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Design and Fabrication of IOT based Smart Dustbin

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Abstract: ***A Smartbin for waste management is presented in this work, as an attempt to maintain clean and hygienic environment. The concept of the Internet of Things (IoT) has been implemented through GSM module integrated with Arduino UNO to design this bin along with Bluetooth connectivity. The Bluetooth Controller App is employed for establishing connection with the Bluetooth module. The module is therefore leveraged to detect distance between the user and the bin, and the information enables the planning of an optimal route for the bin to move towards the user. As it detects the object, the lid of the bin opens automatically and allows the object to dispose the waste into it. The waste is then segregated into dry or wet particles and then the lid will get close automatically. Level indicators allow estimation of remaining capacity of the bin to store further waste. On exhaustion of the capacity of the bin, SMS-based notification is provided to the user via a GSM module. In this work, a low cost, user-friendly, economically viable waste management solution to control pollution is demonstrated.***
Keywords: Pollution control, Waste management, IoT, Bluetooth Controller app, Dry and Wet segregation.

I. INTRODUCTION

Environmental problems are raised by modern cities for waste collection and disposal. Therefore, smart waste management systems with the help of advance technology became essential for cities that aim to reduce cost and manage resources and time. Optimizing the process of trash collection to keep our surroundings clean and green and free from bad odour of waste, emphasizing on healthy environment is the main purpose of the smart solutions. Smart dustbin also helps for the physically challenged people as well as old aged people who is unable to reach towards the dustbin, they can easily bring the Smartbin with using their mobile phones and use it. The purpose of this work is to present a cost-effective smart trash bin for localized and small-scale cases, such as small parks, university campus, cafe and hospitals, etc. to keep cities healthy and more beautiful.

II. LITERATURE SURVEY

For the last few years, many researchers are focusing on IoT-based applications, especially smart city. A smart city is an infrastructure where everything is interconnected and can interact with each other. Everything is supposed to be smart and intelligent in decision-making ability. [1] studied a prototype model of smart dustbin. Mainly it designed the road side smart bin but it is a combination of solid and wet waste. [2] designed and implemented smart dustbins for the campus environment and educating the campus community so that their interest in disposing of garbage in the right place is higher. The recommended smart dustbin system has various types, namely mini-smart dustbin and super-smart dustbin but recommended for further improvement for better operation. [3] designed a dustbin where the lid of the dustbin is opened, on detection of human hand and waste, and the level of waste available inside the dustbin is sent as notification in the form of LED. The concerned official can clan and empty the bin on the notification received by them. [4] developed a Smart Dustbin which is an improvement of normal dustbin by elevating it to be smart using sensors and logics. The ultrasonic sensor detects the distance and object and PIR sensor used for calculating the level of dustbin. A system is proposed by [5] where each dumpster contains an embedded device to track the level of the garbage in the dumpster and unique ID will be provided to easily detect which dumpster gets filled. The embedded device consists of IR Sensor, Arduino Uno and Arduino Wi-Fi Shield. Once the level gets filled it will transmit the level of the garbage with the unique ID through the mobile application. The notifications are accessed by the concern authorities through the internet and they can take immediate actions to clean the dumpster.In this section, various research about garbage or waste collection and a better management mechanism for the collected waste is reviewed. Most of the past work on this subject focused on utilizing cellular network to connect to the internet for sending the sensor's data to a server. On the contrary, this paper considered using the cellular network to send SMS alert directly to the user.

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Therefore, the work in this paper can be considered as a smart device, as well as an IoT solution.

III. PROBLEM STATEMENT

It is seen in the market most of the dustbins are manually operated, so the user will have to move towards the dustbin to throw the waste. So, the existing dustbins are not user-friendly system because it only can be used by normal people and not for the person with disabilities.

It is also observed that most of the people do not use dustbin for littering because they are not interested to come near the dustbin. In the conventional system of the dustbin, most of the time people don't want to touch the lid of the dustbin because of its unhygienic nature. Moreover, there is no smart waste management system in the market which can separate the dry and wet waste.

These problems are overcome by smart waste management system where advance IOT based monitoring system is also incorporated which give instruction to the concerned authority in the convenient mode to remove the waste from the dustbin when the bin is completely full of waste..

IV. METHODOLOGY

Smart Dustbin using Arduino is an IOT based project. Here we are using Arduino for code execution, for sensing we used ultrasonic sensor which will open lid and wait for few moment. It will bring drastic changes in tern of cleanliness with the help of technology. Everything is getting with smart technology for the betterment of human being. So this help in maintaining the environment clean with the help of technology. It is a sensor based dustbin so it would be easy to access/use for any age group people.

1) *Smart Control and Movement:* Its movement will be controlled by Bluetooth controller app : Install Arduino Bluetooth controller app, pair the BT module of the bin, open the app and find the name as "HC-O5"(as we have used HC-O5 BT module), connect the BT module with the app, then use your mobile as a remote to control the bin. This helps when any aged people or handicapped people not able to reach towards the dustbin, but they can call forward the bin towards them.
2) Automatic lid opening when the system near to any user: After when the dustbin comes closer to the user, the ultrasonic sensor the measures the distance between the user and the bin, when the user is in the range the lid of the bin opens automatically.

➢ *Circuit Diagram:*

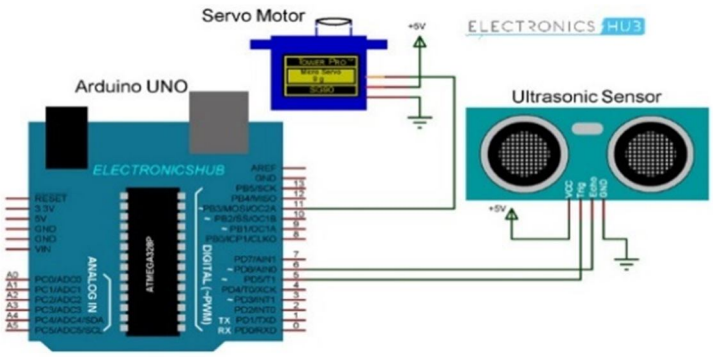


Fig1: Automatic Lid Opening

3) *Dry and wet waste segregation:* After opening of the lid, the user will be able to throw the waste into the bin. There is a mount board inside, on top of that aluminum foil has been introduced which will act as a moisture sensor which will be able to detect the presence of water in the waste or not! Then the board will be able to separate the dry/wet waste and pour it into its respective section inside.

4) *Level indicator shows the current status of the bin:* Inside the bin, two ultrasonic sensors are fitted under the mount board in two different sections (i.e., dry and wet). They will be able to detect the level of garbage separately (i.e., dry/wet waste). The respective ultrasonic sensors measure the distance of the garbage level inside the bin and the pair of LED indicators will glow and shows the waste level of the bin accordingly. There are 4 LEDs with different colour in each level indicator and the functions of each LED are illustrated below.



Fig 2: level Indicator

- *Circuit Diagram:*

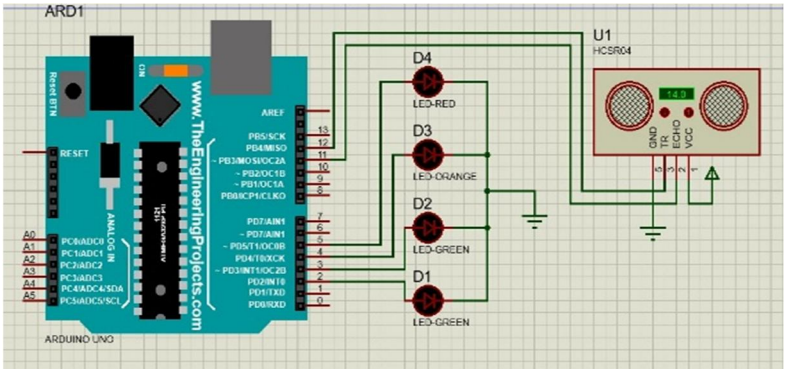


Fig 3: Level indicator connection

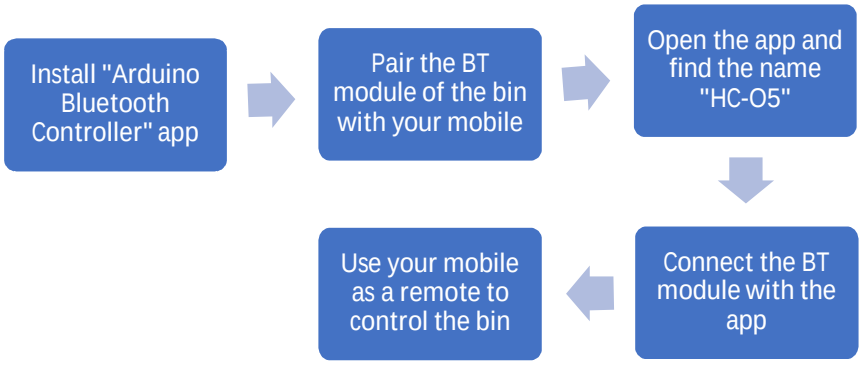
5) *Message alert system when the bin is full:* Now, when the Smartbin is totally full, a message will be sent (YOUR DUSTBIN IS FULL, PLEASE EMPTY IT) to user's mobile through GSM module which has been connected to the bin to alert the user that the bin is filled up completely and he/she has to empty it as soon as possible to further use it.

V. WORKING PRINCIPLE

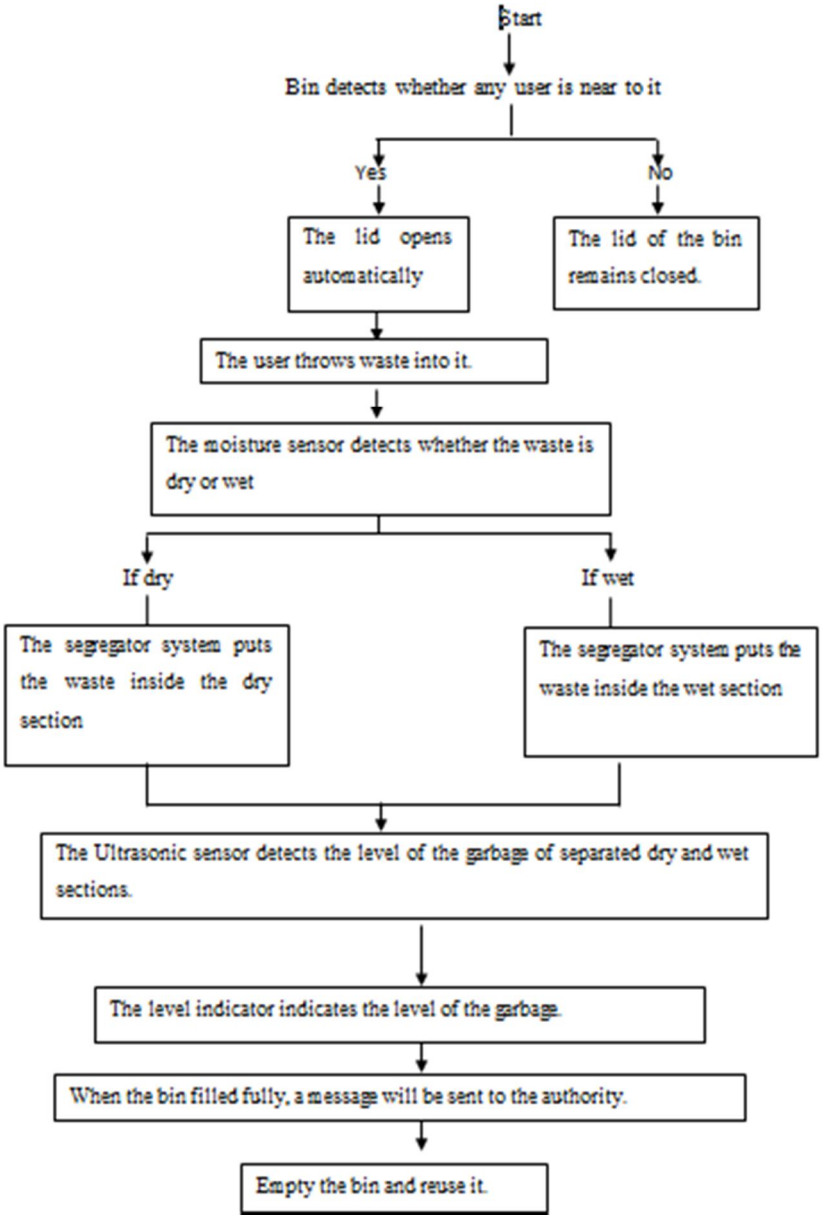
1) Smart control and movement of the bin
2) Automatic lid opening when the system is near to any user.
3) Dry and wet waste segregation.
4) Level indicator shows the current status of the bin.
5) A message sent to the authority's mobile when the bin is completely full by using GSM module

Flowchart

a) For Smart Controlling The Bin



b) For Smart Working Of The Bin



VI. CONCLUSION

This work successfully demonstrates the idea of managing the waste in a completely smart and unique manner. This Smartbin is highly reliable and cost effective. The all new Smartbin based on IOT will give a completely new vision to the human being towards managing the waste material. The environment with pollution free and hygiene will no longer be an obscure dream, but a reality in development of our country. This concept can be implemented at domestic purposes and small-scale cases like small parks, university campus, cafe and hospitals, inside the homes, offices etc. This Smartbin has its brightest of future even in the darkest post COVID-19 phase. The mixture of Indigenous idea along with world class facility will strengthen the foundation of ATMANIRBHAR BHARAT.

VII. FUTURE SCOPE

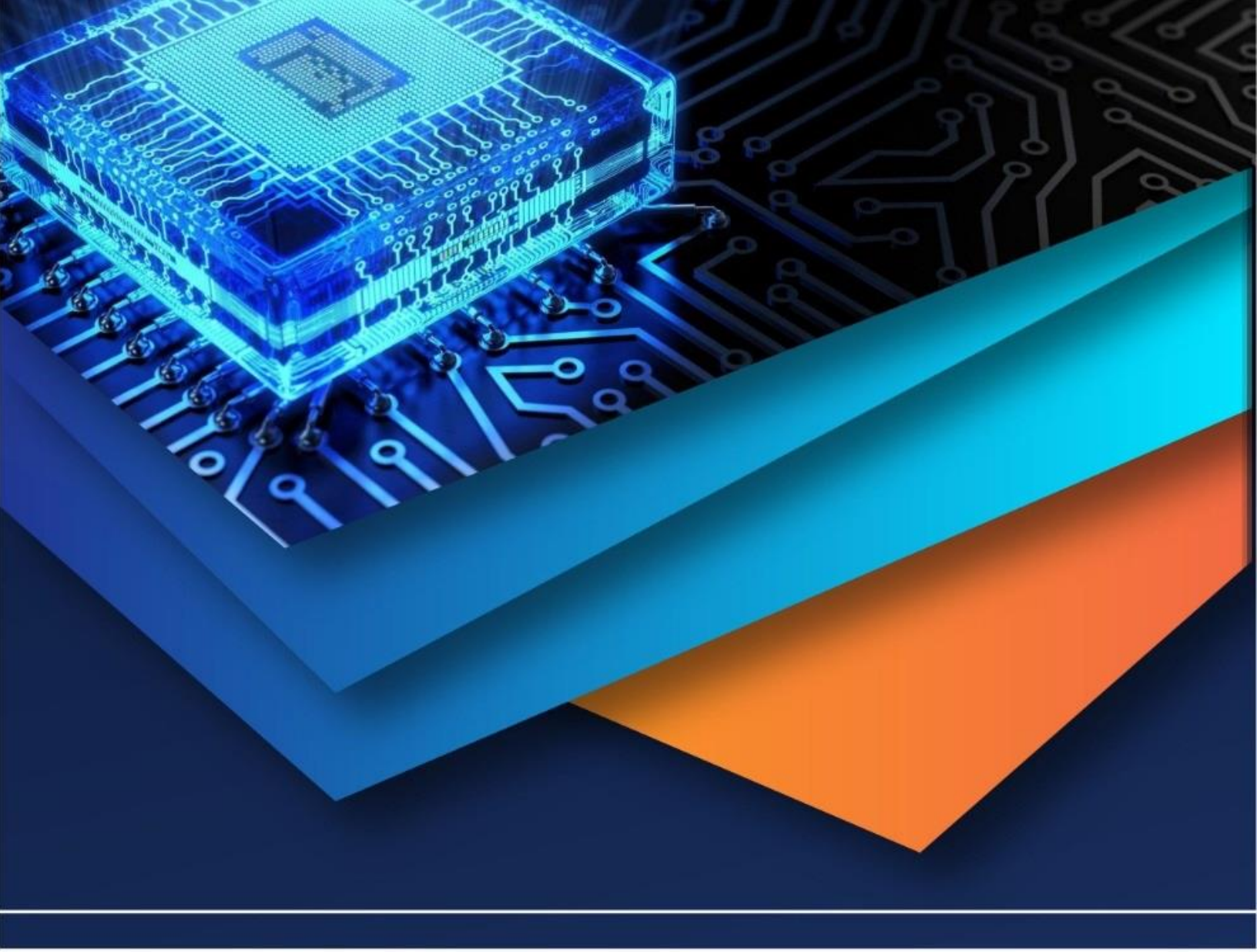
Further, to facilitate the mechanism and save more energy, automated segregating can be installed for bio-degradable and non-bio-degradable types of waste. Then we will introduce the compactor inside which will help to compact the waste, that creates more spaces inside the bin

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