



Smart Waste Management Using Smart Bins

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ABSTRACT

India being a huge and highly populated nation, major concern is to maintain hygiene and health of the people for which effective waste management place a key role. The monitoring, detecting, managing and segregation of waste are the primary problems. This paper proposes and advance method of waste segregation, compression and management is automated. The system makes use of ESP module, IR sensor, moisture sensor for monitoring and motors for segregation and compression. This work presented here provides and approach in segregating of dry and wet waste, compression and disposing of the solid waste in an efficient and easy way. Therefore, the proposed system segregates, compress, monitor and manage the overall waste collection process in IoT based smart bin.

Keywords: ESP Module, IR sensor, Moisture sensor, Motors, Smart bin.

I. INTRODUCTION

Nowadays garbage management is degrading tremendously, which is provoking several serious diseases within those nearby. Waste collection method is an on-going challenge and many struggles due to weak institutions and rapid urbanization. The traditional way of manually monitoring wastes in bins have become complex, utilizes more human effort where in time and cost not compatible with present technologies. Waste collection methods vary widely among different countries and regions. Smart bins are designed for purpose of solid waste segregation, compression and management.

Waste Segregation: When the waste is kept on the lid, wet and dry sensor senses the moisture present in the waste and segregates.

Waste Compression: Once after the segregation, the waste is compressed to effectively utilize the space in the smart bin.

Waste Management: IOT based smart management system will help to get updates on time to the dash board about dry waste filling and wet waste leakages.

II. METHODOLOGY

In the proposed System there are multiple dustbins located throughout the city or the Campus. These dustbins are provided with low cost embedded device which helps in tracking the level of the garbage bins and a unique ID will be provided for every dustbin in the city so that it is easy to identify which garbage bin is full. When the level reaches the threshold limit, the device will transmit the level along with the unique ID provided. These details can be accessed by the concern authorities from their place with the help of message and an immediate

action can be made to clean the dustbins. Level of garbage in the dustbins is detected with the help of IR Sensors. Waste can be segregated based as wet waste or dry waste. The waste is kept on the lid of smart bins, the moisture sensor senses the moisture present in the waste. If the moist is present in the waste, the servo motor connected to the lid rotates and the wet waste is dumped into the wet portion of the smart bin.

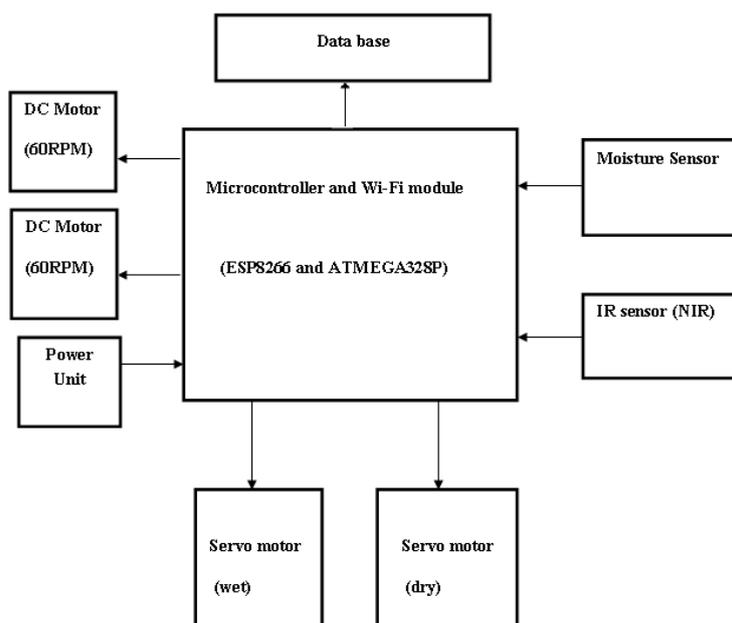


Figure 1: Block diagram of smart bin

If the moisture content is absent in the waste kept on the lid, the servo motor connected to lid rotates and the waste is dumped into the dry portion of the smart bin. Once the waste is dumped inside the wet or dry compartment, DC motors compresses the waste to utilize the maximum space in the smart bin. This chapter describes the steps to be followed to implement the proposed system and hardware components required. In this project of SMART WASTE MANAGEMENT SYSTEM, the system is provided with a 12V power supply. IR sensor used, to know if the waste in smart bin has reached the threshold level. Once the garbage reaches the threshold level the data base shows the unique ID with location and indicates that the dustbin is full. To control this operation, we will be using NodeMcu which has inbuilt ESP8266 wifi module.

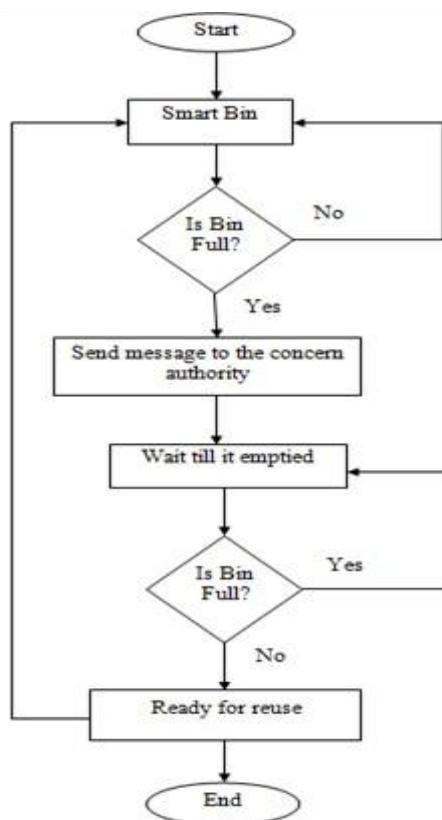


Figure 2: Flow chart of garbage level monitoring

III. FLOW CHART

In this condition when the smart dustbin is full, the IR sensor in the dustbin senses the level of garbage and sends information to the microcontroller (NodeMCU) which has the Wi-Fi module in-built. The Wi-Fi module helps in collecting the data of smart bin. This collects the unique id of that particular dustbin and displays the information on the database of that dustbin to the authorities. Until the waste is emptied from the smart bin the dustbin is not ready for the reuse.

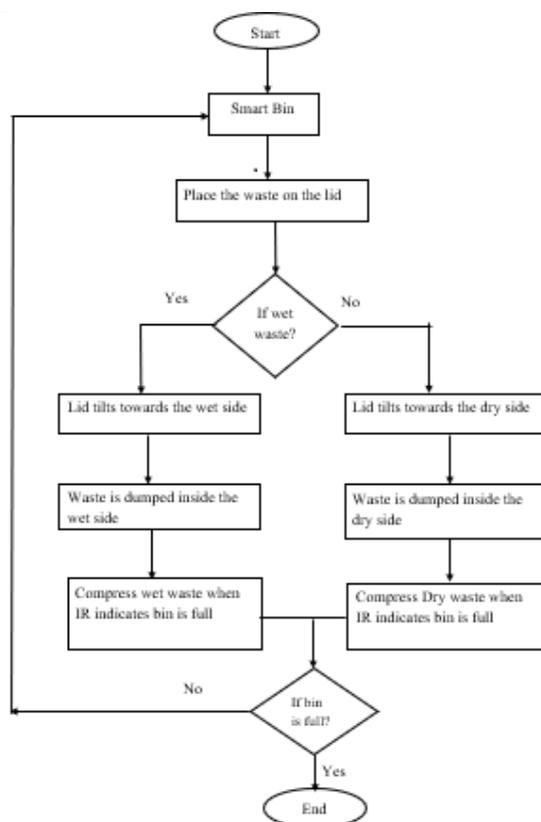


Figure 3: Flow chart to segregation of waste

When the waste is kept on the panel of the smart dustbin, the moisture sensor senses if there is any moisture content in the waste. Based on that, segregation of wet and dry waste is done. If the waste kept on the lid of smart bin is a wet waste the servo motor inside the bin rotates and opens the lid of the wet waste compartment so the waste falls in, if the waste kept on the lid of the smart bin is the dry waste the servo motor inside the dry compartment rotates and opens the lid of dry waste compartment so the waste will fall into that compartment. There are DC motors connected to the lid of the smart bin which are connected to the motor drivers. These motors are used for the compression of the waste. When the IR sensors indicate the waste has reached threshold level of the smart bin, the motors compress the waste to utilize the space in the smart bin. If the space is provided then the waste can be continued to dump else it sends the location and the ID of the smart bin and the location on the database of the respective authority. Then waste is collected from the smart bin. After emptying the smart bin, it is ready for the reuse again.

IV. HARDWARE DISCRIPTION

Node MCU: Node MCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif System, and hardware which is based on the ESP-12 module. The term “NodeMCU” by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language.

IR sensor: IR sensor work on the principal in which IR LED emits IR radiation and Photodiode sense that IR radiation. Photodiode resistance changes according to the amount of IR radiation falling on it, hence the voltage



drop across it also changes and by using the voltage comparator, the voltage change can be sensed and generate the output accordingly. To check the interference, IR sensors are use in this system. Analog output varies from 0 to 1024. If the analog value is less than 400 indicates smart bin is full. If it is in between 500 to 600, it indicates the user interface. If it is 1024 it indicates no user interference.

Servo motor: The servo motor is usually a simple DC motor controlled for specific angular rotation with the help of additional servo mechanism. In this system, if wet waste is detected, wet servo moves 90 degree and lid will open. Waste will be dumped inside the wet side. If the dry waste is detected, dry servo moves 90 degree and lid will open to dump the waste in the dry side of the smart bin.

DC motors: DC motors are widely used, inexpensive, small and powerful for their size. Reduction gearboxes are often required to reduce the speed and increase the torque output of the motor. DC motor is used to compress the waste in the smart. So that, the maximum space in the smart bin can be utilized.

V. FINAL RESULT AND APPLICATION



Figure 4: Overview of the Model



Figure 5: Wet and Dry Compartments

The graph gives the analytics of wet and dry waste dumped in a particular location.

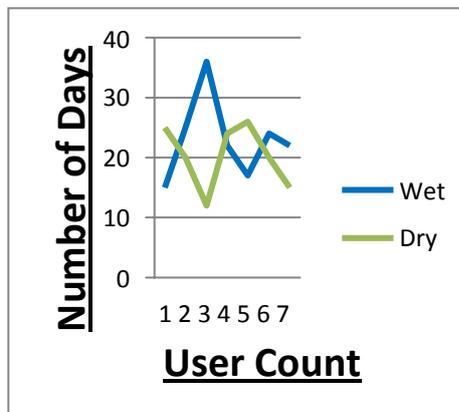


Figure 6: Analytics of waste



Applications

- This can be best used by Municipal Corporation for their betterment of management regarding collection of wastes.
- Waste segregation (wet and dry) can be done.
- Compression of waste to utilize the space in the bin.
- It favors the “SMART CITY” project and “DIGITAL INDIA”.
- It favors the “SWACCHHA BHARATH ABIYAN” (Clean India Mission).

VI. FUTURE SCOPE

1. There is a great future scope for the modification of the smart dustbin in future.
2. Dumping of the waste was manual in smart dustbin this can be automated by fixing a robot arm or a tipper.
3. We can generate electricity with the help of solar panel in this garbage monitoring system.
4. The scope for the future work in the system can be implemented with the time stamp in which real time clock shows to the concern person at what time the waste is collected from the smart bin.
5. RF tags can be given to every user in a particular building.

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