

## Smart Waste Management System

Alok Marathe<sup>1</sup>, Kaushal Purohit<sup>2</sup>, Shraddha Golande<sup>3</sup>, Anuja Ghotekar<sup>4</sup>, Ms.Sonam Boradhe<sup>5</sup>

B. Tech Students, Department of Computer Science Engineering<sup>1,2,3,4</sup>

M. Tech Professor, Department of Computer Science Engineering<sup>5</sup>

Sinhgad Institute of Technology and Science, Narhe, Pune, India

**Abstract:** *Current waste management systems are inefficient and costly. Electronic sensors can be used to efficiently manage the waste and significantly reduce the cost of man labor. In this project raspberry Pi is used along with servo motors and conveyor belt. TensorFlow is used to build the waste object detection model. Waste will be carried by the conveyor belt and servo motors will turn the flaps in order to segregate the waste into solid and wet waste.*

**Keywords:** Object detection, waste management system, TensorFlow

### I. INTRODUCTION

2.01 billion tons of municipal waste is being generated worldwide every year. It is projected to increase at least by 70% to reach 3.4 billion tons by 2050 due to rapid urbanization, population growth and economic development unless urgent measures are not taken. Segregation at the source level is critical to its recycling and disposal. Lack of segregation, collection and transportation of unsegregated mixed waste being dumped in the landfills has an impact on the environment. During such times reducing man labor and automating the tasks of segregation and collection to increase the efficiency can be helpful and this project helps in achieving the same. It helps in reducing the labor cost as well as helps in segregating the waste in the form of solid and wet waste..

### II. MOTIVATION

Traditional waste management system operates based on a daily schedule which is highly inefficient and costly. The existing recycle bin has also proved ineffective in the public as people do not recycle their waste properly. With the development of Internet of Things (IoT) and Artificial Intelligence (AI), the traditional waste management system can be replaced with smart sensors embedded into the system to perform real time monitoring and allow for better waste management.

### III. RELATED WORK

1. GSM communication technology is used as the platform to perform data transmission to the server. Web-based Android applications are developed to interface with a web server to provide information from sensors monitoring bin status, amount of waste in the bin, and time of waste collection. The data are processed by a graph theory optimization algorithm to obtain the shortest path for reaching the bin to efficiently manage the waste collection strategies. Graph theory optimization provides a very cost-efficient procedure to reduce the operation costs of a waste management system.
2. A second IoT-based smart bin, It comes with three compartments, each with its own functionality. The first compartment consists of an infrared IR sensor and metal detector. The second compartment consists of an IR sensor and moisture sensor to detect dry and wet waste. The last compartment is subdivided into three bins for the collection of segregated waste respectively.
3. A third IoT-based solid waste management system is proposed in [26]. In this system, a DHT22 temperature sensor, MQ-135 gas sensor, IR sensor, passive infrared, PIR sensor, and load cell are used to monitor the temperature and humidity, presence of harmful gas, amount of garbage, presence of user, and weight of garbage respectively.
4. A fourth IoT-based system. This system relies on an ultrasonic sensor to monitor the amount of waste in the bin. The monitored data are also transmitted through LoRa communication.

### 3.1 Literature Review

SR.NO	PAPER TITLE	Paper Theme/Idea	Limitation
1	An Internet of Things Based Smart Waste Management System Using LoRa and Tensorflow Deep Learning Mode	The aim of this research is to develop a smart management System using lora protocol and Tensorflow based deep learning model .	steep learning curve
2	Classify Mainland China Visitor Be-haviours in Hong Kong from Check-in Data	This research study about image classification by using the deep neural network (DNN) or also known as Deep Learning by using framework TensorFlow.	requires large amount of data.
3	N. Misran, M. S. Islam, G. K. Beng, N. Amin, and M. T. Islam proposed “IoT based health monitoring system with LoRa communication technology,”	An IoT based health monitoring system using the MySignals development shield for Arduino Uno. Evaluating the performances and effectiveness of the sensors and wireless platform devices are also the aim of the project.	Not economical.
4	A study on Image Classification based on Deep Learning and Tensorflow	More than 50 percent of the world population lives in cities and city governments face a wide range of challenges: they need to produce wealth and innovation but also health and sustainability. Cities are to be green and safe but also culturally vibrant . On top of this, cities need to be able to integrate growing populations from different (ethnic, religious, socioeconomic) backgrounds.	TensorFlow missing symbolic loops

### IV. CONCLUSION

During such times when waste management has become a concern to the world an efficient model is required to overcome the problems being faced. This project will help to increase the efficiency of the current waste management system significantly and also help in proper segregation of wet and solid waste. This project will also help in cutting the labor costs and also in the management process.

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### REFERENCES

- [1] M. Shahidul Islam, M. T. Islam, A. F. Almutairi, G. K. Beng, N. Misran, and N. Amin, “Monitoring of the human body signal through the Internet of Things (IoT) based LoRa wireless network system,” *Appl. Sci.*, vol. 9, no. 9, p. 1884, May 2019
- [2] M. A. Abu, N. H. Indra, A. H. A. Rahman, N. A. Sapiee, and I. Ahmad, “A study on image classification based on deep learning and tensorflow,” *Int. J. Eng. Res. Technol.*, vol. 12, pp. 563–569, Oct. 2019.
- [3] N. Misran, M. S. Islam, G. K. Beng, N. Amin, and M. T. Islam, “IoT based health monitoring system with LoRa communication technology,” in *Proc. Int. Conf. Electr. Eng. Informat. (ICEEI)*, Bandung, IN, USA, 2019, pp. 514–517.
- [4] K. Kumar and S. Kumar, “Energy efficient link stable routing in Internet of Things,” *International Journal of Information Technology*, vol. 10, no. 4, pp. 465–479, 2018.

- [4]. J. Saunders, "Real-time discrimination of broadcast speech/music," in Proc. ICASSP'96, vol. II, Atlanta, GA, May 1996, pp. 993–996.
- [5]. E. Scheirer and M. Slaney, "Construction and evaluation of a robust multi-feature music/speech discriminator," in Proc. ICASSP' 97, Apr. 1997, vol. II, pp. 1331–1334.
- [6]. D. Kimber and L. Wilcox, "Acoustic segmentation for audio browsers," in Proc. Interface Conf., Sydney, Australia, July 1996.
- [7]. T. Zhang and C.-C. J. Kuo, "Video content parsing based on combined audio and visual information," Proc. SPIE, vol. IV, pp. 78–89, 1992.
- [8]. J. P. Campbell, Jr., "Speaker recognition: A tutorial," Proc. IEEE, vol. 85, no. 9, pp. 1437–1462, 1997.
- [9]. A. V. McCree and T. P. Barnwell, "Mixed excitation LPC Vocoder model for low bit rate speech coding," in IEEE Trans. Speech Audio Processing, July 1995, vol. 3, pp. 242–250.
- [10]. K. El-Maleh, M. Klein, G. Petrucci, and P. Kabal, "Speech/music discrimination for multimedia application," in Proc. ICASSP'00, 2000.
- [11]. Atakan Kantarci in Top 10 Voice Recognition Applications in 2021
- [12]. Niko Laskaris in How to apply machine learning and deep learning methods to audio analysis [13]. Nagesh Singh Chauhan in Audio Data Analysis Using Deep Learning with Python (Part 1) [14]. S. Vetrivel et. al. / Indian Journal of Computer Science and Engineering Vol. 1 No. 4 240-250 "AN OVERVIEW OF MPEG FAMILY AND ITS APPLICATIONS"

#### **BIOGRAPHY**

- Shraddha Golande is currently a Final Year B.student of Savitribai Phule Pune University.
- Kaushal Purohit is currently a Final Year B.student of Savitribai Phule Pune University.
- Aalok Marathe is currently a Final Year B.student of Savitribai Phule Pune University.
- Anuja Ghotkar is currently a Final Year B.student of Savitribai Phule Pune University.
- Ms. Sonam Borhade is currently working as a Professor in Sinhgad Institute of Technology and Science, Narhe.