

Design and development of a smart garbage collection and reward generation system using IoT devices

Anjali Baviskar¹, Jyoti Abhale², Rohini Deokar³

^{1,2}B.E. Students, Department of Electronics & Telecommunication Engineering, AVCOE, Sangamner, Maharashtra, India.

³Assistant Prof. Department of Electronics & Telecommunication Engineering, AVCOE, Sangamner, Maharashtra, India.

Abstract - The waste management system is a small step towards building an efficient and economical waste collection with minimal human intervention and also no danger to human life. Separating all this waste at the local level will also save time and money. Implementation of this system can reduce the burden on local authorities. Separation of biodegradable and non biodegradable waste at source helps in removal of carcinogenic and heavy metals from organic waste which produces a good quality compost. In rural areas, the waste generated can cause big trouble to public health and cleanliness. This proposed system of waste management is mainly focused on wet waste management. This is IOT based system which includes ESP3866 wi-fi module, ATmega328P controller, Load Cell with HX711 module, RFID reader and RFID card. The monitor data is stored on the cloud and could be helpful for further analysis of collected waste. The proposed system is mainly focused on wet waste, But in future this system could be modified for other types of wastes.

Key Words: ATmega328P Microcontroller, ESP8266 wi-fi module, Biodegradable garbage Collection, Biodegradable and non biodegradable garbage Segregation, Innovative approach on Garbage management system

1.INTRODUCTION

Over the past few years, the amount of waste generated has tremendously increased. Hence handling of waste requires segregation at source. To encourage people of society to proper waste segregation from the source i.e. house, our system will generate rewards according to the weight of waste collected by individuals. In the hope of profit, people will contribute to the effective management of waste.

For the utilization of massive amounts of waste to generate profit for the government we are proposing a system based on IOT for proper segregation of waste into biodegradable and non-biodegradable waste along with tracking and monitoring of waste. We are providing RFID cards for citizens which will save the information on collected waste in the municipality database. Using this system, the amount of waste collected can be monitored and the GPS module will provide the position of collected waste to the municipality. It will help waste collectors to notify

wherever waste has to be collected. We are designing the database which will store the information of citizens along with the waste collected by them. This database will be connected to municipality database, that they will be able to monitor the waste collection throughout the city. The system is helpful to analyze the collection of waste not only by category but also by area.

In summary, the process of segregating waste prompts the generation of energy out of waste, diminishing landfills, recycling, and reduction of waste. Erroneous disposal of waste leads to recycling contamination. As a solution our project is focused on wet waste processing without contamination. It will help to generate high quality fertilizers. Our system consist of IR sensor, moisture sensor for biodegradable wate segregation, Also for tracking of waste GPS is mounted in system along with the Thinkspeak application to analyze the data collected from sensors deployed in the project. This application will also track the amount of waste collected by user and rewards distributed to the users, where user can check their information of waste. Data collected on Thinkspeak can be further used for research and development of waste management systems.

This application is easy to use and understand.

2.LITERATURE REVIEW

Padmakshi Venkateshwara Rao, Pathan Mahammed Abdul Azee, proposed a system "IoT based Waste Management for Smart Cities". This system includes node MCU, servo motor, Ultrasonic sensor. In this system the "Blynk app" is used to get the SMS as early as garbage bin reaches at optimum level in 2020[4].

Nikolaos Baras, Dimitris Ziouzos has proposed a system "A cloud based smart recycling bin for in-house waste classification" in the 2nd International Conference on Electrical, Communication and Computer Engineering, Istanbul Turkey in June 12-13 2020[5]. This system has used neural network and Artificial intelligence to collect the measurements. It is a centralized Information System capable of to classify the wastes by their types with 93.4% .

Shashank Shetty, Sanket Salvi "SAF-Sutra: A prototype of Remote Smart Waste Segregation and Garbage Level Monitoring System" International Conference Communication and Signal Processing, India, July 28-30,2020[6]. This system useful for remote monitoring .The implemented system has it's interaction with mobile and web application.

Rania Rizki Arinta, Dominikus Boli Watomakin "Improve Smart waste Management to Preserve Tourist Attraction Yogyakarta in IoT Environment" International Conference on Smart Technology and applications (ICoSTA), 2020[7]. This system is connected with smartphone using wi fi module which gives the levelof garbage in dustbin with the help of ultrasonic sensor.

Chetna Kaushal, Anshu Singla had published a paper on "Architecture for garbage Monitoring System using Integrated Technology" in 15 September 2020[8]. Proposed system utilizes the IoT and digital image processing technology which helps to monitor the overflow of garbage and inform to concerned authority to take required actions.

Claude-Noel Tamakaloe, Dr.Elena V.Rosca "Smart System and the Internet of Things (IoT) For Waste Management" Bioengineering/Electrical and Electronic Engineering Dep. Ashesi University Accra, Ghana[9]. Dustbin is capable of detect and monitor total weight later on it sends the information to server side application.

3. COMPONENT AND WORKING

3.1 ESP8266 MODULE:

This module connects the system to the internet. The ESP8266 is a low-cost Wi-Fi chip that enables microcontrollers to connect to 2.4 GHz Wi-Fi. It's mostly used for developing IoT (Internet of Things) embedded applications. Internet: Allows the system to be monitored and controlled remotely. Web page: Provides a user interface for monitoring the system remotely.



Fig.1: Wi-Fi Module

3.2 RFID CARD READER:

Every RFID system consists of three components: a scanning Antenna, a Trceiver and a Transponder. RFID reader is combination of scanning antenna and transceiver is also known as interrogator. It is feasible in use as it can be mount permanently or portable. Signals get transmitted through radio waves to activate the tag. After activation waves get back to antenna and translated into data. The transponder is in the RFID tag itself.



Fig.2: RFID Card Reader

3.3 LOAD CELL(WEIGHT SENSOR):

Load cell monitor the weight of garbae bags,and give data to the HX711 module.HX711 module is a Load Cell Amplifier breakout board for the HX711 IC that allows you to easily read load cells to measure weight. No need of any amplifiers or dual power supply just use this board and interface it to any micro-controller to measure weight.

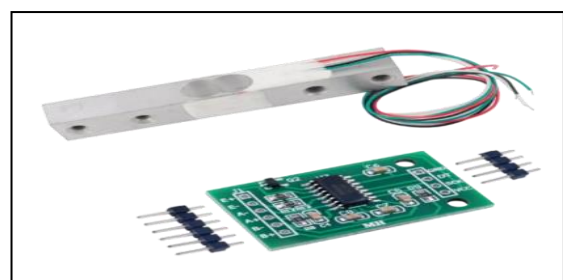


Fig.3: Load Cell

3.4 16X2 LCD:

LCD (Liquid Crystal Display) screen is an widely used electronic display module and has used in most of application. A 16x2 LCD display is used in various devices and circuits. As compared to seven segment and multi segment LEDs. LCDs are cheap and easily programmable. It doesn't have limitations for displaying special and custom characters animations and so on.

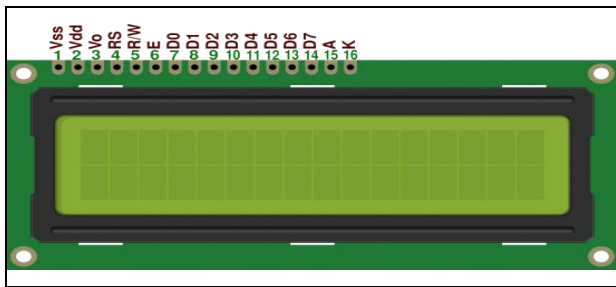


Fig.4: 16x2 LCD display

The purpose of using 16x2 LCD in our project is to display the monitored garbage weight and Reward point assigned to user.

4. Methodology

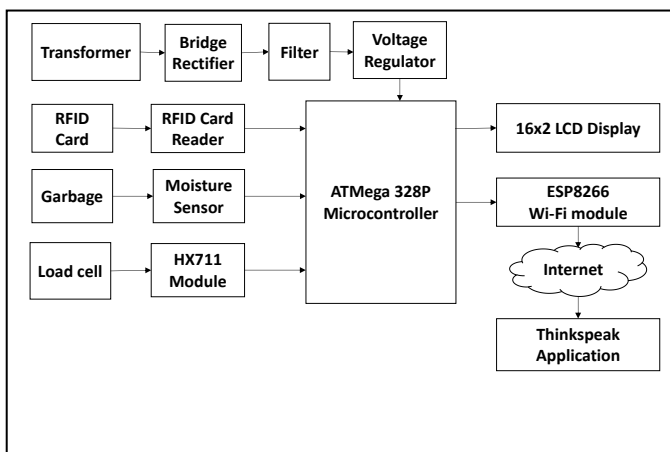


Fig.5: Block diagram of project

Above Fig. explains working of effective waste management system. ATmega328P is microcontroller which will control the sensor and databases. Transformer, Bridge rectifier, voltage regulator will collectively forms a power supply for AC to DC power consumption required to give power to the ATmega328P microcontroller and ESP8266 wi-fi module. Load cell will measure the weight of waste put on the floor connected load cell. Simultaneously RFID card will allow access to authorized user. The identity no. of user and weight of collected waste will be displayed on 16x2 LCD Display. The displayed information will be stored at RFID card reader as well as cloud database through wi-fi module present in Node MCU. Using the GSM module location of area in which waste collection system get used is detected and location will be sent to municipality database.

This system will generate rewards according to garbage collection for citizens who contribute in proper garbage collection. Main motive of generating rewards is to attract most population of area for effective garbage collection. Using above components, we will design a system which will analyze the garbage segregation. Our system will

generate rewards according to weight of the garbage collected individually by citizen. All the information about the contributing citizen and collected garbage will be saved at RFID database, and monthly rewards will be generated. We also obtain the parameters on the mobile through web application.

5. FLOWCHAT

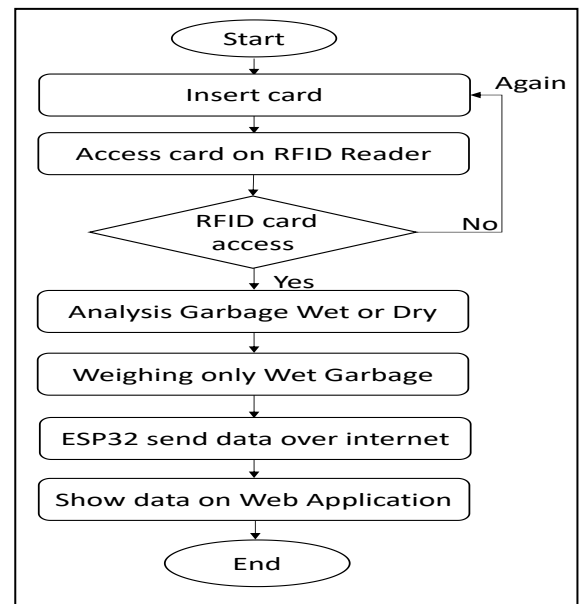


Fig.6 Flowchart of project

The components flow:

1. Insert RFID card for unique access.
2. Card access can be granted.
3. Insert Garbage on Platform.
4. Checking wet or dry garbage.
5. Only Measuring weight of wet Garbage by loadcell.
6. Analyzing the measured weight.
7. Display measured weight on LCD and web application.
8. And also show Reward point on LCD display and web application.

6. CONCLUSIONS

This project enhances the cleanliness of the cities by the practical application of “Smart Garbage collection and Reward generation using IoT”. As urbanization has increased population is increased and waste disposal became an major issue of concern. This paper has given an effective waste management system with no human interference to manage and monitor the tremendous amount of waste collected at respective area. It provides timely collection and disposal. This paper has demonstrated a system can be implemented at domestic level in household or at the large level in public places. Reward generation after collection of waste will

eventually encourage the people for proper collection of waste.

Ms. Rohini N. Deokar , Assistant Prof., Department of Electronics and Telecommunication Engineering, AVCOE, Sangamner, Maharashtra, India.

REFERENCES

- [1] Sub Theme III Waste to Wealth, Activity Guide Book 2018 & 2019 Published by Government
- [2] <https://mnre.gov.in/waste-to-energy/current-status> – updated on 2 October 2023
- [3] <https://iasbaba.com/2016/05/iasbaba-press-information-bureau-pib-9th-may-to-15th-may-2016/> -updated on 5 October 2023
- [4] Padmakshi Venkateshwara Rao, Pathan Mohammed Abdul Azeez “IoT based waste management for smart cities” International conference on computer communication and information (ICCCI), Coimbatore, India, Jan22-24,2020.
- [5] Nikolaos Baras, Dimitris Ziouzos “A cloud based smart recycling bin for in-house waste classification” in the 2nd International Conference on Electrical, Communication and Computer Engineering, Istanbul Turkey June 12-13 2020.
- [6] Shashank Shetty, Sanket Salvi “SAF-Sutra: A prototype of Remote Smart Waste Segregation and Garbage Level Monitoring System” International Conference Communication and Signal Processing, India, July 28-30,2020.
- [7] Rania Rizki Arinta, Dominikus Boli Watomakin “Improve Smart waste Management to Preserve Tourist Attraction Yogyakarta in IoT Environment” International Conference on Smart Technology and applications (ICoSTA), 2020
- [8] Chetna Kaushal, Anshu Singla “Architecture for garbage Monitoring System using Integrated Technology” 15 September 2020.
- [9] Claude-Noel Tamakaloe, Dr.Elena V.Rosca “Smart System and the Internet of Things (IoT) For Waste Management” Bioengineering/Electrical and Electronic Engineering Dep. Ashesi University Accra, Ghana.

BIOGRAPHIES

Miss. Anjali Y. Baviskar , B.E.Student, Department of Electronics and Telecommunication Engineering, AVCOE, Sangamner, Maharashtra, India.

Miss. Jyoti J. Abhale , B.E.Student, Department of Electronics and Telecommunication Engineering, AVCOE, Sangamner, Maharashtra, India.