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## Automated Waste Management System

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### Abstract

In the current scenario, the major problem faced by almost all the municipalities is, the management of garbage. With the increase in the population, there is an increase in the garbage around urban areas. It is very important to focus on this issue as it leads to many environmental problems and spread diseases. Conventional dustbins open when the lever is pressed and the garbage is thrown into it and needs a person to keep track, whether the bin is full or not, so that it can be emptied without overflowing. Here in this smart waste management, the proposed smart bin works all by itself. It operates automatically using IoT and sensor-based circuitry, the sensor used will detect the human object signal and the bin opens and closes its hatch automatically without any need to press its lever.

It also consists of a level sensing ultra sonic sensor that constantly measures the level of garbage in the bin and informs the same using IoT to the concerned person when it is about to fill up. The circuit that is present with the bin will transmit the information to the garbage collector to empty the garbage bin. IoT Gecko development platform is used to develop the online web transmission for the system. The Data collected through IoT gecko is analyzed and message can be sent to the concerned person to empty the bin. IoT Gecko is deployed in the smart dustbins for a wider geographical area with a minimum amount of man power. Smart Dust bins can help to take decisions on which dust bin is filling fast and which is not used frequently. This work is of great use in municipalities, offices and at home for garbage management as it is used for garbage cleaning automatically. The proposed model completes the required tasks in managing the waste and fulfils the idea of Swatch Bharat mission.

### Keywords:

Smart waste management, sensor-based circuit, automated, Swatch Bharat mission, IoT.

### Introduction:

The collection of waste is an important aspect for the municipal authorities. The conventional method of manually checking the wastes in dust bins require more human labor, takes longer time, and costs more money. To overcome all these problems, a waste management system was developed with the least human intervention to maintain clean surroundings.

IoT based Garbage Monitoring System, a self-developed website, allows users to request dust bins close to their location. This system keeps an eye on the dustbins and updates the web server with information on the amount of trash being collected in the bins. The dustbins are connected through the internet. They send the real time data to the IoT Gecko

Server. The system used here has a variety of sensors to identify different garbage types and then classify them into separate bins by opening the door automatically.

To determine the garbage level in the bin, ultrasonic sensors are positioned over the bins. As smart bins are maintained in real-time, it will prevent the overflow of trash can along road side and in neighborhoods. Additionally, smart-bin filling and cleaning times would be shortened, making clean and empty dustbins accessible to regular people.

The impact of this work will be marketed in village panchayat and municipalities, since the recycling is done with the collected waste and make them earn. By using this, the method of waste collection

becomes easier. It helps in reducing pollution, time, manpower and money. This work adds an edge to villages and cities which are aiming to get smart and create a people-friendly environment. This work also enhances the effective utilization of human resource.

## Literature Survey

The work done on smart waste management previously is as follows:

In this work, Adil Bashiret al., [1] used sensors to avoid the overflow of waste from the bins which are previously loaded by man power or with loader in traditional trucks in a residential area. So, this method helps in making use of vehicles and man power productively.

B. Chowdhury & M. U. Chowdhury designed an RFID-based [2] smart trash where the person pays as the trash is thrown in the bin and uses a weight-based billing using load sensor for residential collection, which motivates residents to reduce their waste.

Fachmin Foliato et al, designed a system which collects data using sensors and delivers through the wireless network. The system reduces the consumption of power and the operational time by using a duty cycle technique. The development board was used in an outdoor environment for the waste collecting people and municipal contractors to make better decision for collecting waste and also helps them in management of time [3].

Dr.K.R.Nataraj and Meghana K.C, [4] proposed a system which concentrates on creating awareness of cleanliness which is most important for our ecosystem. The smart trash has these sensors namely IR sensor which is inside the trash to sense the level of waste in the bin and gas sensor for sensing the toxic substances, as soon as the trash is full, sound is obtained from alarm.

S.S.Navghane, et al., designed an intelligent garbage bin with a weight sensor, IR sensor and Wi-Fi module for the transmission of data. The system does the cleaning of the dust bins as soon as the garbage level reaches its maximum and the information is sent to the higher

authority who takes an action. This will in turn reduce the total number of vehicle trips to collect waste and the expenditure incurred for fuel [5].

In the work done by Gaikwad Prajakta, et al., [6] on collecting garbage based on Image processing uses a GSM module to operate automatically. The camera is used in this work along with the load cell placed at the bottom of each garbage and can continuously measure the amount of garbage by taking snapshots. After analyzing the amount of garbage, a message is sent through GSM module to the Garbage collection center to inform the disposal of required waste using a robot mechanism to tilt the can.

Vishesh Kumar Kurre [7] has presented a work to collect the garbage by an authentic person after knowing the density of the waste in the bin, using a sensor placed under the bin. The density of the Dustbin is determined through the internet on a Dash board using a GUI (Graphical User Interface).

## Methodology

In the present work, the sensors and modules are connected and controlled using Raspberry Pi. Here, two sensors are used in which the IR sensor measures the proximity of the person and accordingly the smart bin opens. The other one is ultra sonic sensor which is used to identify the depth of the waste in the dustbin. This detection helps in the automatic opening and closing of the lid through servo motor. The garbage fill level of the bins is measured by the ultrasonic sensors and is continuously fed to the Raspberry Pi single board computer. The Raspberry Pi displays the real time garbage filled data on the LCD and sends it to the servers using output devices i.e. on IoT development platform.

IoT Gecko is an Open source IoT development platform, which helps to monitor remotely located physical devices. A log in and customized interface is created where the real time data collection in the dustbin is monitored. This helps the person collecting the waste from the dustbin to take decisions on which one should be emptied first.

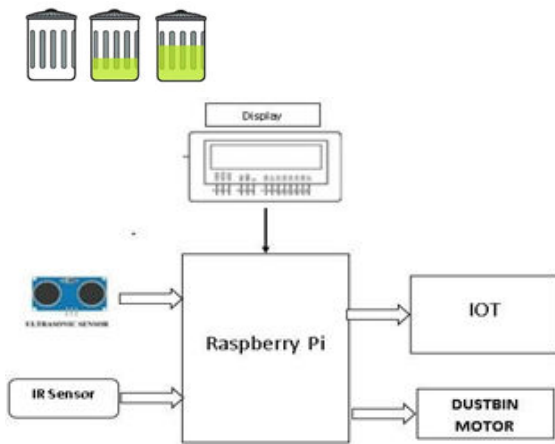


Figure 1: Block diagram

The system has an extensive and user-friendly web-based GUI. The administrator has one set of the privileges, and the users have another. A person with the administrative rights can check the amount of waste the bin, the amount of trash in it, all the sensor data, information about the registered users, requests for bins, and complaints. The amount of waste, its location, and the complaint and bin request form are all visible to the user depending on their user credentials.

The developed system provides many useful features for any city that wants to optimize its waste collection as well as to reduce the overall cost of running the collection process. This helps to keep the cities clean, as waste management is done in a better way and properly.

### Results

Testing of each module of a system is called as a Unit testing. The main purpose of this Testing is the Software quality checking. In this work, unit tests are conducted on all modules and obtained the expected results. Later, the component testing is conducted on each module to get the expected results, and modules in the system worked properly. The prototype development board is checked to see the implementation of the designed system and its output which is developed by the integration of the different modules.

Figure 2 shows the prototype development board with all the sensors connected to Rasberri pi along with LCD. The result

obtained on IoT gecko server is displayed and shown in Fig3. Fig 4 shows the amount of garbage in the bin read by the sensor used i.e. ultrasonic sensor.

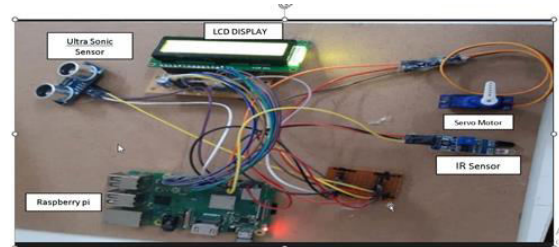


Figure 2: Prototype development board

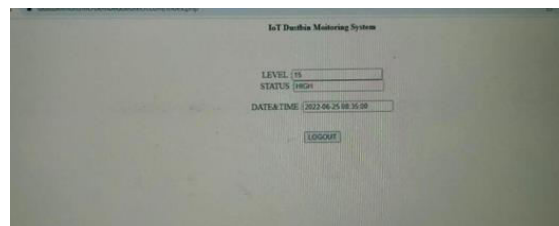


Figure 3: Display on IoT server

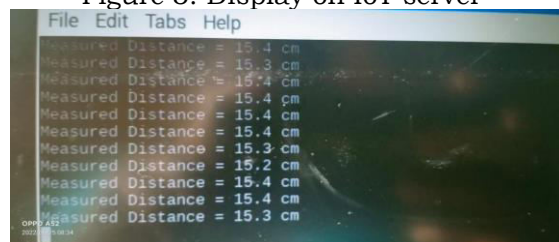


Figure 4: Measurement of the level and status of the bin



Figure 5: Display of measurement of the Distance

Figure 5 shows the amount of garbage filled in the bin. If the reading of the distance is less than 75cms, the readings of the bin are shown as full. If the distance is obtained between 75 to 150cm, the waste in the bin is medium. If the measured distance is greater than 150 cms then the bin is empty.

### Conclusion

Rapid population and increasing industrialization are the major causes of pollution. The problem of overflow of

garbage, leads to unhygienic conditions of sanitation due to lack of information passed on time to the dust collection authorities. Advancements in technology are utilized to overcome these problems. This work is initialized to aid the concept of keeping the city smart and swatch Bharat Abhiyan. It uses a cheap and reliable Raspberry pi as a central control board and is interfaced with some more sensors for smoke detection, dustbin status, GPS module for identifying the location. All the sensors' data are stored in an online database in real time, using web and SMS notification the system becomes more efficient and reliable.

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