

# Design and Development of E-Dumpster System

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## ABSTRACT

The smart dustbin would be operational with the help of sensors. These bins will have a common waterproof sensor plate which would detect the garbage and would analyze whether it is water based or dry. The bin will have two separate compartments for dry and wet garbage. The sensor plate will play a major role in checking and shifting the garbage to right compartment. Thus the smart dust bin would also notify the users about the capacity- full or empty to avoid spilling. The human sensor embedded below the bin would help users to open and shut the bin in one clap of the user. The bin can also accommodate other facilities like sanitary bag, sanitizers, etc. This model can be the best fit for corporate colleges, hotels, flights, etc.

**Keywords:**E-Dumpster system, IR Sensor, Microcontroller

## 1. INTRODUCTION

The generation and move of waste in enormous sums have made a progressively conspicuous stress after some time for the world which is negatively affecting the human lives and environmental conditions. Wastes are the one which develops with the development of the nation. It influences practically every one of the areas of the nation, for example, economy, culture, wellbeing, and way of life and life standard of individuals. Segregation of waste is significant for appropriate transfer of huge measure of trash current society delivers in an ecologically reasonable mode. People got changed in accordance with heaving things away and never comprehend the results of their movement. The normal technique for move of the mechanical waste is by uncontrolled and improvised, and revealed dumping at the stream goals and open domains. This strategy is harming to plants, human prosperity and animal life [1].

In India the customary waste administration framework is gathering and clearing trash normally and intermittently by the metropolitan company or focused power. This structure will be logically amazing and non-hazardous with the metropolitan people, when no dangerous material will be in contact with them. A general public will get its waste dispatched appropriately just if the dustbins are set and discharged appropriately.

In the event that the squanders are not overseen appropriately, at that point there is a large scale manufacturing of microscopic organisms, creepy crawlies which at long last spread various maladies. In this manner the typical existence of a person gets influenced due to undesirable condition. Cleanliness is very important and for a smart city and hence we have designed an automated E-Dumpster system for the wellbeing and an efficient way to manage waste.

India makes 62 million tons of waste every year, of which under 60% is accumulated and around 15% took care of. India is positioning as third for landfills as far as ozone harming substance discharges, and expanding pressure from the general population. The Government of India updated the Solid Waste Management following 16 years. This paper proposes an institutional structure that will address this grave regular and general prosperity concern and understands a basic change in the division [2].

In 2013, the number of inhabitants in India crossed the 1.2 billion imprints, and now it remains 1.33 billion. With a populace thickness of 325 for every square kilometers, in 2011 India's 2.9 million square kilometer of land region holds near 18% of the total populace. In spite of the fact that the organization has attempted to stay aware of the prospering urban areas, either approaches intended to address essential open administrations have been inadequately encircled or the time taken to execute strategies has taken decades, accordingly basically rendering them insufficient.

- Waste Generation in India

As indicated by the Press Information Bureau, India creates 62 million tons of waste containing both non-recyclable and recyclable waste each year, with a normal development pace of 4% (PIB 2016). The produced waste can be separated into three significant classifications: Natural (a wide range of biodegradable waste), dry (or recyclable waste) and biomedical (or clean and dangerous waste).As in the Figure demonstrated as follows, about half of the absolute waste is natural with the volumes of recyclables and biomedical/perilous waste developing every year as India turns out to be increasingly urbanized (McKinsey Global Institute 2010).

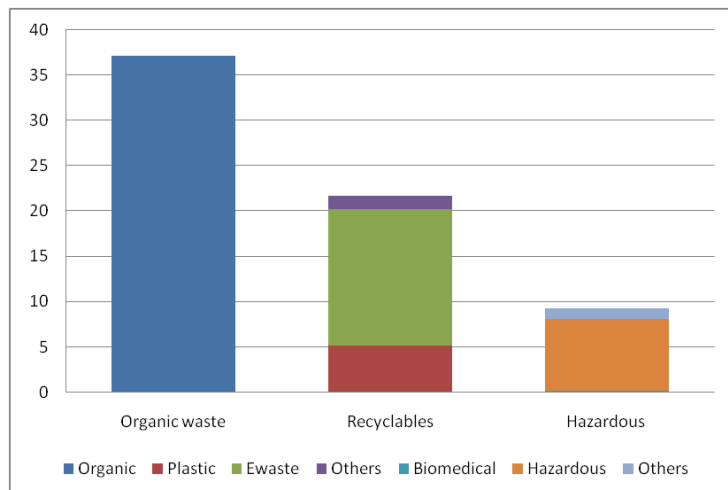


Fig. 1 Waste Composition of India, in Million Metric Tons for every annum

- Waste Management in India

As in the Figure demonstrated as follows, under 60% of waste is gathered from families and just 15% of urban India's waste is prepared in a nation multiple times as thick as that of the United States (US) (PIB 2016).

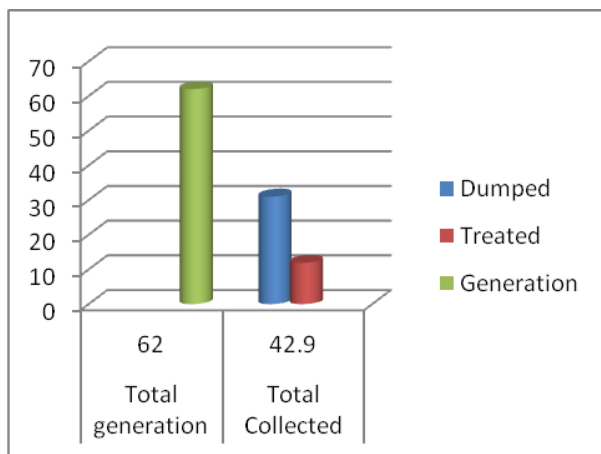


Fig. 2 Collection vs. Dumped Statistics

While the assortment rate should be improved to dodge unlawful dumping and consuming waste at traffic intersections and abandoned grounds, what befalls the waste post-assortment is the topic of focal point of this segment.

## 2. LITERATURE REVIEW

Literature review for this project has to do a lot with the design and the mechanism of the current and final design version since every research paper has a different version of the smart dustbin and segregation designs. But as most of the research papers has a one common goal i.e., to try and sense that if the garbage is up to the mark and send alerts to the concerned personal and there are some unique designs. According to ‘Smart Dustbin’ by Twinkle Sinha and K. Mugesh Kumar in which there is a piston which compresses the waste to the bottom of the bin and making a more efficient use of the space and sending alerts via messages of a Full Bin. According to Research Paper ‘Waste Segregation using Smart Dustbin’ by H. Chaithanya das, Jeswin Jose and Kushal R in which the dustbin segregates dry, wet and metallic wastes using respective sensors and a conveyer belt that that separates the waste in between the individual bins. Also According to Research Paper ‘Smart E-dustbin’ by Chinmay Kolhatkar, Prachi Choudhari and Bhavesh Joshi in which The basic idea for the bin is to use IoT protocols to transmit the level of the bin and also an automatic door that opens for the collection and deposition of the waste using a proximity sensor [3]. According to Research Paper ‘Smart Dustbin Management System’ by Swati Sharma and Sarabjit Singh in which A network of dustbins connected together that displays the reading of the level of the each dustbin individually over an android application and LCD’s.

### 3. METHODOLOGY

First it comes to the deposition of the garbage into the dustbin cavity which has a base plate that is positioned horizontally that is having some contact less liquid level sensors which works on the principle of water sensing capacitor that can detect the presence of any kinds of liquids as such, by the reference of the signal from the sensor we segregate the trash on the base plate which further is dropped on to the dry or the wet side. Once we see any side of the dustbin being full by the ultrasonic sensor placed above it, its gets packed automatically and the moved on to the other storage capacity of the dustbin just behind it.

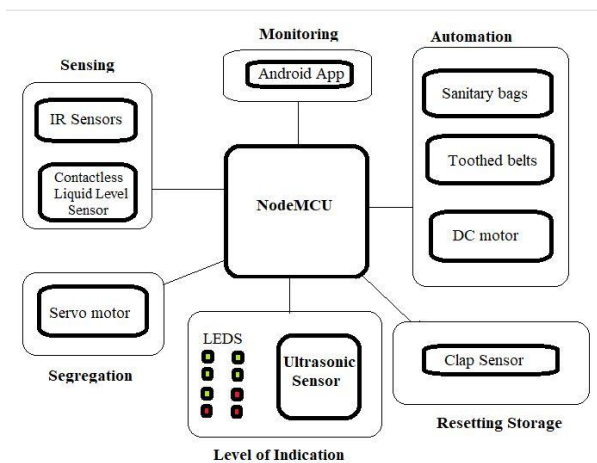


Fig. 3 Block Diagram

As we detect the number of bags being packed and move on to the storage area of the dustbin we send some alerts to the concerned person about the storage of the dustbin. As the person comes to collect the dust from the bin we are placing a clap switch lock which takes the reading or the count of the number of bags that are been sent on to the storage and opens the back storage for the collection of the dust, and the only manual work that needs to be done for the working of the dustbin is to place new bags every time when the given limits of the sanitary bags are finished.

- **Sensing and Segregation**

A segregation plate will be there as above figure in which it has 2 IR sensors to sense whether the waste is placed on the sensor or not and it has 2 Contactless Liquid Level Sensors to sense whether the waste is wet or not as shown in Figure 4.

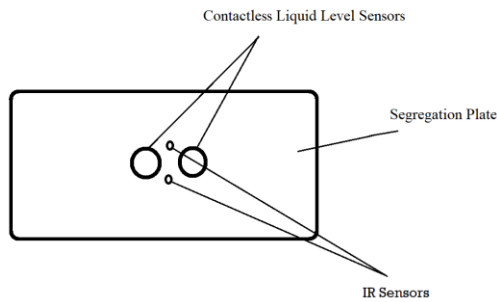


Fig. 4 Segregation Plate Representation

- **Sensing:**

When we place a waste on the plate the IR sensor detects the substance and returns value '1' to the microcontroller. It has 2 IR sensors to detect the waste more precisely when one of the sensor detects the waste then both sends the value '1' to the microcontroller.

When the microcontroller receives the value '1' from anyone of the sensors which means waste has been placed on the plate. Then Contactless Liquid Level Sensors sense the waste. If the waste is wet based then it sends value '1' to the microcontroller which means wet and if the sensor sends the value '0' it means waste is Dry. If one Contactless Liquid Level Sensor sends '1' and other sends '0' then we consider it as Wet. If anyone of the sensor detects '1' then is wet. If both the sensors detect '0' then we consider the waste as dry.

After sensing the waste whether it is dry or wet the value is sent to the microcontroller. According to the value the waste should be placed in wet container or dry container.

- **Segregation:**

A Servo motor is there below the plate to tilt the plate as shown in above figure 5. When Similarly for the dry waste, according to the instructions the servo motor tilts the plate towards dry container by rotating 45 degrees clockwise direction as shown in above figure 5 [4].

- **Level Detection**

The waste is dumped to specific containers according to the type of waste. In this section we find the level of container up to where the waste came. Ultrasonic sensors are placed above of both wet and dry containers as shown in figure 5.

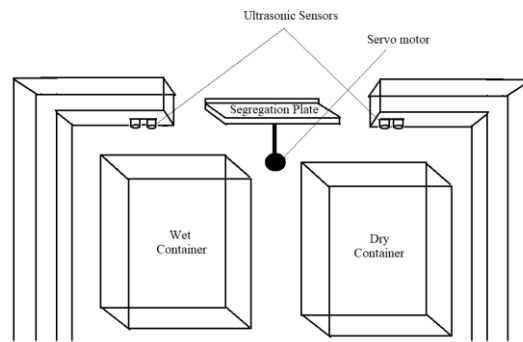


Fig. 5 Level detection Working

The ultrasonic sensor sends the ultrasonic waves to the container after touching the waste or the material inside it reverts back. By knowing the time taken to revert back we can assume the level of containers. When the level of the container is full. Then the microcontroller sends signal to the automation part [5].

- **Automation**

When the microcontroller receives the data that the container is full then the automation part is triggered. The motor attached with toothed belt will start moving to change the container of the specific side. For both containers separate motors and toothed belts are provided.

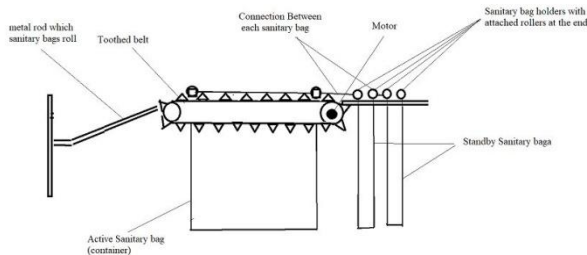


Fig. 6 Toothed Belt Mechanism side view

The replacement mechanism for both the containers is same [6]. The model of the replacing the filled sanitary bag with new sanitary bag is shown in the figure 6.

All the sanitary bags are placed aside where they are in standby position. One bag is present on the main track. All the bags including the current bag which holds the waste all are located and supported on rod which is like a railway track for the sanitary bags.

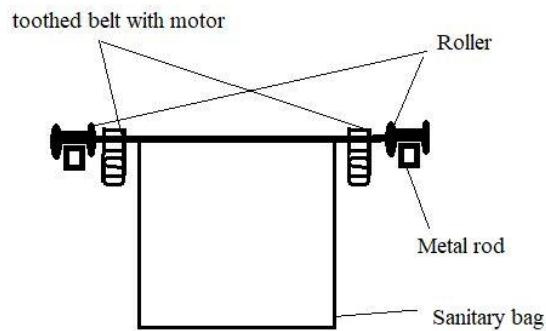


Fig. 7 Toothed Belt Mechanism front view

The metal rods and toothed belts are side by side with same height so the track will always remain on the track. And the toothed belt helps the sanitary bags to move on the metal rod.

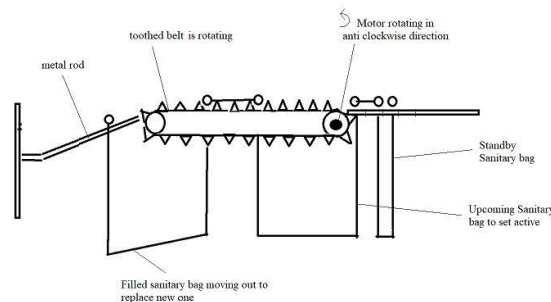


Fig. 8 Toothed Belt Mechanism Working

When the bag is full, the microcontroller gets to know that the bag is full by ultrasonic sensor. Then it gives instruction to the motor. The motor moves in anti-clockwise direction so that the bag present on the track moves left and slides to the left edge which is filled bags storage area. The second bag open end is linked to the first bag last end. So the second bag also starts moving due to the link provided between bags.

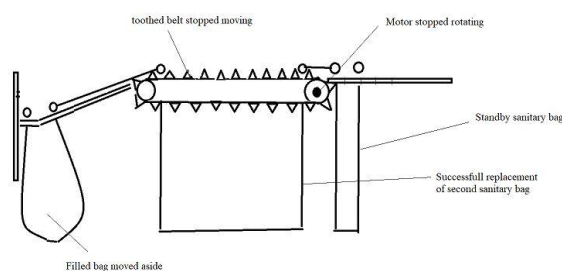


Fig. 9 Toothed Belt Sanitary Bag movement

After moving certain time the bag slides down and second bag comes to the exact position so that it can take waste. The third bag comes to the position of second bag. The first bag which is full is placed aside in storage area of the dumpster.

- **Level Indication**
- The level of the each container is indicated front side of the dumpster system. The level is measured by ultrasonic sensor placed above of each container. This level is indicated by 4 LED's showing the level with green and red color. The green indicates empty and the red the full up to particular level.

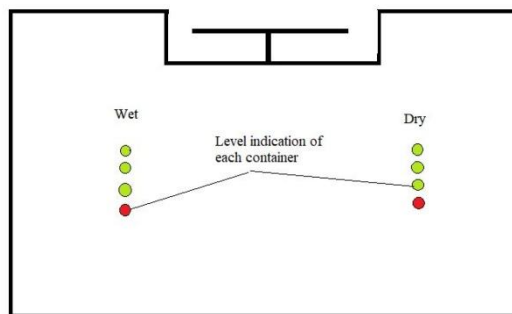


Fig. 10 Level Indication

- There are four LED's placed on each side. Each LED represents 25 percent of the container. If the LED's entire are green then the container is empty or may be full below 25 percent. If the bottom LED is red and remaining are green then it is showing that the dumpster container is 75 percent empty. Accordingly for bottom 2 LED's are red and above are green represents 50 percent free. If the entire LED's are red represents the container is completely full and within a short span the container will be replaced with a new sanitary bag automatically then the LED's status will be reset to all green.
- **Android Application**

The android application is a backend indicator to the particular supervisor of the Dumpster System. Numbers of bags for each container, filled bags empty bags are shown in the android application.



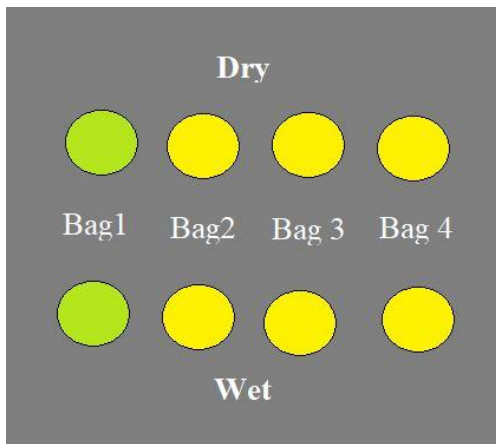


Fig. 11 Indication of the bags Status-1

In the Figure 11 the indication is shown such a way that bag 1 is in active mode of both wet and dry containers. Other bags are in standby mode. When the first one is full, the second bag will be active.

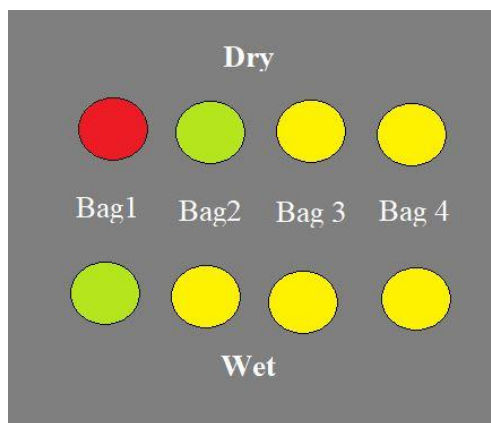


Fig. 12 Indication of the bags Status-2

As shown in the figure 12, Bag 1 of the Dry container is red which means the bag 1 is full and moved aside to storage area. The bag 2 occupied the active mode and other bags are still in standby mode.

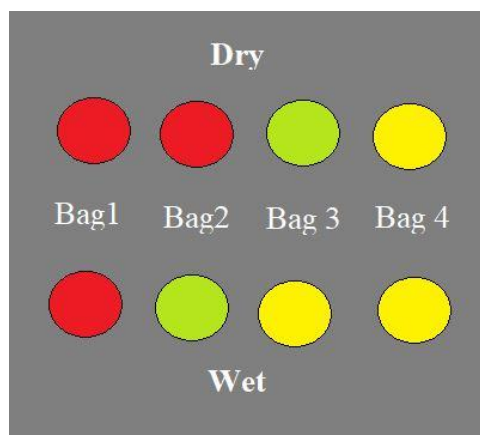


Fig. 13 Indication of the bags Status-3

In the above figure 13 2 bags of Dry compartment is full, third bag is in active mode and fourth is in standby mode. For wet compartment one bag is kept in storage area which is full, second bag is in active mode and third and fourth are in standby mode.

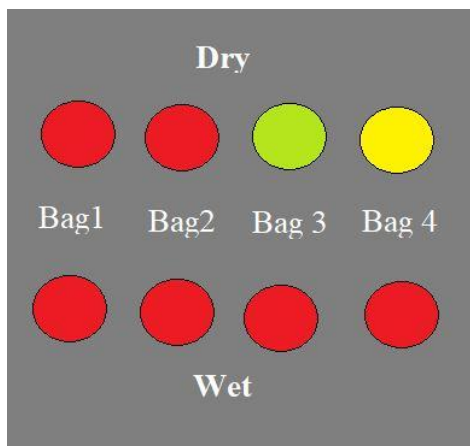


Fig. 14 Indication of the bags Status-4

As represented in the above figure, the wet compartment bags are all full and moved to storage area and there are no sanitary bags to replace the new bags. That means it reached the limit of the bags. So it is showing all the bags to red.

- **Message Protocol**

A message is a last alert to the person who is in charge to maintain and checks the health monitoring of the Dumpster System. As shown in the figure 14 wet compartment is full. In that situation a message will be sent through normal message and mail to the concern person to change the bags immediately.

- **Resetting the bags**

When all bags are full and moved to storage area a message will be sent to the person. When the person comes to the Dumpster he will clap. After clapping the clap sensor receives the signal and sends to the microcontroller which gives command to the electronic lock of the backside storage area.

When the clap detected and the bags are full then only the electronic lock will be opened. Then the person will remove all the bags and replaces with new bags in such a manner that the one bag is on active mode and other are in standby mode and the following is updated in display system and in android application also by presetting the preset button of the particular container. All the sanitary bags which are full and packed are taken away to do further waste management [7].

**CONCLUSION**

This execution of E-Dumpster System marker container, gives an answer for unsanitary natural condition in a city. This execution of Smart Garbage assortment container utilizing web, IR sensor, and microcontroller. This structure assurance to send admonitions and status on dashboard of dustbins when the refuse level lands at its generally outrageous if the dustbin isn't cleaned in explicit time, at that point the record is sent to the higher authority who can take appropriate action against the concerned contractor. This system also helps to monitor the fake reports and hence can reduce the corruption in the overall management system. This reduces the all-out number of excursions of trash assortment vehicle and thus decreases the general consumption related with the trash assortment

It extreme keeps cleanness in the general public. Along these lines, the E-Dumpster framework makes the trash assortment progressively productive the utilization of sun based boards in such frameworks may decrease the vitality utilization. Such frameworks are defenseless against ravaging of parts in the framework in various ways which should be chipped away at. These residue receptacle models can be applied to any of the keen urban areas around the globe. A waste gathering and checking group which is sent for assortment of trash from the city can be guided in a well way for assortment.

Swachh Bharat Abhiyan (English: Clean India Mission and truncated as SBA or SBM for "Swachh Bharat Mission") is a national crusade by the Government of India, covering 4,041 statutory urban areas and towns, to clean the boulevards, streets and framework of the nation. In our system, the Smart dustbins are related with the web to get the persistent information of the sharp dustbins. In the continuous years, there was a speedy advancement in masses which prompts progressively waste exchange. So a proper waste organization system is critical to refrain from spreading some perilous sicknesses,

#### **ACKNOWLEDGMENT**

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