# IoT BASED FOOD WASTE MONITORING AND CONTROLLING SYSTEM

**Jeyanthi S[1], Arun Kumar A[2], Muthu Rani M M[3], Rohini M I[4], Divya Jeyashree V[5]**

[1,2]Assistant Professor, Department of EEE, Ramco Institute of Technology, Rajapalayam, Tamilnadu, India

[3,4,5]UG Student, Department of EEE, Ramco Institute of Technology, Rajapalayam, Tamilnadu, India

Email: jeyanthi@ritrjpm.ac.in

DOI: 10.47750/pnr.2023.14.03.073

## Abstract

Food waste is a common issue at several places such as colleges, schools and workplaces these days. It is estimated that the world population hits 9 billion by 2050 however lesser attention is given for wastage of food in many countries. This result in high demand for the food in future. The main objective of our work is to analyse and reduce the food waste. The proposed system finds a solution to reduce the food waste problem. A new approach is developed where the main focus is on measuring the food waste and recommending the competent authorities to change the menu according to the report generated by the food waste monitoring system. A display is placed in the system where every individual's real time food waste is displayed and the same is communicated through a message to the admin about the wastage of food. The data of food wastage is also saved in cloud for future reference. The proposed model creates a parallel result to give a detailed report to the management and the admin about the amount of excess food each time. The result of the proposed system will reduce the amount of food being cooked the next time. By incorporating Internet of Things (IoT) the food wastage date will be stored and transferred automatically at every instant. RFID (Radio Frequency Identification) sensor is used to monitor the wastage of individuals. Dustbins are opened only after the scanning of RFID tag provided to every individual.

**Keywords:** Internet of Things, IoT Gateway, microcontroller, SMS.

## I. INTRODUCTION

T In India, the private sector grew swiftly as a result of the adoption of a mixed economy, causing rapid urbanisation. The percentage of people living in cities was 11.4% in 1901, 28.53 percentage in 2001, and 31.16 percentage in 2011. By 2030, the World Bank predicts that more than 40% of the country's population would be living in cities [1]. According to a 2017 study in the Times of India, India's metropolitan population generates a staggering 62 million tonnes of rubbish each year. Only around 22 to 28 percentage of this trash is processed, while the remainder is left to rot. This pollutes the air, hurts the environment, causes a slew of fatal diseases, and slows economic growth. The primary challenge that India is currently grappling with is 'waste management.' Solid trash and liquid waste are the two types of waste, both of which are destructive [2-3]. The three main sources of liquid waste are residential regions, industrial areas, and commercial sectors. Contaminated industrial water, home garbage, and so on is examples. Solid trash consists of objects such as metal and tin scarps, food waste, and old furniture, among other things.

In India, workers remove rubbish from bins every two to three days, but if the dustbins are full with dust, there are no options for cleaning them. It causes garbage overflow, resulting in an unsanitary atmosphere and the spread of various diseases. It is the result of the government's lack of ability to inspect whether the dustbin is full or not before the scheduled waste collection day. This current model or strategy of rubbish collection does not work well when the population grows at a rapid rate.

The main purpose of this essay is to design a prototype for future bins in which the contents can be recycled. The status of bins based on their depth is transmitted to officials once they are full, as well as to make the bin lids open and close automatically when people arrive, improving the hygiene of the surrounding areas. IoT device ESP 32 system [4,5] for monitoring and controlling of the food waste. RFID sensor and ultrasonic sensor [6] is used to monitor and measure the food wastage of individuals. The measure data is securely transferred via the internet.

## II. METHODOLOGY

The following section deals with methodology of our system. The figure 1 shows our basic block diagram. It consists of sensor, display device and power source.

A. Block diagram

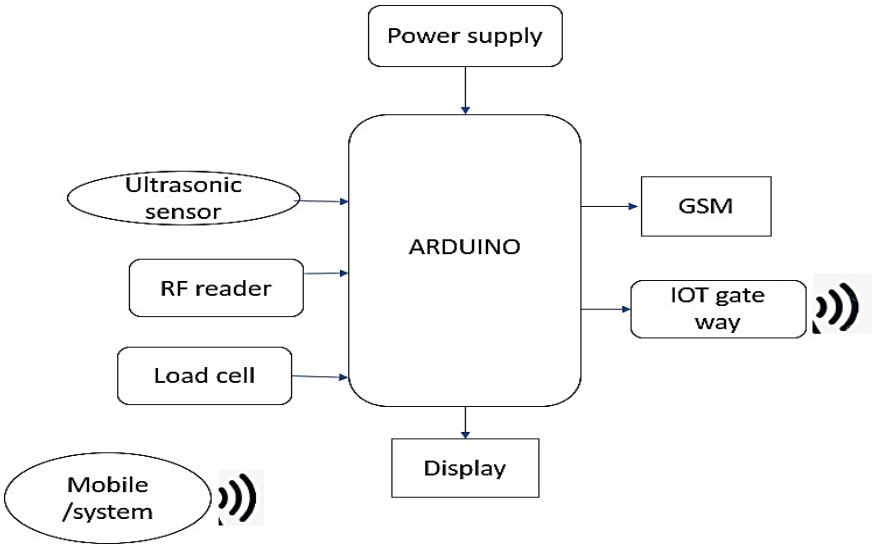


Figure 1. Block Diagram

The Ultrasonic sensors will gather the data and send it to the microcontroller. The microcontroller will send the received data to the cloud and process the data. With the processed data, the decision is taken and suitable information is displayed.

B. Components

The Arduino mega microcontroller is used along with Ultrasonic sensor, RFID Reader, GSM, Load Cell and NodeMCU ESP32.


Figure 2. Arduino Mega

Figure 2 shows image of Arduino. It has 54 Digital Input/Output (I/O) pins and 16 Analog I/O pins. It is programmed using Arduino IDE and by 5V DC supply.

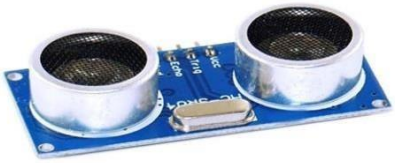

Figure 3. Ultrasonic Sensor

The Ultrasonic sensor is shown in figure 3. When the ultrasonic transmitter was turned on, it sends a single ultrasonic wave in one direction and begins timing. When it struck impediments in its path, ultrasonic dispersed across the air and returned quickly. The sensor's distance from the target item is calculated. In a simple-to-use design, it provides outstanding non-contact range detection with high accuracy and reliable readings. The operation of the device is unaffected by sunshine or dark materials. The sensor is powered by a 5V DC supply voltage. The sensor's trig and echo pins are connected to the controller to give digital input.


Figure 4. RFID Reader/Writer Module

Figure 4 shows that the RFID readers are network-connected devices that can be portable or fixed. It transmits signals that activate the tag via radio waves. When activated, the tag sends a wave back to the antenna, which converts it into data. The RFID tag contains the transponder. RFID tag read range varies depending on factors such as tag type, reader type, RFID frequency, and interference in the surrounding environment or from other RFID tags and readers. Each member has to scan the given RFID card and name of the student and the amount of waste will be displayed in LCD and the data will be stored in the cloud.

Figure 5. GSM

Figure 5 shows that GSM is a type of digital cellular technology that is used to transmit mobile voice and data services. It transmits signals using the narrowband Time Division Multiple Access (TDMA) technique. GSM is a circuit-switched system in which each 200 kHz channel is divided into eight 25 kHz time slots. In most parts of the world, GSM operates on the mobile communication bands 900 MHz and 1800 MHz. GSM sends message to the admin when the dustbin is full.

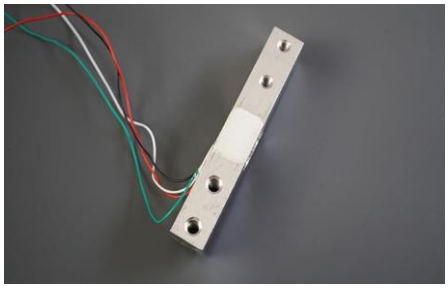

Figure 6. Load Cell

Figure 6 shows that a load cell is a sensor or transducer that converts an applied load or force into an electronic signal. Depending on the type of load cell and circuitry used, this electronic signal can be a voltage change, a current change, or a frequency change. Each member's food waste is detected by the load cell and is displayed in the LCD. Analog to digital converter is connected to the load cell to display the data digitally.

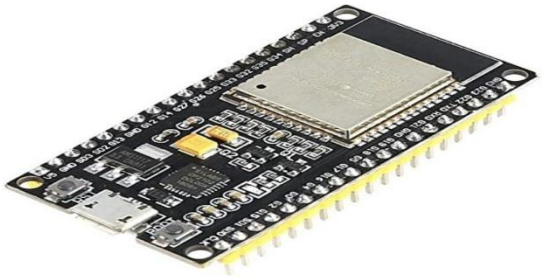

Figure 7. ESP32

Figure 7 shows that an intelligent central hub for IoT devices is an IoT gateway. IoT gateways connect Internet of Things devices to one another and to the cloud, translating communication and filtering data into useful information. The data like student name, their individual waste and total waste are stored for analysis of amount of waste collected.

### C. Operation

A method to track each individual's food waste is implemented. The organization can develop strategies based on data from each individual's food waste. Each user is given with individual RFID card. The Ultrasonic sensor is placed at the top of the bin it measures the level of the bin. Once the garbage can full it sends the message to the Mess Supervisor through GSM so that they are able to come and collect the wastage at the garbage can once it's full. The student scans the RFID tag in front of the system and place their food wasted in the garbage can. The load cell placed under the garbage can measures the weight of the individual student waste and displays it through LCD. The LCD display shows the student name and their individual waste and the total waste of the bin. From the load cell data's are transmitted to the cloud server by Node MCU. The cloud used here is the IoT Logs. In the cloud data's are updated frequently and the admin can able to view the student's individual waste and the dustbin status anytime. From that they can warn the students who waste more periodically. We can analyse the waste for a two to three weeks from the data we obtain from the cloud for example if Mondays of the two week we got same amount of waste continuously then there may be a problem in food menu.

## III. RESULTS AND OUTPUT

The output is shown below in the following images. The figure 8 illustrates the proposed system and it consists of RC522 RFID Reader/Writer Module, Arduino UNO and Ultrasonic sensor, Node Mcu, Load cell, LCD display, HX711 amplifier, GSM and Cloud (IoTGateway).

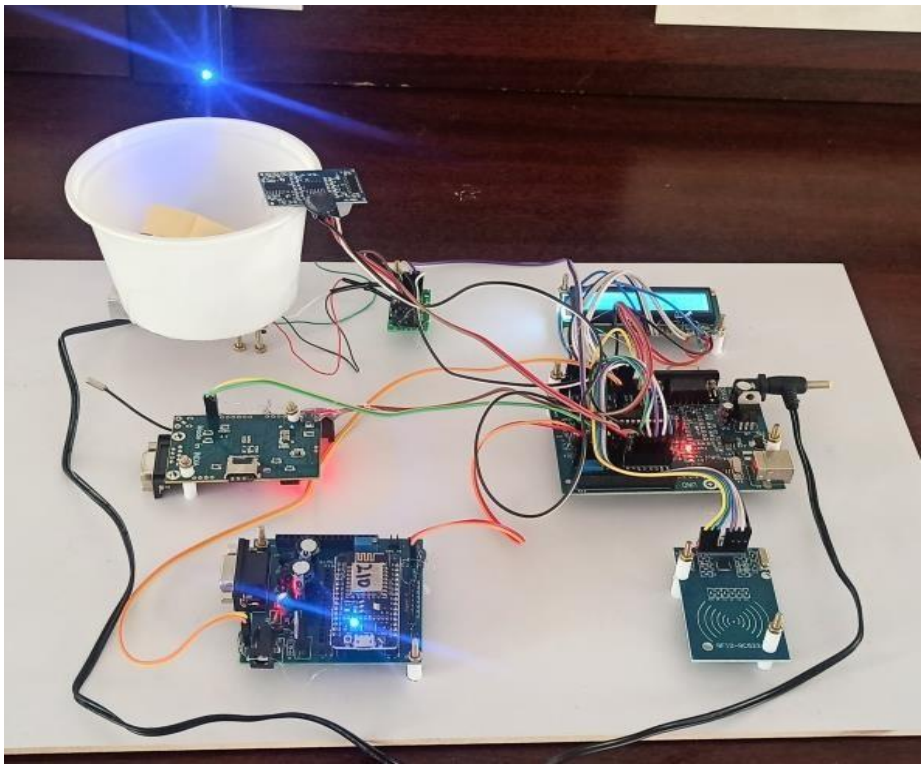

Figure 8. Overall implementation


Figure 8.1. Scanning of RFID card


Figure 8.2. Waste display in LCD

Figure 8.1 represents that when a student scans the RFID card the system gets processed the name of the student and a tag place waste will be displayed in the LCD display. Figure 8.2 displays the student name and the amount they have wasted in milligram. The total waste is also displayed in the LCD display. Here S1t denotes student 1 and the amount they have wasted in milligrams (1469.00 mg). The OT denotes the total waste of the bin (1469 waste).

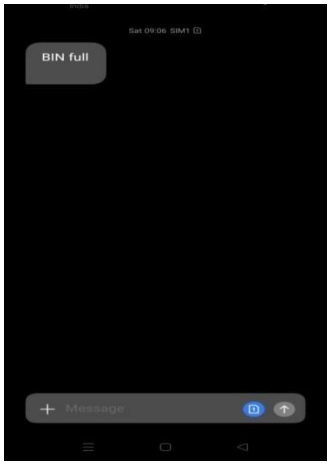


Figure 8.3. SMS Notification

Once the dustbin is filled a message will be sent to the mess supervisor that the bin is full. The message displayed after the full bin is represented in figure 8.3.

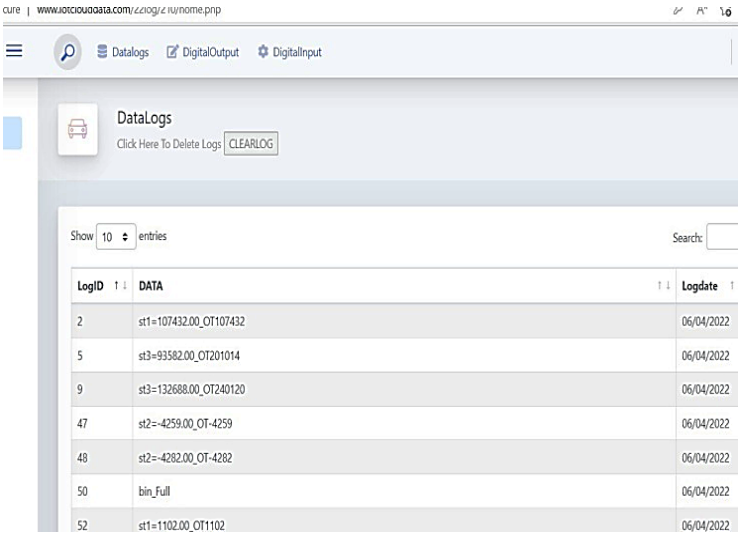


Figure 8.4. Cloud Data

The data that we get from the waste in the dustbin will be stored in the cloud (IoT Gateway) for future reference and to record the amount of waste wasted by the student. There is an admin login in that admin can enter the log in id and password from that the admin can see the every individual waste and the total waste of the bin as well as the bin status anytime. The first line

is the student individual waste as st1=107432.00 mg and OT as total waste of the bin.

## IV. CONCLUSION

The smart bin monitors the amount of rubbish in the bins to determine whether they are full or not. The information about the dustbin can be accessible by the user/authorities from anywhere in this system. When dustbin levels reach a certain level, the condition details of the bin will be kept in a database and this system will reduce the cleaner's monitoring system for checking garbage levels, resulting in a reduction in solid waste. The amount of waste deposited by an individual can also be tracked using this system. This keeps a detailed record of the user's information. The RFID cards are used to gain entry to the container. This saves a lot of time and effort on the part of the user.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the management of Ramco Institute of Technology, Rajapalayam, Tamilnadu for their constant support and encouragement during this research.

## REFERENCES

1. Soujanya V. Kivadanavar. A Novel Approach to Food Waste Management. International Journal of Scientific Research in Science and Technology (IJSRST), Volume 3, Issue 6, Print ISSN: 2395-6011, Online ISSN: 2395-602X.
2. Tejashree Kadus, Pawankumar Nirmal, and Kartikee Kulkarni. Smart Waste Management System using IOT. International Journal of Engineering Research and vol. V9, no. 04, May 2020.
3. Hong, S. Park, B. Lee, J. Lee, D. Jeong, and S. Park. IoT-based smart garbage system for efficient food waste management. The Scientific World Journal, vol.2014, Article ID 646953, 13 pages, 2014.
4. R. Jai Ganesh, A. Arun Kumar, B. Devisri, P. Pragadeesh, N. Srivathsan. IoT based Covid Patient health monitor during self-quarantine. Turkish Online Journal of Qualitative Inquiry (TOJQI) Volume 12, Issue 6, July, 2021: 7750-7762.
5. Daniel Gold Sam C, Mohamedabdulazeez M, Mithinesh S, Jeyanthi S. Air and Water Quality Monitoring System. International Journal of Scientific Research in Science and Technology (IJSRST), Volume 9, Issue 1, March-April 2021, Print ISSN: 2395-6011, Online ISSN: 2395-602X.
6. Pranav Kaarthick. R, Dhamodaran. P, Ramanan. S, Bharathi. B, Jeyanthi. S. IB-SAEMACS: IoT Based Smart Autonomous Environment Monitoring and Control System. Vol. 8, Issue 2, February 2019, ISSN (Print): 2320 – 3765 ISSN (Online): 2278 – 8875.
7. Pavan Manjunath, Pritam Gajkumar Shah. IOT Based Food Management System. Web Publication. https://ieeexplore.ieee.org/document/903253.
8. Shazmina Gull, Imran Sarwar Bajwa, Waheed Anwar, and Rubina Rashid. IoT-based smart garbage system for efficient food waste management. The Research Article, vol. 2021, Article ID 9931228, 13 pages, 2021.
9. N.Gayathri , A.R.Divagaran , C.D.Akhilesh ,V.M.Aswiin , N.Charan. IoT- based smart garbage system for efficient food waste management. 7th International conference on advanced computing and communication systems, vol.2021, Article ID 9441819.