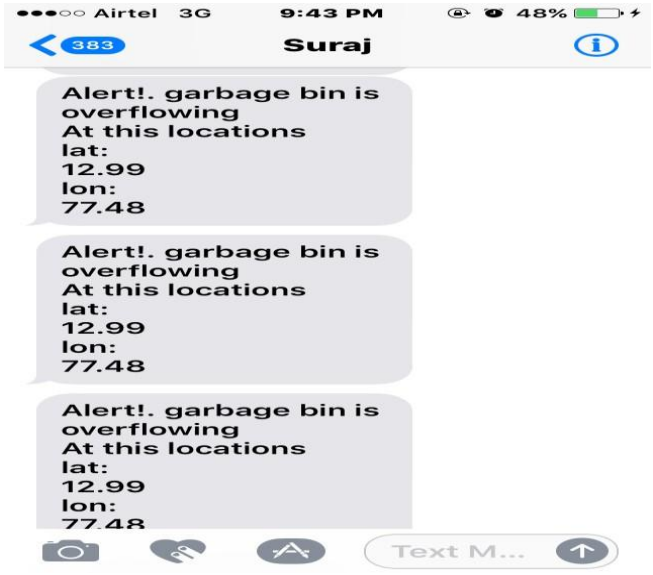

Fig 5: Alert message and location of trash sent to the registered mobile number

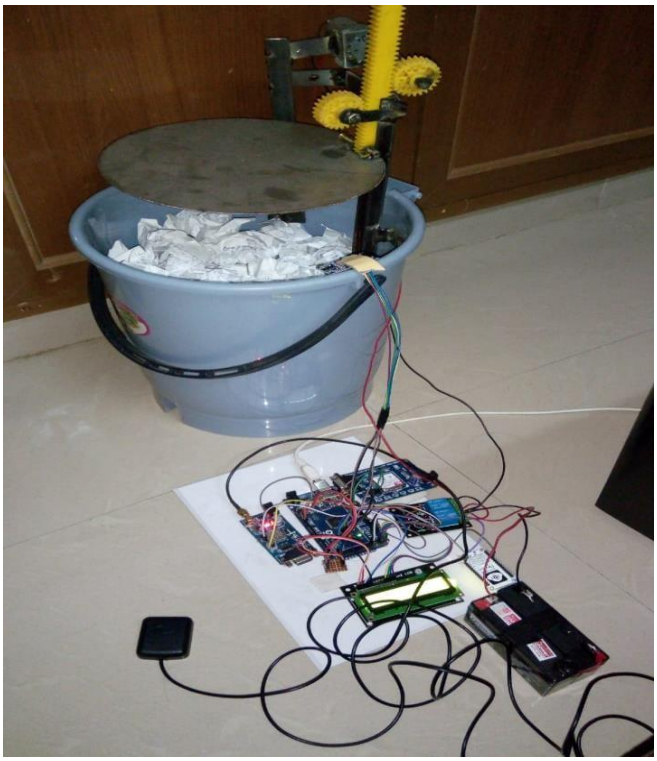

Fig 6: System prototype and experimental setup.

V. CONCLUSION AND FUTURE SCOPE

This paper describes the planning of a sensible waste bin useful to users around the world by reducing the likelihood of overflowing trash also as being efficient and eco-friendly. This system is important for the environment because it can greatly cut back the likelihood of risk hazard and conjointly the spreading of infectious diseases. This system consists of a compressor which compresses the trash and creates more room for further disposal thus waste management became more efficient. The main goal of this design aside from keeping the globe a threat-free zone is to eliminate any risk of overflowing of waste bin. In major cities, the waste assortment vehicle visits the space's daily double or thrice depends on the population of the particular place and usually, these trash bins may not be full. Our System will inform the condition of each and every dirt bin in real time, therefore, the concerned authority can send the rubbish assortment vehicle only to the trash can which is full. This technique not only solely saves fuel and but also aids in the construction of a greener and cleaner environment.

In this paper, implementation is done only for a single bin, integration of many bins each with a unique ID can be done. This system is powered up by using a 12v battery and this system doesn't have dry and wet waste separation facility, The future scope of this system may be enforced with solar power to conserve energy and to encourage green city and also a dry and wet waste separation facility can be incorporated.

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Authors Profile

Mr. Sachin K N is pursuing his 8 semester B.E in Computer Science & Engineering at East West Institute of Technology, Bengaluru, India. His area of interest includes IOT, Java, Python, Algorithms, Web development.

Ms. Tejaswini D S is pursuing his 8 semesterB.E in Computer Science & Engineering at East West Institute of Technology, Bengaluru, India. Her area of interest includes C, IOT, Java, Algorithms, Web development.

Mr. Suraj N R is pursuing his 8 semester B.E in Computer Science & Engineering at East West Institute of Technology, Bengaluru, India. His area of interest includes C, C++, Java, IOT, PHP.

Mr. Rajshekar S A received the B.E degree in Computer Science and Engineering from REC Bhalki, Gulbarga University, in 1996 and got M.Tech degree in Computer Science from PES Mandya, India. He is currently working as Associate Professor in the Department of CSE, EWIT, and pursuing PhD in VTU, Belagam, India. Her area of interest includes Developing a reliable routing protocol for wireless acoustic sensor networks.

