Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 10, October 2024

Waste Management by Smart Bin and App System using IOT

K Sivapriya,
Assistant Professor

Dr.N.Mohanapriya
Associate Professor,Vivekanandha College of Engineering for Women,
Tiruchengode,Tamilnadu (India),

Sneha.P, Subhashini, S.Haripriya, S.R.Siamala.J
Student Of Vivekanandha College of Engineering for Women,Tiruchengode,Tamilnadu (India),

***Abstract*— The Internet of Things (IoT) refers to a framework comprised of interconnected embedded sensors and services. These sensors are incorporated to collect various information, track physical conditions, e.g., waste bin's status, and exchange data with different centralized platforms. The traditional waste management system relies on a daily schedule, making it inefficient and costly. However, with advancements in the Internet of Things (IoT) and Artificial Intelligence (AI), this system can be transformed through the integration of smart sensors that enable real-time monitoring and improve waste management. The aim of this project is to develop a smart waste management system using various sensors, Arduino Board, Node MCU and MIT App inventor. The smart bin analyze the monitoring and allow for better waste management. The aim of this project is to develop a smart waste management system using various sensors, Arduino Board, Node MCU and MIT App inventor. The smart bin analyze the department to manage and maintain the waste by monitoring the status of garbage bins and intimate the updated status to the management people to take action instantly and to maintain clean city.**

***Keywords*: Internet of Things, Waste Management, smart bin, Arduino, NodeMCU, real-time monitoring**

I. INTRODUCTION

The Internet of things (IoT) describes devices with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. The Internet of things encompasses electronics, communication, and computer science engineering. The term "Internet of Things" is often seen as a misnomer, as devices do not necessarily need to be connected to the public internet; they only require a network connection and individual addressability. The field has evolved through the convergence of various technologies, including ubiquitous computing, affordable sensors, advanced embedded systems, and machine learning. Established areas such as embedded systems, wireless sensor networks, and automation—encompassing both home and building automation—individually and collectively contribute to the development of the Internet of Things. In the consumer market, IoT technology is most synonymous with "smart home" products, including devices an appliances(lighting fixtures , thermostats,home security systems,cameras, and other home appliances) that support one or more common ecosystems and can be controlled via devices associated with that ecosystem, such as smart phones and smart speakers. IoT is also used in healthcare systems. There are several concerns about the risks linked to the expansion of IoT technologies and products, particularly regarding privacy and security. In response, both industry and government have taken steps to tackle these issues, such as developing international and local standards, guidelines, and regulatory frameworks.

II .ABBREVIATION

- Node MCU — Node Micro-Controller Unit.
- Arduino IDE — Arduino Integrated Development Environment.
- MIT App Inverter — Massachusetts Institute of Technology Application Inverter

III. LITERATURE REVIEW

1. A LoRaWAN IoT-Enabled Trashed Bin Level Monitoring Systems.

S.R Jino Ramon et al. [1] had proposed the fact that the existing system to manage the solid waste efficiently, this article presents the development and validation of a self-powered, LoRaWAN Internet-of-Things (IoT)-enabled trash bin level monitoring system. In the proposed IoT system, the end nodes are referred to as Trash Bin Level Measurement Units (TBLMUs), and they are placed in each trash bin to monitor their status. The TBLMU measures the unfilled level and geographical location of a trash bin.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 10, October 2024

2. IoT-Aware Waste Management System Based on Cloud Services and Ultra-Low-Power RFID Sensor Tags;
Luca Catarinucci et al.[2] had proposed the fact that the existing system In this paper, an innovative system capable of capturing and processing data relating to the door-to-door separate waste collection in the context of future smart cities is presented. Specifically, the system features an advanced RFID sensor tag equipped with low-cost weight sensors, along with a cloud-based software system designed to manage the collected data and meet the diverse expectations of various stakeholders.

3. Smart Waste Management System using TensorFlow Lite and LoRa-GPS Shield in Internet of Things Environment.
Mohammad tariqul islam(Senior Member, IEEE) et al.[3] had proposed the fact that the existing system in this research is to develop a smart waste management system using the deep learning model that improves the waste segregation process and enables monitoring of bin status in an IoT environment. By integrating the trained model on TensorFlow Lite and Raspberry Pi 4, the camera module detects the waste and The ultrasonic sensor monitors the waste fill percentage, and a GPS module obtains the real-time latitude and longitude.

4. An IoT Based Waste Management System Using LoRa and Tensorflow Deep Learning Model.
Teoh Ji sheng, norbahiah misran etal.has proposed the existing system by to develop a smart
Waste management system using LoRa Communication protocol and TensorFlow based deep learning model.
LoRa sends the sensor data and Tensorow performs real time object detection and classication is done in TensorFlow framework with pre- trained object detection model. This object detection model is trained with images of waste to generate a frozen inference graph used for object detection which is done through a camera connected to the Raspberry Pi 3 Model BCas the main processing unit.

5. Smart waste management system using IoT.
Tejashree kadus, pawankumar nirmal (IJERT),was proposed the existing system In order to deal these problems with Smart netbin. A smart netbin was elevated using a microcontroller based platform Arduino uno based interfaced with load sensor and wifi module.Smart netbin uses multiple technologies firstly the technology for measuring the amount of trash dumped,secondly the movement of the waste.The proposed system will function on client server model, a cause that wil assure clean environment,good health,and population free society.

6. An Intelligent Smart Bin System for Solid Waste Management in Smart cities.
Jeni moni et al. proposed the existing system that the smarter way for collecting and managing the waste in an efficient manner. This model introduces an IoT aided smart waste management system which uses various sensors to detect the level of garbage in the bin. When the waste reaches a certain threshold value, an alert message is transmitted to the authorities concerned so that proper actions can be initiated for waste management. This system also aims to help the waste collector to track and locate the bins easily through the possible shortest path using Travelling Salesman Algorithm.

7. Opportunities for IoT-Based Smart Platforms for Intelligent management of Waste systems in Bulgarian Municipalities.
Nikolay tsonkov; kamen petrov el al. proposed the existing system that the Bulgarian municipalities need to adapt and implant smart management in their systems. One very important system is waste management. The bigger a city is the more serious the problem of efficient waste collection, treatment, and management becomes. In this sense, the main objective of the authors is to analyze and evaluate the possibiblities of implementing smart solutions in the field of urban environment and waste. These solutions are related to the implementation of platforms based on the
Internet of Things.

8. Smart Trucks: An IoT-based Novel Approach for Smart and Effective Waste Management System.
In this paper, we have proposed an IoT-based environmental-friendly methodology for waste management. In the present scenario, there is a need to segregate waste before as well as after collection and classify it into biodegradable and non-biodegradable waste categories. This segregated biodegradable waste can be further recycled to produce bio-compost and fertilizers. Smart Trucks based on IoT with sensors will be used to collect garbage from the homes of smart cities. The waste will be segregated at the produce bio-compost and fertilizers. Smart Trucks based on IoT with sensors will be used to collect garbage from the homes of smart cities. The waste will be segregated at the

9. Internet of Things-Enabled Real-time Waste management system for smart cities.
S. Asha; shaki Hussain et al.was introduced the existing system that in smart cities, the demand for efficient waste management systems has increased in tandem with the city's population. The Internet of Things (IoT) has demonstrated its potential as a solution-oriented technology by enabling the development of intelligent and efficient waste collection and disposal infrastructure. This article provides a comprehensive analysis of Internet of Things (IoT) solutions for municipal waste management in smart cities. It discusses the pros and cons of these systems, as well as their fundamental components, architecture,and functionality.

IV. SYSTEM ANALYSIS

4.1 EXISTING SYSTEM

A smart waste management system already existing the process of implementing the trash bin level monitoring system. This system executed that the measures of unfilled level and geographical location of a trash bin. In addition, there are implemented the process of Door to Door separate waste collections for satisfy the various stakeholders and garbage picker. There is a need to segregate waste both before and after collection, classifying it into biodegradable and non-biodegradable categories. The separated

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 10, October 2024

biodegradable waste can then be recycled to create bio-compost and fertilizers. In smart cities, IoT-enabled smart trucks equipped with sensors will be used to collect garbage from homes.The waste will be segregated at the level of the house into dry and wet waste categories. This segregated waste will be further segregated by smart trucks. Also existing the process of monitoring the status of bin such as detects the waste, waste fill percentage and GPS module. The introduction of smart netbin system for measuring the amount of trash dumped using load sensor. The Internet of Things (IoT) has demonstrated its potential as a solution-oriented technology by enabling the development of intelligent and efficient waste collection and disposal infrastructure. This article provides a comprehensive analysis of Internet of Things(IoT)solutions for municipal waste management in smart cities. These are all the process which is used in existing system and the technique was implemented previously in smart waste management system. From the existing system, it was only established the process of monitoring the status of bin. There is no execution for the further process of transmitting and intimating the status of collected data of bin to the required department and the people who can want to monitor and maintain the clean and Hygiene infrastructure of the garbage bin.

4.2 DISADVANTAGES

1. In the existing system, there was executed the bin level monitoring only for the trash unfilled level and amount of trash dumped within the bin.
2. In there is no technique implemented for overflowing of trash around the Garbage bin.
3. In a smart bin system there is no implementation process for monitoring the moisture level and fire intimation system in the trash bin.
4. The existing system only implement the process of monitoring the status of bin. There is no execution for the further process of transmitting and intimating the status of collected data of bin to the required department and the people who can want to monitor and maintain it and who can able to rectify the issues.
5. So that we cannot be properly maintain the clean and hygiene infrastructure of the trash bin. This kind of performance was considered as a disadvantages of smart waste management system.

4.3 PROPOSED SYSTEM

Iot is an important technology to make city smatter, greener and safer. In urban area, the waste management becoming a key challenges. The waste containers are usually placed in a public area without well management. In this project, the smart bin performs the action of monitoring the overflowing level of bin, monitor the moisturizing content in the bin, intimate the status if any stimulation of fire (or) smoke in the bin. The cap of the garbage was open automatically while the people put the waste into the bin. Power supply to the garbage for working performance of devices, to give power supply through “Electric current” by using adapter. To give power supply through “Solar system” by using Solar panel. Introducing the APP for waste management department by using Arduino Software and MIT App inventor. For network connection using the Wi-Fi modem and to share and store the data by using cloud technology. From the Smart bin “APP” the waste management department to manage and maintain the waste by monitoring the status of garbage bin conditions such as overflowing level of wastes, moistening condition in the bin and Fire & smoke condition in the bin. The outcome of this study is that, the waste management department can able to know about the update status of garbage bin so that they can take action instantly. The public people and the waste management department should be aware of waste management importance and How to make it simple and effective. System. Thus to maintain Clean and Hygiene city with the smart move of IoT technology.

4.4 ADVANTAGES

1. In our proposed system, to maintain the infrastructure of the garbage bin by monitoring the overflowing level of the wastes. To avoid the moisturizing and firing condition in the garbage bin.
2. The cap of the bin open automatically while people put the waste into the bin so that people will be convenient to use it. For power supply, can be use electricity from switch board while placed indoor purposes and can be use solar panel for power supply while placed in outdoor purposes.
3. It absolutely for user conveniences and it can reduce electricity charges. To intro the” Smart Bin App” for intimating the status of bin to the waste management department.
4. It causes the waste management department people can easily update the “Status of Bin”. Then to avoid the overflowing of waste around the bin and to avoid moisture and fire conditions of the garbage.
5. Thus we can maintain the waste management system simply and effectively and we can able to maintain Clean and Hygiene infrastructure int the city.

V.EXPERIMENTAL DISCUSSIONS

1) System Performance and Reliability:

Evaluate the accuracy and durability of sensors in smart bins, including their ability to monitor fill levels and weight. Test connectivity options (e.g., Wi-Fi, Bluetooth) for data transmission stability and measure metrics like sensor accuracy and battery life to ensure reliable performance.

2.) Data Analytics and Optimization:

Focus on developing algorithms to analyze data from smart bins for optimizing waste collection schedules and routes. Assess improvements in efficiency, cost savings, and recycling rates to demonstrate how data-driven insights enhance waste management practices.

3.) User Experience and Engagement:

Test the app’s usability and features, such as real-time notifications and waste tracking. Gather user feedback to evaluate app effectiveness and user satisfaction. Measure engagement levels and adoption rates to identify areas for improvement.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 10, October 2024

4.) Operational Efficiency and Cost-Effectiveness:

Compare operational metrics before and after implementing the smart bin system, focusing on factors like fuel consumption and labor costs. Analyze cost savings and efficiency improvements to determine the system's impact on waste management operations.

5.) Privacy, Security, and Data Management:

Implement and test data protection measures, including encryption and anonymization, to ensure user privacy and data security. Evaluate the system's compliance with privacy regulations and its effectiveness in safeguarding sensitive information.

VI.SYSTEM IMPLEMENTATION

6.1 SMART BIN SYSTEM:

6.1.1. Monitoring the overflowing level

The smart bin utilizes an ultrasonic sensor to monitor trash levels and detect overflow. This sensor emits ultrasonic sound waves to measure the distance to the trash, sending a notification when the bin is full. Additionally, the bin's lid opens automatically when someone approaches to dispose of waste. Ultrasonic sensors work by emitting high-frequency sound waves, which are inaudible to humans, and using a transducer to both send and receive these waves. By calculating the time, it takes for the sound waves to travel to the trash and back, the sensor determines the distance to the waste.

Fig 6.1.1 Ultrasonic sensor

6.1.2. Monitoring the Moisturizing level

A smart waste management system using IoT and water level sensors monitors moisture content in bins. The sensor measures the pressure at a certain depth (H) in the liquid waste, converting it into the water level. The system uses IoT devices, sensors, and cloud platforms to collect and analyze data, optimizing waste management, platforms to collect and analyze data, optimizing waste management, preventing overflow, and providing real-time monitoring. The ESP8266 WiFi module controls the components and actions via network connectivity, ensuring efficient waste management through automation.

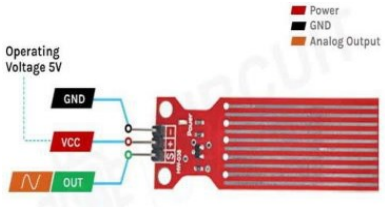


Fig 6.1.2 Water level sensor

6.1.3. Monitoring the Fire & smoke level

Monitor the status if any stimulation of Fire & smoke in the bin by use the technique of Flame sensor. A flame detector is a type of sensor that can detect and respond to the presence of a flame.These detector have the ability to identify smokeless liquid and smoke that can create open fire. A flame detector is a type of sensor that can detect and respond to the presence of a flame. These detectors have the ability to identify smokeless liquid and smoke that can create open fire. Thus can be avoid the fire and smoke condition in the bin.

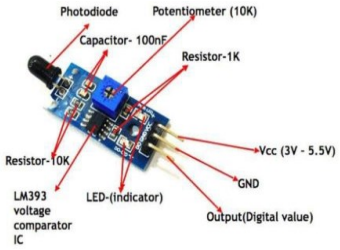


Fig 6.1.3 Flame sensor

6.2 POWER SUPPY SYSTEM

6.2.1 Electric Current

An adapter converts AC voltage to a single DC voltage for computers, acting as an external battery to reduce size. Many IoT devices, like sensors and microcontrollers, require power, and a 12V adapter is a common, cost-effective option. However, it's essential to check the device's specifications to ensure the adapter meets the required voltage and current.

Fig 6.2.1 12V Adapter

6.2.2 Solar System

Solar panels, made from silicon or other semiconductor materials, convert sunlight into electricity using photovoltaic PV cells. When exposed to sunlight, these cells

Fig 6.2.2 Solar panel

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 10, October 2024

release excited electrons that flow through a circuit, generating direct current DC electricity. This electricity can power devices or be stored in batteries. Solar panels are also referred to as solar cell panels, solar electric panels, or PV modules.

6.2.3. Smart Bin App

The "Smart bin APP" was created and installed in our mobile. It displays the status of bin with the conditions like BIN STATUS was GOOD if there is no overflowing, FIRE STATUS was GOOD if there is no fire, WATER STATUS was GOOD if there is no water. Thus the condition level of smart bin was displayed in our smart bin mobile app.

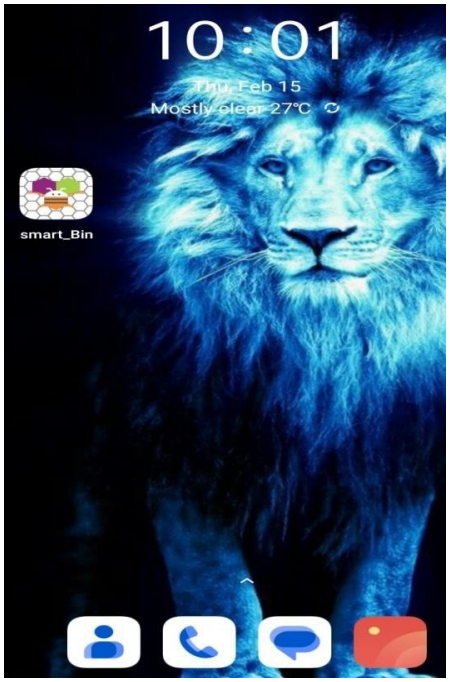


Fig 6.2.3 (a)Smart Bin App

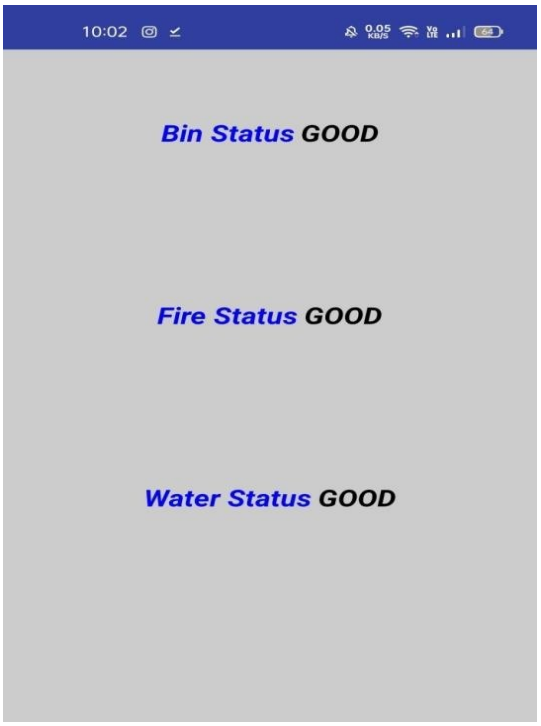
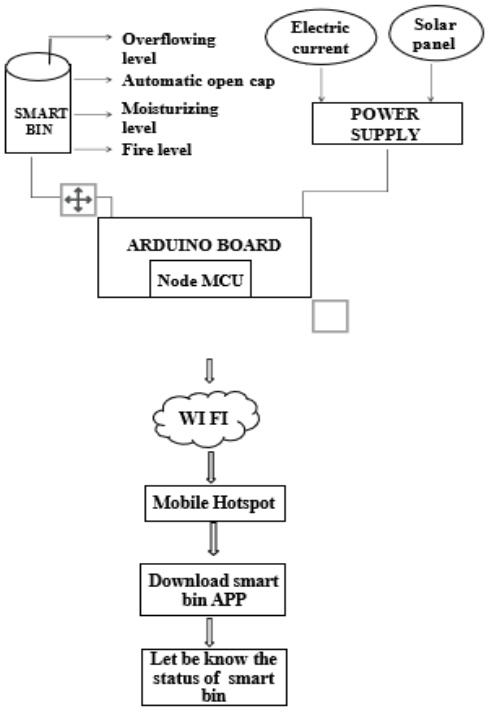


Fig 6.2.3 (b)Smart Bin App Output

VII. SYSTEM DESIGN

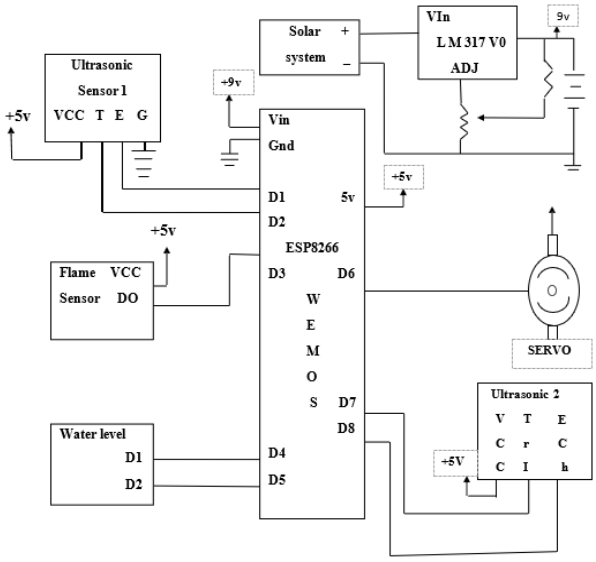
7.1 SYSTEM ARCHITECTURE:



(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 10, October 2024

7.2 BLOCK DIAGRAM



VIII. CONCLUSION & FUTURE WORK

8.1 CONCLUSION

In this project, the smart bin performs the action of monitoring the overflowing level of bin, monitor the moisturizing content in the bin, intimate the status if any stimulation of fire (or) smoke in the bin. The cap of the garbage was open automatically while the people put the waste into the bin. Power supply to the garbage for working performance of devices by using adapter and solar panel. Introducing an "APP" for waste management department to manage and maintain the waste by monitoring the status of garbage bin conditions such as overflowing level of wastes,
moisturing condition in the bin and Fire & smoke condition in the bin. The outcome of this study is that, The waste management department can able to know about the update status of garbage bin so that they can take action instantly. The public people and the waste management department should be aware of waste management importance and How to make it simple and effective system. Thus to maintain Clean and Hygiene city with the smart move of IoT technology.

8.2 FUTURE WORK

The shift to technology-driven solutions, this shift towards smart solution is marked by the integration of IoT, AI, and Data Analytics in waste management system. These technologies have enabled cities to handle waste more enabled cities to handle waste more effectively, with real-time tracking system, predictive analytics, and automated processes. The future of waste management lies in the adoption of innovative recycling technologies, the implementation of circular economy principles, and the promotion of zero waste strategies. In future the proper waste management helps to prevent pollution of air, water, and soil. It reduces the release of harmful substances into the environment, minimizing negative impacts on Ecosystems, Wildlife, and Human health.

IX OUTPUT:

X REFERENCE

[1] P. Jajoo, A. Mishra, S. Mehta and V. Solvande, "(2018). Smart Garbage Management System.2018 International Conference on Smart City and Emerging Technology",(ICSCET),2018.
[2] P.M.Jacob and P.Mani,"A Reference Model for testing Internet of Things based Applications", Journal of Engineering Science and Technology (JESTEC),vol.13,no. 8,pp.2504-2519,2018.
[3] M. Al-Jabi and Diab, "IoT-enabled citizen attractive waste management system,"in Proc. 2nd Int. Conf. Appl. Inf. Technol.Developing Renew Energy Processes Syst. (IT-DREPS), Jan. 2018.
[4] S. Vigneshwaran, N. Karthikeyen, m. Mahalakshmi, and V. Manikandan ,"A smart dustbin using LoRa technology,"Int. J.Sci.Res.Rev.,vol.7,no.3,pp.704708,2019
[5] O. Adedeji and Z. Wang."Intelligent Waste classification system using Deep learning convolutional neural network,"Procedia Manuf.,vol.35, pp.607612,Oct.Feb.2020.
[6] Z Lv,B.Hu,and H.Lv,"Infrastructure monitoring and operation for smart Cities based on IoT system,"IEEE Trans.Ind.Informat.,vol.16,no.3,pp. 1957-1962,Mar.2021.
[7] S Keerthana et al.,"2021.A Review on Smart Waste Collection and Disposal System Journal of Physics",Conference Series,vol.1969- 26-27 March 2021.
[8] P.Haribabu,S R Kassa,J Nagaraju,R Karthik, N Shirisha and M Anila, "Implementation of a smart waste management system using IoT",(ICISS).

(This work is licensed under a Creative Commons Attribution 4.0 International License.)