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Smart Garbage Monitoring System

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SMART GARBAGE MONITORING SYSTEM

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Abstract* – *There has been a rapid growth in the pace of environmental development in the past few years and thus there is an immediate need of a well-planned and urbanization plans. Now, using new and emerging technology and sustainable approach, the concept of smart cities is gaining momentum all around the globe. And so a smart city would be incomplete without an intelligent waste management system. Also, the scenario of cleanliness with respect to garbage management is degrading tremendously. Proper waste management techniques are very crucial to control the garbage menace which has spread everywhere. The paper elucidates the application of our project "Smart Bin" in managing the garbage collection system of our surroundings. The idea of Smart Dustbin is for Colleges, buildings, schools, bus stands, parks, hospitals and other community areas. Smart bin is an improvement of a regular dustbin by raising it to be an intelligent product using logic and sensors. The smart dustbin is a novel and innovative idea of implementation which makes a regular dustbin intelligent using sensors for garbage level detection and its other physical parameters. The network of sensors enabled bin helps to provide an automatic open and close facility and the analysis of the data regarding the height of the waste-filled in the dustbin at a particular time along with reporting the physical condition of the bin such as temperature and moisture to identify whether the type of garbage disposed of is solid or wet. Audio will be played every time the lid of the bin is opened which create awareness among people regarding the concept of blue and green bins. The real-time analytics of the bin with show the conscious response of the people when they spill the trash into the bin. The paper also aims at promoting further insightful research on the topic.

Keywords – **Smart dustbin, logics, Sensors, waste management, Internet of Things(IOT), Analytics**

I. INTRODUCTION

1.1 Background

As the world is in a phase of development, there is one stinking quandary. We need to manage Garbage! In our day to day life, we see the photos of trash canisters being overfull and all the trash spills out. This prompts the quantity of infections as enormous number of dangerous insects and mosquitoes breed on it. A major challenge in the urban areas is the task of trash collection like in India and for the vast majority of other nations as well. Thus, a framework must be constructed which can annihilate this issue or at least reduce the menace caused by it. The model proposed in this project provides us one of the most proficient approaches to maintain our conditions healthy and green. The concept of smart city is still a novel concept in developing country like India, in spite of the fact that it has gotten a great deal of consideration in recent years when our Prime Minister gave the idea of constructing 100 smart urban cities. As the number of smart cities in the country goes up, the responsibilities accompanying them also increase. The primary need of a healthy and clean way of life starts with cleanliness and this in turn starts with a bin. The community will get its garbage disposed of properly only if the bins are arranged well and the garbage is gathered well. The main problem in the current waste administration framework is the unfortunate status of trash bins. In this paper,I have attempted to redesign the simple yet essential part of the urban waste administration framework, which is the dustbin.

The manual waste collection system has drawbacks like insufficient information regarding the time and place of collection. In such a scenario, the trucks might visit the place when the dustbin has not yet been filled. There is an absence of legitimate garbage monitoring framework to pursue all exercises of waste collection and disposal. This paper demonstrates powerful answer to deal with the garbage. This system is executed utilizing logics, sensors and microcontroller. The information related to every dustbin can be checked with the assistance of an app, website or other kinds of GUI. The sensors, microcontrollers and ESP8266 module ensures that the cleaning of dustbins is maintained by signaling the trash levels and henceforth acknowledge the individuals not to drop the waste outside of the trash bin. When they attempt to drop it out of the dustbin, the hand movements are sensed through motion detectors and an appropriate message to the user is displayed. This framework similarily detects the fake reports and henceforth can diminish the flaw in the regular execution of waste

management. This brings down the number of trips that a garbage van taken to collect the garbage. This process helps maintain the cleanliness in the surroundings and reduce the spread of diseases caused by garbage.

1.2 Statement of Problem

In the present days, in most of the Ethiopian urban areas there are numerous dustbins which are in terrible conditions. The dustbins are over flooded with garbage. Numerous individuals are tossing trash on those dustbins which are already full. Due to this unhealthy usage, poisonous and unhygienic gases which are awful for nature are released into the surroundings. This makes a city look terrible and contaminates the air.

1.3 Objective

1.3.1 General Objective

The prime goal of the model is to plan, design, create and execute automated waste monitoring framework.

1.3.2 Specific Objectives

1. To research on the works performed so far to screen the garbage.
2. Propose and develop a programmed waste monitoring system.
3.Simulate the structure utilizing Arduino UNO microcontroller.
4. Actualize the simulated model together with hardware and software.
5. Implement with computer programming specifications.

II. SYSTEM DESIGN

2.1 Block Diagram of the System

During the implementation, the transmitting part of the system is placed along with the smart bin while the recipient part is located at the IOT analytics web platform-Thinkspeak

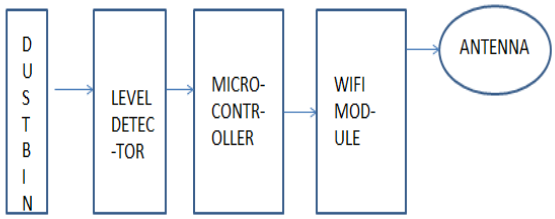

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Fig 1: Transmitter part of dustbin

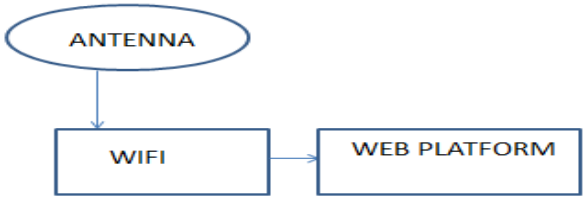

Fig 2: Reception of data on Thinkspeak

2.2 Requirement Specification

2.2.1 Components-

1. Microcontroller- Arduino UNO
2. LCD display
3.ESP8266
4.ISD1820 Audio module
5. Relimate Connector 4 Pin Connector
6. Battery 9V 1A
7..Jumper wires(MM,FM.FF)
8.Servo motor-9g
9.Breadboard, PCB
10. Ultrasonic Sensors/Distance sensors(2)
11. Soldering Iron,wire
12. Voltage regulator
13. Moisture Sensor
14. Temperature Sensor(RTD)

2.2.2 Simulation Tool-

Arduino IDE is an open source software to simulate the program. It is freely available on its home website. Anyone can download Arduino IDE from www.arduino.cc. It compiles the arduino program in it and then by using USB cable we can dump program to arduino connected to arduino

2.2.3 Analytics Tool-

ThingSpeak is Internet of Things application and API to store and retrieve data from hardware and show results. LCD was used as GUI to display the result on dustbin.

III. METHODOLOGY

3.1 Circuit Diagram

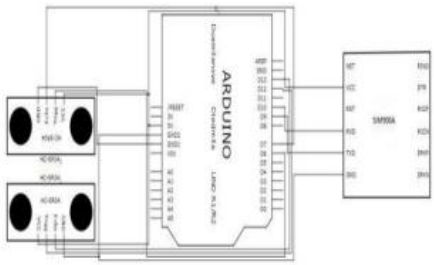

Fig 3: Circuit Diagram as per Description

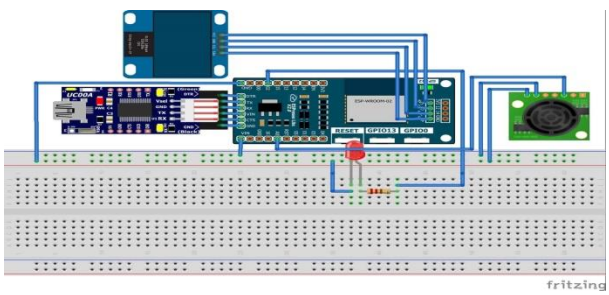

Fig 4: Sensors integration to Arduino

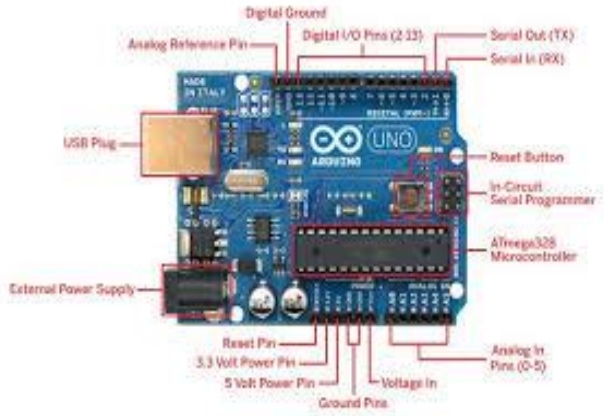

Fig 5: Description of the pins of Arduino for connection

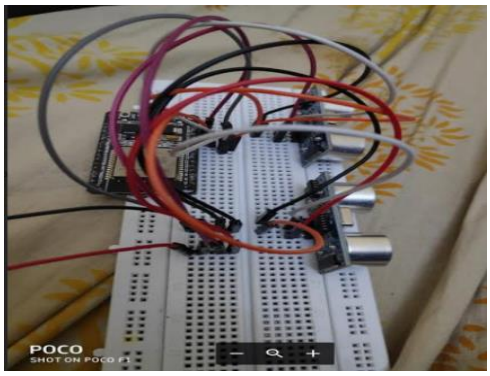

Fig 6: Circuit connection of Hardware

The circuit diagram shows the Smart Dustbin connection. It consists of hardware Components as listed under the requirements section. The Arduino is used as a micro-controller. One ultrasonic sensor detects the level of the dustbin. One ultrasonic sensor detects the presence of a human at a distance which helps in automatic open/close of the dustbin using servo motor. If any of the sensors don't detect the level then it doesn't send the information to the cloud. The moisture sensor is been used to find the status of moisture content in the dustbin. The temperature sensor is been used to find the temperature inside the dustbin. This helps to analyse whether the trash disposed of in the bin is dry or wet. This will further help in easy waste segregation by the authorities. To increase awareness among the people about the concept of blue and green bins, the audio will be played every time the lid of the bin is opened. The audio instructs the people about the type of bin they are using so that they contribute in keeping the surroundings clean. This is a strategic approach to promote the concept of using intelligent bin among people. Thinkspeak is the real-time IOT analytics virtual cloud that shows the track and information of the bins at every time interval. The LCD display is integrated into the bin to show the real-time data of the bin. Audio is been played when the ultrasonic sensor detects the presence on a person near dustbin and plays audio as well as open and closes the bin. A time interval is set to keep the bin open. When the level is detected by both the ultrasonic sensor then it sends the signal to the Arduino Controller for further process. As the Signal is received by Arduino then it activates ESP8266 which is the wifi module. As esp8266 is activated then it sends the data regarding the level of waste in the bin to the cloud for the Municipal Council. Then the authority will send a van by informing the van driver to replace the fully filled dustbin by a blank dustbin. When the blank dustbin is kept at that place then it's utilized by the general people go through the waste in that dustbin.

3.2 Implementation

The hardware components are gathered as per their specifications.Then they are tested using led bulb. The connections are made to the micro-controller as per the circuit diagram. The code is written for the functionalities of each hardware component for their interfacing with the controller. Arduino IDE is used as the simulating tool to debug and run the code. If the code works perfectly then it is uploaded to the controller. The username and password of the wifi is been set for the particular project to integrate the bin to the cloud. Arduino IDE is an open source software that is mainly used for writing, uploading and compiling the c++ code into the Arduino Module. It is readily available for operating systems like Windows, MAC and Linux. It runs on the Java Platform which comes with numerous inbuilt functions,declarations and commands and play a crucial role for editing, debugging and compiling the code. The environment allows both C and C++ coding languages.

Setup an account on Thinkspeak and create channel.Include the unique key along with the code to integrate the project with thinkspeak cloud. The ultrasonic sensor detects the level by calculating the distance. The distance is calculated when the transmitter transmits the pulse and receiver receive the signal and calculate the time period. Then the distance is calculated by using formula as below.

Speed = Distance/Time

The ultrasonic transmit the signal with the speed of 340 m/s. Now, Supply 5-7V power to the circuit. Once the system is set ON, Arduino starts identifying for any object near the distance Sensor. If the distance Sensor identifies any object like a foot or hand for example, Arduino will calculate its distance and if it less than or equal to a certain predefined entered value, it will signal the Servo Motor and with the help of the extended arm, it will instruct the lid to open. After certain pre-defined time, the lid will automatically be closed. In the moisture and temperature sensor, all the data will be sent to the cloud at every instance of time and a graph will be traced out to show the statistics of the bin. Using audio module to create awareness among the people

Fig 7: Final Hardware design of the Project

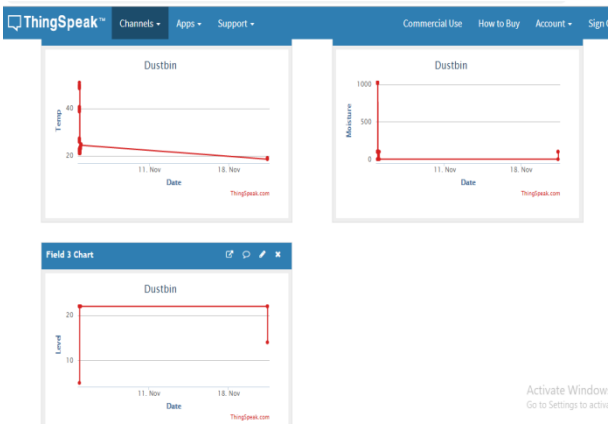

Fig 8: Real time data display on cloud

IV. RESULTS

This research work is secured categorizing waste, systematic disposal, careful and timely collection and successful recycling. It is an interrelated arrangement for the current garbage disposal issue. Microcontroller based intelligent dustbin defeats the problems related to the currently existing waste management system. It will help to designate a relative set of intelligent dustbins to a defined number of households on account to their encountered waste amount. The dustbin will be automated using a servo motor. The dustbin will be opened only when the user is administered in the range specified in the code of distance sensor The dustbin will stay open till some pre-defined time value and then close automatically. Other ultrasonic sensor sends the data of the garbage level to Thinkspeak and is also reported on the bin using LCD display. An audio message played during the time lid opens will help encourage the use of blue and green bins. The physical conditions of the bin are mapped on the analytics platform. This data is then carefully studied to draw insightful conclusions and suggest the further scope of improvement.

V. CONCLUSION

The Smart Dustbin designed is an optimal solution to monitor and manage the trash in a productive way. As the inefficient garbage management is due to a lack of proper strategy to monitor garbage and collect them in a viable time plan , the framework designed will impact the individuals to intelligently manage their waste. At the end of the project, it can be concluded that the proposed design is

1. Cost-effective
2. Smart, efficient and reliable
3. Approximately 85% accurate
4. Consumes less power
5. Eco-friendly

VI. FUTURE SCOPE

1. Water proof circuit design
2. Real time data analytics
3. AR for view of the garbage inside the bin
4. Temperature, Humidity etc. measurement
5. Smart waste segregation into dry and wet

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