iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** XI **Month of publication:** November 2023

DOI: https://doi.org/10.22214/ijraset.2023.57006

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XI Nov 2023- Available at www.ijraset.com

EnviroSense Smart Waste System: Revolutionizing Waste Management Through IoT

Nakul Rajesh Shenode[1], Ankita Vijay Rekkawar[2], Neha Jagdish Kawathe[3]
[1]Civil Engineering, [2]Electronics & Telecommunications Engineering, [2]Science & Humanities Engineering Department, Swaminarayan Siddhnata Institute of Technology, Nagpur, India

Abstract: The EnviroSense Smart Waste System is a slice-edge system that uses the power of the Internet of Things (IoT) to transfigure traditional trash operation processes. As urbanization accelerates and environmental enterprises grow a smart and effective waste operation system becomes increasingly important. The EnviroSense Smart Waste System tackles these issues by combining ultramodern detectors, networking, and data analytics to make a complete and long-term waste operation system. The system's introductory operation entails the installation of smart detectors into waste lockers and holders, allowing for real-time monitoring of scrap situations and composition. These detectors use IoT connection to shoot data to a centralized platform, where it's reused by advanced analytics algorithms. The technology gives practicable data, allowing original governments, waste operation enterprises, and other associations to make better opinions.
Keywords: EnviroSense, Smart Waste System, Internet of Things (IoT), Data Analytics, Waste Operation

I. INTRODUCTION

The EnviroSense Smart Scrap System is a slice-edge system that uses the power of the **Internet of Things** (IoT) to transfigure traditional trash operation processes. As urbanization accelerates and environmental enterprises grow a smart and effective waste operation system becomes increasingly important. The EnviroSense Smart Waste System tackles these issues by combining modern sensors, networking, and data analytics to make a complete and long-term waste operation system. The system's introductory operation entails the installation of smart sensors into waste lockers and holders, allowing for real-time monitoring of scrap situations and composition. These sensors use IoT connection to shoot data to a centralized platform, where it's reused by advanced analytics algorithms. The technology gives practicable data, allowing original governments, waste operation enterprises, and other associations to make better opinions. The EnviroSense Smart Waste System underscores its commitment to stoner-friendly operation, making it an important tool for cosmopolises, waste operation realities, and citizens. This emphasis on ease of use not only maximizes relinquishment rates but also contributes to the system's overall effectiveness in transubstantiating waste operation practices.

The EnviroSense Smart Waste System Operation Process:

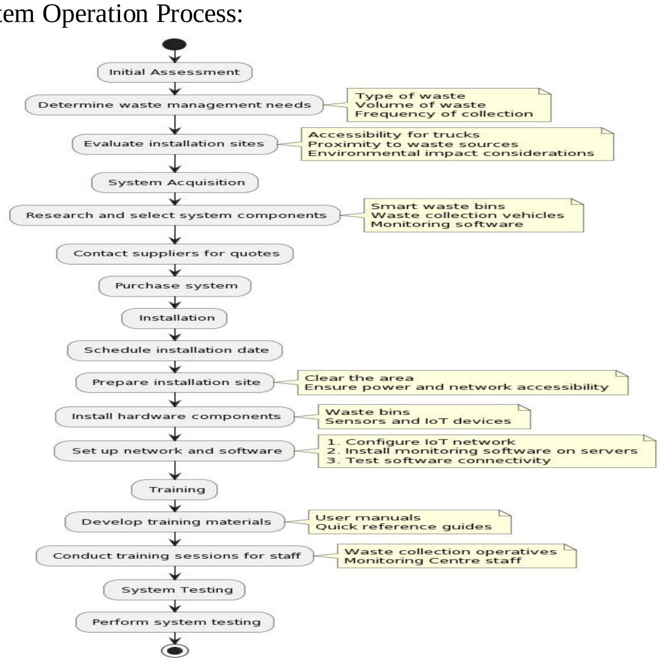


Fig: The EnviroSense Smart Waste System Operation Process

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XI Nov 2023- Available at www.ijraset.com

This isn't an original idea, the IoT rested tip was executed and effectuated much before. Some authors presented systems where the detectors in the caddy checked if the caddy was filled up to the brim or not. However, through the Arduino SIM module, which used the operation of the Arduino board, if it was filled an automated communication was transferred to the garçon end of the system.

Some authors also executed real time waste operation system by using smart shambles to check the filled position of shambles whether they were filled. In this system the information of all smart shambles can be entered from anywhere and anytime by the concern person and he or she can take a decision consequently. By administering this proposed system, the cost reduction, resource optimization, effective operation of smart shambles was carried out. This system laterally reduced business in the megacity.

In major megalopolises the scrap collection vehicle visited the area's everyday doubly or thrice depending on the population of the particular area. The System informed the status of each and every dust caddy in real time so that the concerned authority can shoot the scrap collection vehicle only when the tip is full. Some proposed smart scrap operation system using IR detector, microcontroller and Wi- Fi module. This system assured the cleaning of shambles soon when the scrap position reached its outside. However, also the records were transferred to the advanced authority who took applicable action against the concerned contractor, If the tip wasn't gutted in specific time.

This system also helped to cover the fake reports and hence helped to reduce the corruption in the overall operation system. It eventually helped to keep cleanliness in the society precipitously the Tip with Wi- Fi Router attached in it was also introduced. The Dustbin had a Passive Infrared Sensor. The Wi- Fi router was programmed to display the temporary connecting law. When the stoner throwed trash in the tip, the PIR detector detected the trash and transferred signals to the microcontroller. The microcontroller detected the signals and encouraged it to the router device. The router vindicated the signals and generated arbitrary canons and also encouraged it again to the microcontroller. The microcontroller scrutinized the signals and encouraged it to the TV Display. The TV Display displayed it. The stoner entered the arbitrary law generated by the router on the PHP interface which was hosted on the garçon. The garçon also responded to the request and displayed the Master Wi- Fi word to the stoner. The stoner also used the Master Wi- Fi word to connect to the internet. The stoner got the internet access for 10 beats and automatically got disconnected. detector will measure the weight of the trash been ditched in the caddy. once the set limit of weight is been satisfied the word of the router will get displayed on the TV screen, although the router is still out. after the word has been displayed the stoner have to pull this plate outside so that the trash which has been collected on the plate falls down in the tip. This stir of the falling trash is captured by the IR detector and once the IR detector sense the falling stir Advantages of proposed system over the being

1) Low-performance cost
2) Simple module
3) Easy Functionality

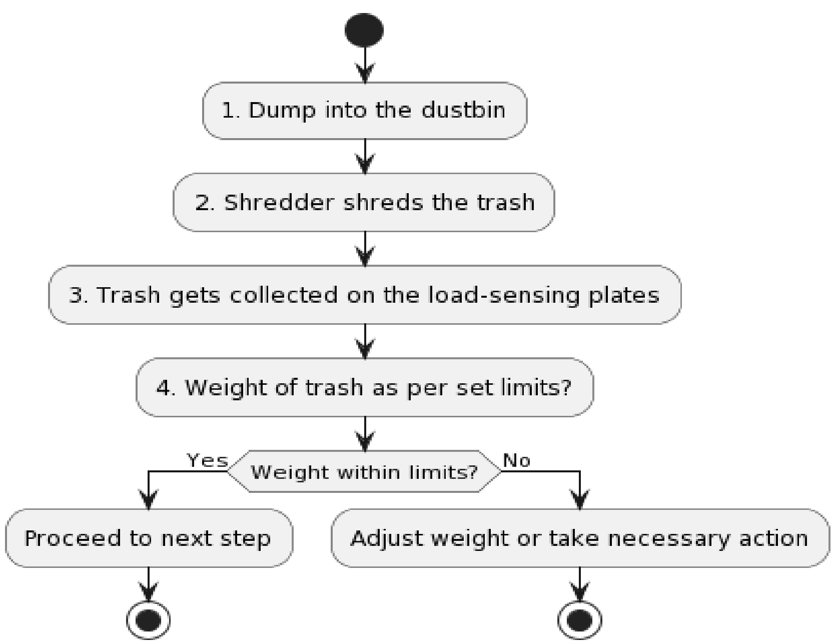


Fig: The initial processing of EnviroSense Smart Waste System Operation Process

II. FLAWS IN THE EXISTING SYSTEM:

1) Connectivity Issues
2) Security Vulnerabilities
3) Data Accuracy and Reliability
4) Scalability Challenges
5) Power Consumption
6) Integration with Existing Systems
7) User Adoption and Training
8) Costs and Return on Investment (ROI)

A bedded system can include any of the following types of attack factors Sensor or other input device. Gathers information from the observable world and converts it to an electrical signal. The type of data gathered depends on the input device. Analog-to-digital motor. Changes an electrical signal from analog to digital. Processor. Processes the digital data the sensor or other input device collects. Memory. Stores specialized software and the digital data the sensor or other input device collects. Digital-to-analog motor. Changes the digital data from the processor into analog data. Chooser. Takes action predicated on the data collected from a sensor or other input device.

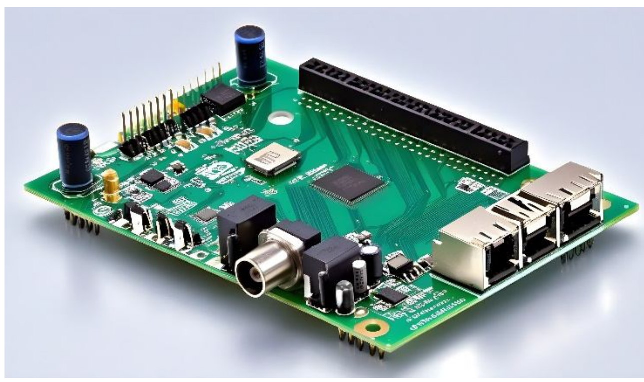


Fig: Assembly adopted in EnviroSense Smart Waste System Operation Process

III. SENSOR'S DATA ESTIMATION

To calculate the empty level and weight of the waste, we have performed a set of experiments concerning time. Table. 4 shows the corresponding experimental data of the ultrasonic sensor and load measurement sensor. In this table, we have focused on how the system is operated in response to time. We have taken five samples, time delay in minutes, individual waste level in cm, empty level in percentage, and a load of the waste in Kg. The two-output data, such as the empty level and weight of the trash, will be sent to the corresponding mobile application of the users.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XI Nov 2023- Available at www.ijraset.com

(a) (b)

(c)

Fig: The application of EnviroSense Smart Waste System Operation

IV. PROGRAMING

A. Algorithm 1: AHA-LEACH Algorithm

Input: Smart Bins Distribution.

Output: Return smart bins network with low energy consumed and best of cluster head.

Processing:

Step 1: Initially, place all smart bin nodes on the purpose of the area and maximum iteration (Maxiter).

Step 2: Find the energy distribution of all smart bin's nodes.

Step 3: Dividing the field into concentric zones, with the average radius of the smaller zone being avg and the maximum radius of the larger zone being dmax, where:

dmin is the distance between the nearest node and base station (BS) dmax is the distance between the farthest node and base station (BS) The threshold radius is avg = (dmin + dmax)/2.

Step 4: Define a fitness function f(n)

f(n) = {DBs

BS <= avg, Otherwise,

*

C1 DBS 3c1/Dbs

C2/ Er + C3 / Dintra 0.9c2 / Er + C3 / Dintra

where n denotes Smart bin (SB) location being considered for CH

Dgs = distance between SB and Base Station, and

E = Residual Energy of hub

Dintra= The sum of the SB's distances relative to other SBS in the same cluster

Step 5: If a cluster's average energy is higher than the CH's Energy, the CH should be switched out for a node with a lower fitness cost.

Step 6: Repeat step (5) until all smart bins are checked.

B. Algorithm 2: AHA-KNN Input: Missing dataset D.

Output: Dataset completed.
Processing:
Step 1: A feature label is associated with each datapoint in the dataset. feature = {F1, F2,...,Fn}.
Step 2:
Preprocess dataset D using Min-Max Normalization according to eq. 20.
Step 3: Initialize the AHA parameters (the population size P, maximum number of iterations Maxiter, n, d, f, Low, Up)
Step 4: h a randomized K-value and determining the fitness function based on accuracy.
Step 5: Calculate each hummingbird position using the fitness function and save in Visit table (VT)
Step 6: Hummingbird positions are updated if they are better than the previous best position.
Step 7: Using the hummingbird's previous best location, find its optimal new location.
Step 8: Relocate the hummingbird to its new feeding location.
Step 9: Repeat from step 4 until the end condition is met or Maxiter is attained.
Step 10: Training the KNN algorithm with an optimized K value produces the value of K- closest neighbors for an input sample.
Step 11: Apply the principle of a majority vote to determine whatever data can be most frequently used.
Step 12: classify a sample test and use the feature's most frequent label.

V. RESULTS

The results from the experiments in this section of the three phases took place and were discussed in the EnviroSense Smart Waste System. All the results are run on the same Mobile, which has the detailed settings shown in the table. All experiments were carried out using an Android application, and the results were extracted and analyzed using it.

Specification name	Specification settings
Software specification	
OS	Mobile (Android App)
Programming language	MATLAB R2019a
Hardware specification	
CPU	Core (TM) i7-4500
Frequency	2.40 GHz
Memory	16 MB
App Size	26 MB

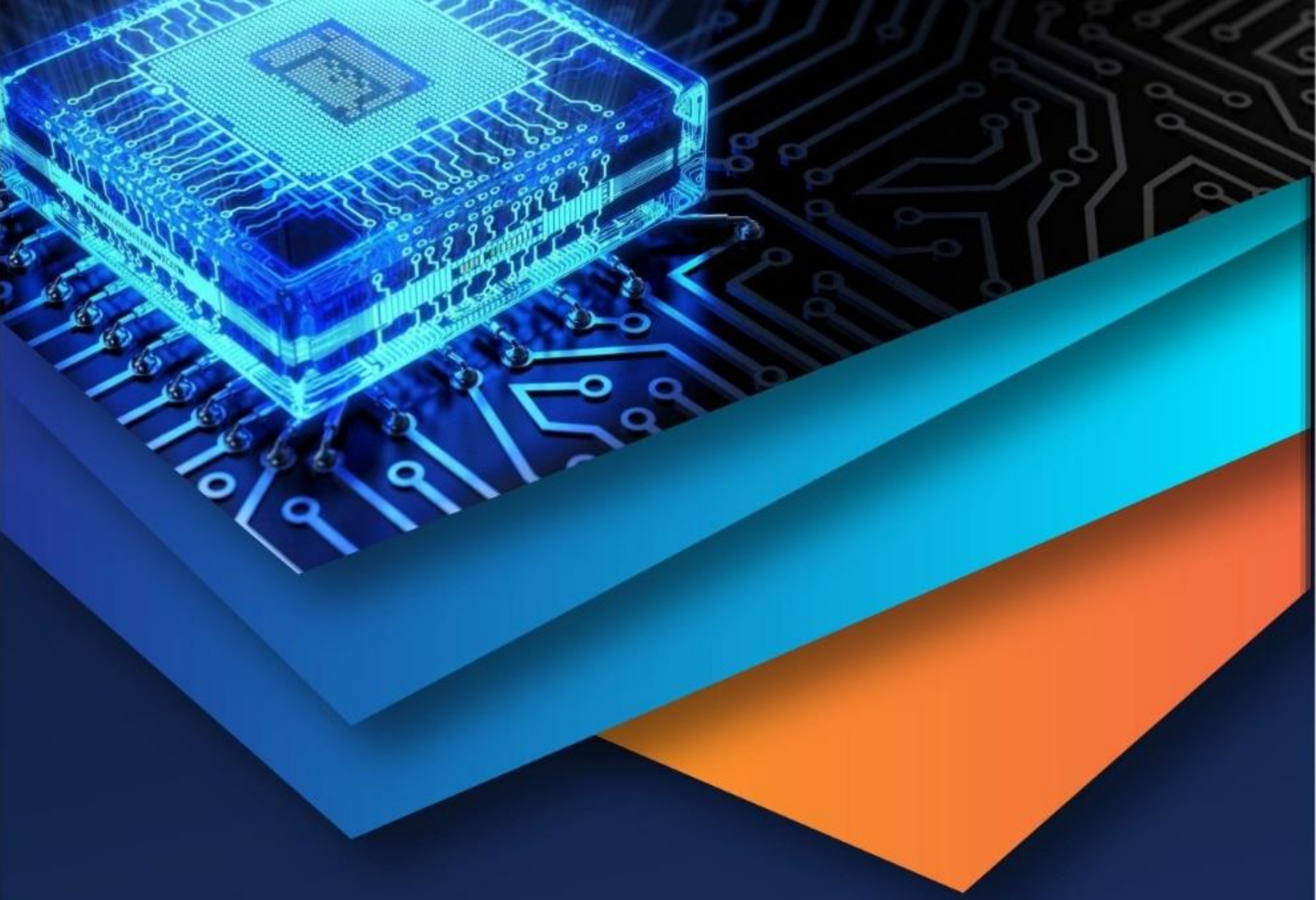
IoT-based intelligent waste management system

VI. CONCLUSION

This paper represents a real-time waste monitoring system utilizing deep learning paradigm and IoT. The research is conducted with a set of the development process to ensure an efficient waste management process. The proposed model has classified into two significant parts. One is the architectural model of waste classification using a raspberry pi and camera module along with the mechanism of deep learning. Another one is the embodiment of IoT based smart trash box utilizing a microcontroller with multiple sensors for real-time waste monitoring. Again, this paper represents the data calculation methodology of proposed CNN model, ultrasonic sensor and load measurement sensor. This article also presents several experimental data analyses to provide the effectiveness of the proposed method. The proposed method has found the waste classification accuracy of 95.3125%. This research is further furnished with the System Usability Scale to check the regular user's satisfaction and found the SUS score of 86%. The first limitation of this work is the model works with only five categories of indigestible waste. Another limitation is utilizing only two sensors in the developed prototype.

REFERENCES

[1] Monika K A, Rao N, Prapulla S B and Shobha G 2016 Smart Dustbin-An Efficient Garbage Monitoring System International Journal of Engineering Science and Computing 6 7113-16
[2] Navghane S S, Killedar M S and Rohokale D V 2016 IoT Based Smart Garbage and Waste Collection Bin International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) 5 1576-78
[3] Kasliwal Manasi H and Suryawanshi Smithkumar B 2016 A Novel approach to Garbage Management Using Internet of Things for smart cities International Journal of Current Trends in Engineering & Research 2 348-53.
[4] Medvedev A, Fedchenkov P, Zaslavsky A, Anagnostopoulos T and Khoruzhnikov S 2015 Waste management as an IoT-enabled service in smart cities In Conference on Smart Spaces Springer International Publishing 104-15
[5] Schafer G 1994 U.S. Patent No. 5,326,939. Washington DC: U.S. Patent and Trademark Office.
[6] Anitha A, Paul G and Kumari S 2016 A Cyber defence using Artificial Intelligence International Journal of Pharmacy and Technology 8 25352-57
[7] Anitha A, Kalra S and Shrivastav 2016 A Cyber defense using artificialhome automation system using IoT International Journal of Pharmacy and Technology 8 25358-64



10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY