

Automatic Waste Management and Segregation System using IoT

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Abstract-This system is developed to overcome the challenges, barriers and to provide an opportunity for improvements in waste management and segregation system. The Automatic waste management and segregation system use the concept of IoT, where the proposed system is placed all over the cities, with an embedded system to segregate and monitor the level of the bin. The status of bins is sent to concerned authorities to evacuate the bins and the locations of bins are traced via the internet. This system reduces human intervention, interaction and also reduces the consumption of time and cost.

Keywords-IR sensor, MQ sensor, Dry wet sensor, Arduino Uno, Node MCU, Bin.

I. INTRODUCTION

In the current situation, India is facing various challenges in the environment by the waste generated such as improper waste collection, treatment, transport, disposal. The most difficult challenge is from its inception to its disposal. Due to the increasing urban population, our country cannot survive the current system which results in environmental and public health pollution.

Waste can be solid or liquid and each type of waste will have different methods of disposal. Waste will be a threat to human health. Proper management of waste is necessary and important to have a healthy lifestyle. An unhygienic environment will be created if flooding of the dustbins happens every day. Waste segregation i.e., separation of dry and wet waste is also important. Segregation of waste helps in the reduction of the amount of waste that gets landfilled and also reduces air and water pollution. If we segregate the waste, it is easy to dispose of compared to mixed waste.

This application helps in managing and segregating waste. Dustbins are placed in the entire city; it is delivered with minimum cost embedded method to assist in tracking of the garbage bins. Once the bin is filled and reached its maximum level an SMS text is sent to the municipal corporation. Then instant action will be taken by the respective authorities once the status of the bin will be notified through the Internet. This system which is proposed is developed by using ultrasonic sensors, node MUC, servo motor.

II. LITERATURE SURVEY

Padmakshi Venkateshwara Rao, Pathan Mahammed Abdul Azeez, 2020[1] introduces the "IoT based Waste Management for Smart Cities" to overcome the challenges in the environment such as inadequate waste collection, treatment, disposal. Due to flooding of the dustbin causes unhygienic conditions are created, the dustbin is placed in the entire city; it is delivered with minimum cost embedded method to assist in tracking of the garbage, therefore the "Blynk app" is used to get the immediate SMS as early as garbage bin reaches its

peak level. Therefore, instant action will be taken by the alarmed authorities once the status of a bin is notified through the internet. Ultrasonic sensor, node MCU, blynk app, a servo motor is used to develop the proposed system.

Nikolaos Baras, Dimitris Ziouziou, 2020[2] introduces "A cloud-based smart recycling bin for in-house waste classification" urban waste increases as long as modern lifestyle increases. Recycling is the best way to create a sustainable environment and also it needs the segregation of waste materials which is a tedious time-consuming task. It is the minimal cost and effective smart recycling bin that uses the power of the cloud in order with waste classification in personal in-house usage. A centralized Information System collects measurements in smart dustbins, the waste in each bin can be classified using Artificial Intelligence and also neural networks. And it is capable of classifying different types of waste with an accuracy of 93.4%.

Shashank Shetty, Sanket Salvi, 2020[3] This introduces the SAF-Sutra: "A Prototype of Remote Smart waste segregation and garbage level monitoring system", which can remotely monitor and is built at a very minimal cost. The design of the presented system considers the portability and ease of assembly of components as the essential factors during implementations. The demonstration shows the implemented system; its interaction with the user using the mobile along with the web application.

Clude-Noel Tamakloe, Dr. Elena v. Rosca, Introduces the Smart System and the Internet of Things (IoT) for waste management to provide an efficient and effective manner for waste disposal, improving the city's waste management. The proposed system is drawn and makeup a prototype of a solar powered, compact smart garbage bin whose monitoring is done with server side applications. The smart garbage bin is capable of monitoring internal garbage levels, compact them, and also free 25% of the space with each compactness. The bin detects and monitors the total weight and is capable of sending all the information to a secure server side application.

Rania Rizki Arinta, Dominikus Boli Watomakin, 2020[5] introduces the "Improves smart waste management to preserve tourist's attractions Yogyakarta in IoT environment", the main agenda is to make waste recycled, if it is not recycled, it will make the decomposition process more tedious. Therefore, the dustbin is integrated with the smartphone to find out information about the capacity of the garbage by using the ultrasonic sensor. The wi-fi module combined with the dustbin allows the sensor to send the data through the wi-fi module via smartphone.

Chethan Kaushal, Anshu Singha, 2020[6] introduce the Architecture for garbage monitoring systems using integrated technology, proposed the novel architecture of waste

management that utilizes the concept of IoT and digital image processing, the architecture acts as a surveillance system to monitor the over the flow of the garbage and delivers the message to the concerned authorities to take the necessary and instant action.

III. METHODOLOGY

In this proposed system, the two bins were used to store dry and wet waste, these bins are replaceable for cleaning purposes. The waste is placed on the dry wet sensor. The dry-wet sensor is set with a threshold value of moisture. This senses the moisture content; the relay helps in the rotation of the servo motor in both clockwise and anticlockwise directions hence it moves waste into its respective bins. The IR sensors are used to know the level of the garbage in the bin and intimate the message to the municipality. The MQ sensor is used to detect the odor and the concentration of different gases. All the sensed data from Arduino UNO using sensors are sent to the cloud using node MCU. The program would be coded in embedded C. Thus, messages will be displayed to the users in the LCD, and obtained status will be notified to the authorized people via MQTT protocol for sending bin status.

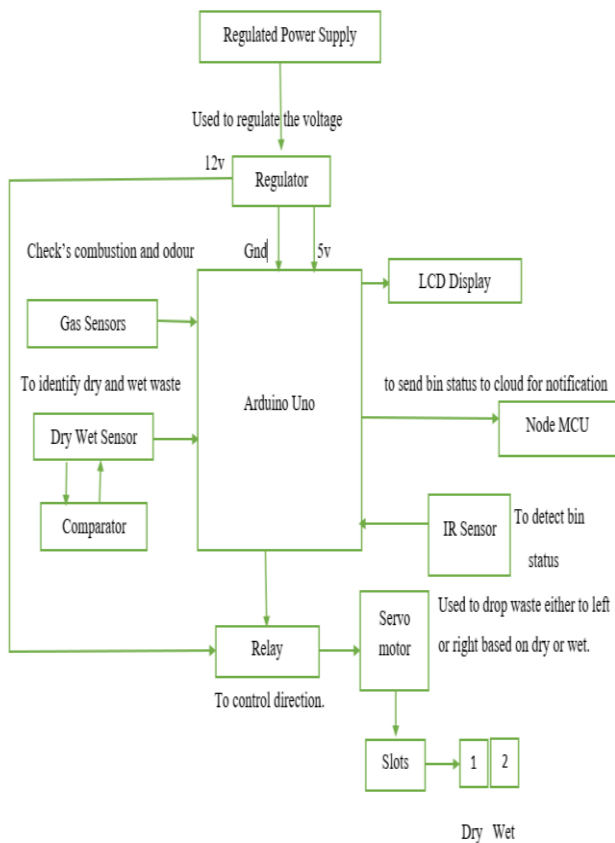


Fig1. Block diagram of proposed work

The below figure depicts the flow of our project where we initially initialize the library functions, declaration of the pin has to be done, we have assigned the pre-set values to sensors. We have to check if the button is pressed if yes it proceeds to the next step, else it will halt the process. The system will check for moisture content of waste then it will segregate waste into dry or wet waste based on previously set values. If the bin is filled then the message will be sent to

the department for collection of garbage, then the bin will be emptied. Else the above process repeats.

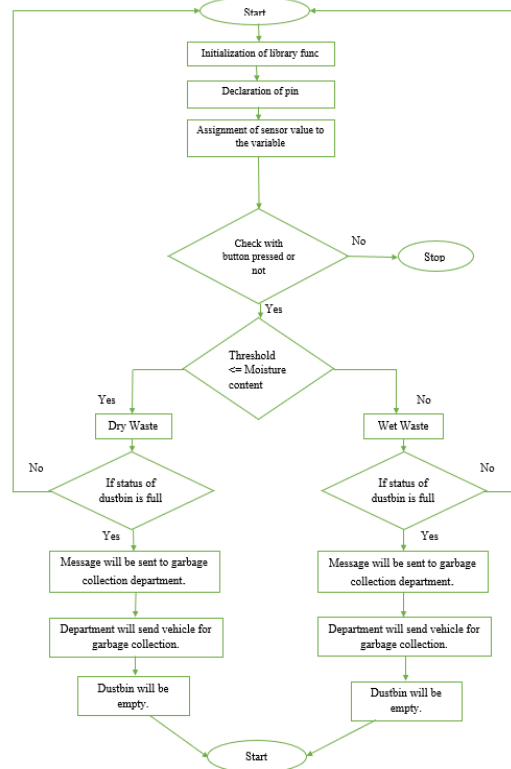


Fig.2. Flow chart of the proposed system

IV. WORKING PRINCIPLE

- In our proposed system, it contains two bins for the storage of wastes. Initially, the waste has to be placed on the dry-wet moisture sensor.
- It senses the moisture content of waste using the dielectric permittivity of the medium which is a function of water content. Then it displays in the LCD to the user whether this detected waste is dry or wet based on a previously set threshold value.
- With the help of relay and Servo motor, the wastes are moved into their respective bins. The IR sensors in both bins are used to detect the amount of garbage inside it.
- If the bins are filled then messages are sent to the municipality to evacuate the bin at the earliest and in LCD the message will be displayed to the user that the bin is filled.
- The MQ sensor and flame sensors are used to check the odor and combustion in wet and dry bins respectively.
- If any odor or combustible substance is detected it sends a message to the municipality based on the concentration of the gases present.
- Thus, the status of bins is sent to the cloud via MQTT protocol which can be accessed by the municipality.

V. SYSTEM REQUIREMENTS

1. Arduino Uno

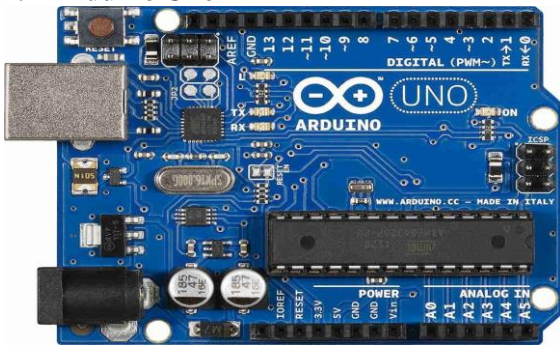


Fig.3. Arduino Uno

The Arduino Uno is an open-source microcontroller. The board is provided with digital and analog I/O pin sets. It contains fourteen digital I/O pins in which 6 of PWM output, Six analog I/O pins, and is programmable with the Arduino Uno. It might be turned on with the help of a USB cable or with help of external 9 volt battery, it can accept voltage from 7 to 20 volt.

2. Infrared sensor



Fig.4. IR Sensor

An infrared sensor emits to sense the surroundings. It is used to detect the amount of waste in each dustbin. Thus, it helps in preventing overflow of bins.

3. MQ sensor



Fig.5. MQ sensor

The MQ sensor gas sensor is a highly sensitive sensor used to detect gases like ammonia, smoke, sulphur, and other harmful gases. It used to detect toxic substance and explosive gasses and measure gas concentration. Here it is used to detect the odour of waste and sends an SMS to municipal department if there is strong concentration of odour. Hence helps to have good environmental condition.

4. NodeMCU



Fig.6. NodeMCU

NodeMCU is an integrated chip that provides full internet connectivity to the embedded circuit in which it is present. It is mapped through the USB port using Arduino IDE. It contains 30 pins of which 9 pins are digital pins while 1 pin is an analog pin. It is a tool that works on Wi-Fi networking. It has low power consumption. In this project, it has been employed as the main microcontroller owing to its inbuilt Wi-Fi connecting capacity which can be exploited to transmit real-time monitored sensor data to web and mobile interfaces.

5. Dry wet sensor

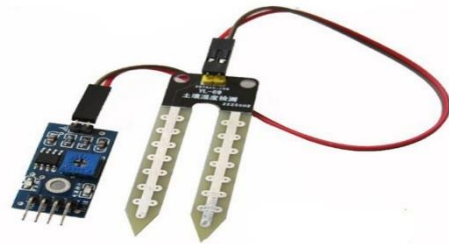


Fig.7. Dry wet sensor

The moisture sensor has been used to detect the type of waste being placed on it. Here the sensor classifies the waste into dry and wet based on the moisture content on it.; if the moisture content is above a preset threshold value, then the waste is declared as wet waste else it is declared as dry waste.

6. Servo motor

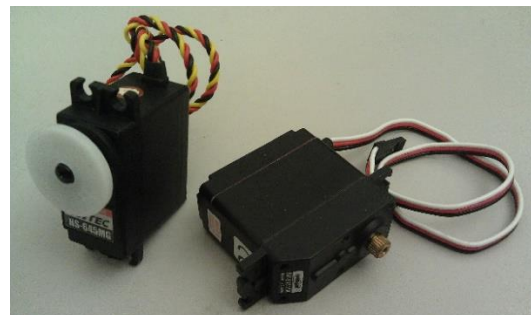


Fig.8. Servo motor

A servomotor is an electric motor. It is controlled with the help of servomechanism. A servo motor is an electrical device, that spins the parts of a machine with high efficiency and with great precision. In our project servo motor moves both bidirectional clockwise and anticlockwise at an appropriate angle to dispose of the trash at a particular place.

7. SOFTWARE REQUIREMENTS

- Framework open c.
- The programming language Python 3.7
- IDE: Python Idle
- MySQL

VI. ADVANTAGES

- This system keeps our surroundings free, clean, and green from the odor of trashes supports good environmental conditions, and keeps towns more beautiful.
- It also helps to reduce the requirement of manpower to manage the waste collection process.
- Due to direct message transformation between smart segregation system and municipal department the traffic flow on the road reduces.
- The automatic waste segregation process also helps to reduce the health issues and work stress of workers who manually segregate the wastes.
- It also plays a major role in the reduction of environmental pollution.

VII. DISADVANTAGES

- The system requires a greater number of garbage bins for separate waste collection as per the population in the city. This results in a high initial cost.
- The sensor nodes used in the dust bins will have limited memory size.
- It is an automatic system there is no human requirement which results in unemployment.

VIII. RESULTS AND DISCUSSION

- This project can be used in our day-to-day life, which will be able to segregate the dry and wet waste.
- This system monitors the status of the bin and intimates it to the municipality.
- It avoids overflow of bins which in turn reduces the environmental pollution and hazards to human health.
- It enables the wireless transmission of data and its data can be accessed anywhere at any time.

The proposed system can be implemented everywhere in the cities and also in urban areas to which pollution free and creates an environmentfriendly atmosphere which helps to lead healthy, hazardous free life. It saves the life of the people without causing hazards to life by avoiding the overflow of bins.

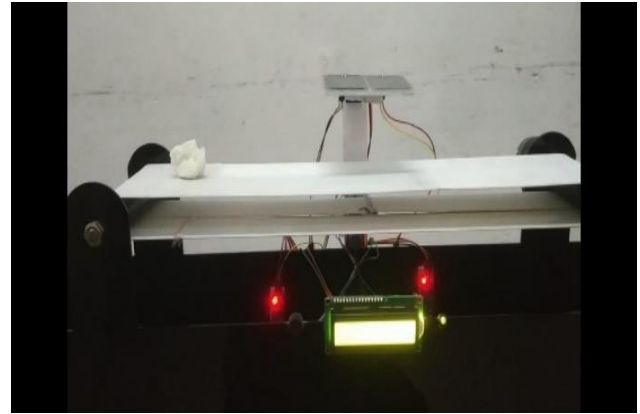


Fig.9. The proposed system



Fig.10. Rare view of Proposed system



Fig.11. Message displayed to place waste near container.



Fig.12. Message displayed to replace the bin as the dry bin is filled.



Fig.13. Message displayed that waste detected is wet in condition.

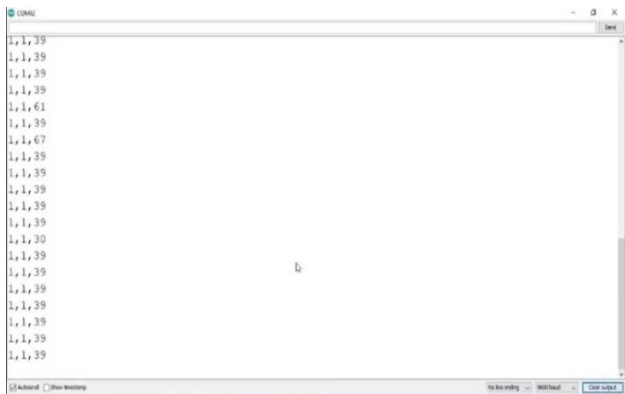


Fig.14. Message sent to cloud.

In the above fig.14, The messages can be displayed in both numerical and alphabetical manner as required by an authorized user. Here '1' indicates some more waste can be dumped into the bin and '0' indicates that the bin is filled. Third column values indicate the value of MQ sensor, the first column refers to dry and second column refers to wet bin garbage levels, whereas columns can interchange as required.

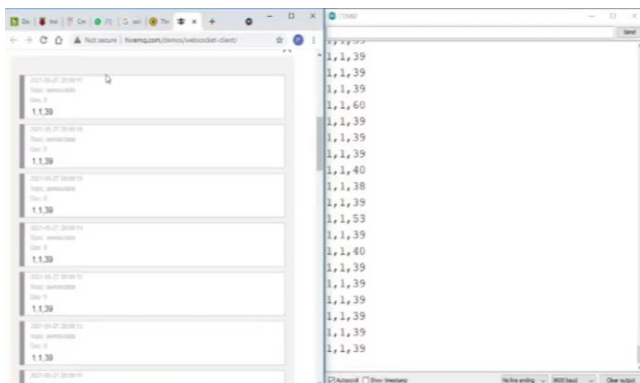


Fig.15. Message obtained at the authorized end.

IX. CONCLUSION

This paper enhances the cleanliness of the smart cities by the practical application of “Automatic waste management and segregation system using IOT”. With urbanization and increasing population, disposal of waste is a major concern. This proposed system is an effective waste segregation system that has no human intervention or interference to separate dry and wet waste. It provides timely collection and disposal. The proposed system can be deployed on a domestic scale in a household or a large scale in public places.

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