doi.org/10.54473/IJTRET.2024.8107
International Journal of Trendy Research in Engineering and Technology
Volume 8 Issue 1 February 2024
ISSN NO 2582-0958

GENERATION OF ELECTRICITY FROM WASTE MATERIALS USING Node MCU AND IOT

Nagashree R N, Chandana M Y, Divya M S, Keerthana P Tawade, Himashree G

Department of Electronics and Communication Engineering,
GSSS Institute of Engineering & Technology for Women, *Mysuru, Karnataka, India*

Received 04 March 2024 Received in revised form 10 March 2024 Accepted 12 March 2024

ABSTRACT

Nowadays, electricity is considered one of the major commodities in our lives. Due to the increase in demand for electricity, the supply also needs to be increased. There are many effective methods like hydroelectricity, solar power, nuclear power etc, one such method is the generation of electricity from waste materials which is eco-friendly and cost-effective, about 75% of waste in India is reduced by waste-to-energy conversion plants which decrease the number of pollutants like CO, SO2, NO2 to a huge number. With India's substantial population and the corresponding waste generation, implementing such solutions can significantly alleviate environmental concerns while meeting energy demands. To ensure effectiveness and sustainability, it's crucial to address any drawbacks associated with waste-to-energy conversion. This might involve optimizing technology to maximize energy output while minimizing emissions, ensuring proper waste management practices to handle various types of waste safely, and conducting thorough environmental assessments to mitigate any potential negative impacts. Collaborating with experts in renewable energy, waste management, and environmental science can provide valuable insights and guidance for our project. Additionally, engaging with local communities and stakeholders can help garner support and ensure the project aligns with their needs and concerns. Overall, we focus on reducing pollutants and promoting renewable energy production through innovative waste-to-energy solutions is commendable and holds great potential for a sustainable future.

Keywords: Waste-to-energy conversion, Renewable energy, Stakeholders, Sustainability, Pollution reduction

I. INTRODUCTION

The main goal of this paper is to generate electricity with the help of waste materials like paper, dry leaves, coconut husk etc which helps to generate electricity with less emission of harmful gases. The concept of generating electricity from waste materials not only addresses the pressing issue of waste management but also offers a renewable and eco-friendly energy source. By harnessing the energy potential of organic waste, such as biomass, agricultural residues, and municipal solid waste, we can simultaneously reduce the burden on landfills and contribute to the transition towards a circular economy.

IoT technology adds a new dimension to this endeavour by enabling real-time monitoring, control, and optimization of waste-to-energy processes. Through the integration of sensors, actuators, and communication networks, IoT systems can provide valuable insights into the composition, quantity, and quality of waste feedstock, allowing for more efficient and effective energy conversion. Moreover, IoT-enabled smart grids facilitate the seamless integration of distributed energy resources, including waste-to-energy facilities, into the existing power infrastructure, thereby enhancing grid stability and reliability.

The process of generating electricity from waste materials primarily involves thermal processes, such as incineration, which produce steam used to generate electricity. Thermal processes involve the incineration of waste, which is then used to generate steam and produce electricity. The main advantage of electricity generation by burning waste materials is that it reduces the volume of waste sent to landfills, which in turn reduces the amount of space required for landfill sites. This can help to mitigate the negative impacts of landfill sites on the environment, and greenhouse gas emissions.

The technology that is used is constantly evolving with new ideas which makes the process eco-friendly and cost efficient.

II. RELATED WORKS

Abhishek Pandey et al proposed **"Waste to Energy: Generation of Electricity Using Waste Materials"** In their paper they burnt the wastes is in a container where heat is been generated and in result, they found to get Electricity as an output. It is of low cost, low pollution and easy way.

Apurva Karn et al [2] utilized organic waste materials to produce biogas or direct combustion for electricity generation. It ensures that there is increase in demand

for energy and provides a renewable and sustainable source of energy. It requires significant upfront investments, making the initial costs relatively high.

Savitra Totad et al [3] have used high-temperature plasma to convert non-biodegradable waste into syngas, which can be used for electricity generation. They ensured that increasing volume of non-biodegradable waste poses environmental challenges. This project reduces the volume of waste in landfills, addressing the issue of waste accumulation. It requires high upfront costs for infrastructure and equipment.

Rohit et al [4] have used the method of incineration of dry waste. Rapid urbanization and population growth lead to an increase in the generation of solid waste which is converted to generate electricity by incineration of dry solid waste method. It encourages waste reduction at the source and reducing reliance on fossil fuels.

Harshit Sharmael al [5] addressed the issue of increasing number of wastes and its impact on humans they utilized energy harvesting sensors to power IoT devices using ambient energy sources. It reduces the reliance on external power supplies and continuous data collection from sensors may lead to data overload.

Kusumika et al[6] in their report they introduced Anaerobic digestion which is a process that decomposes organic matter in the absence of oxygen where Food waste often has high moisture content, which make it challenging to efficiently convert into energy. This contributes to a more sustainable and environmentally friendly energy mix.

Gopi Raju et al [7] their paper have addressed the issue of rapid urbanization which increases the solid waste they have utilized the method of burning waste to generate heat, it is used to produce steam to drive turbines. Provides a renewable source and contributing to a cleaner energy mix. But it releases pollutants, and may impact on air quality and public health which is the drawback of this project.

Sharma and Kaushal[8] proposed a "Design and Development of Intelligent Waste Monitoring System for Generation of Electricity with Cloud Based Online Access Control System"
They have carried out this work by applying machine learning algorithms. Insufficient data on waste generation hinders informed decision-making and resource optimization. This project ensures that easy accessibility, scalability, and reduces costs, and enhances resource allocation. Storing data in cloud raises concerns about data security, requires robust measures to prevent unauthorized access or data breaches.

III. METHODOLOGY

The system begins by burning collected waste materials within the firebox. This combustion process releases heat energy, which serves as the primary energy source for the system. The generated heat is then directed through a heating panel. This panel is designed to efficiently convert heat energy into electricity through thermoelectric or similar means. This conversion process allows the system to produce usable electrical power from the waste heat. The electricity produced by the heating panel powers LED bulbs, providing illumination. Any surplus electricity generated by the system is stored in batteries. These batteries act as a reservoir for energy, ensuring a consistent power supply even when waste combustion is not actively occurring. To prevent the dissipation of stored energy, a diode is incorporated into the battery circuit. A diode allows current to flow in only one direction, ensuring that energy stored in the batteries cannot leak back into the system or be wasted unnecessarily. The system includes a heat sensor that monitors temperature levels within the firebox or surrounding environment. When the heat sensor detects a sufficient level of heat, it triggers the activation of the energy stored in the batteries. This ensures that the LED bulbs receive power when needed, such as when waste combustion is producing significant heat.

A. Block diagram

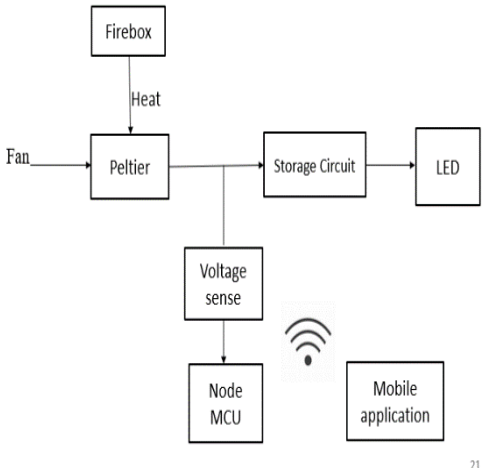

Fig 1-The above figure represents block diagram of generation of electricity from Waste Materials using IOT

B. Hardware and Software Requirements

Hardware Requirements:

i. Fire Box: The system uses firebox in order to heat the collected waste materials.

ii. Heating Grids: The heating grid is a component that converts waste heat from the firebox a

iii. A capacitor is an electronic component that stores electrical energy in an electric field.

iv. Storage Battery: A storage battery, also known as an accumulator or rechargeable battery, is a type of electrical battery that can store energy in a chemical form and release it as electrical energy when needed.

v. LED Bulbs: LED (Light Emitting Diode) bulbs are lighting devices that use semiconductor technology to produce light.

vi. Node MCU: Node MCU is an open-source firmware and development kit based on the ESP8266 Wi-Fi module, designed for IoT applications. It allows developers to easily build connected devices and projects by providing Wi-Fi connectivity and a platform for programming using Lua scripts or the Arduino IDE.

Software Requirements:

i. Arduino Software (IDE): The Arduino IDE (Integrated Development Environment) is a software application used for writing, compiling, and uploading code to Arduino microcontroller boards.

ii. Blynk application: Blynk is a mobile app that enables users to control IoT devices and projects remotely through a smartphone or tablet. It provides a user-friendly interface for creating customizable dashboards and interfacing with connected hardware using a variety of widgets and sensors.

C. Flowchart

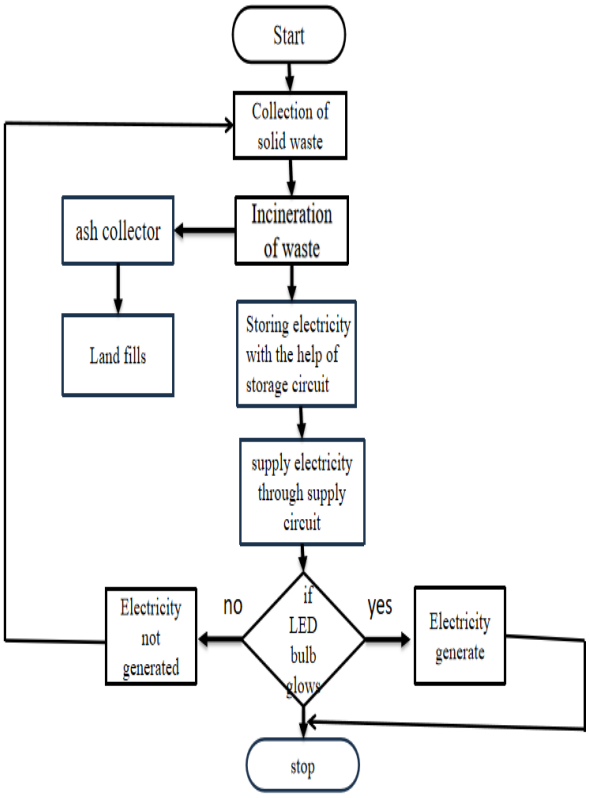

Fig 2-The above diagram represents flow chart of electricity by waste materials using IOT

The paper begins with the collection of solid waste materials, which are then processed for disposal. The collected waste materials are incinerated in a firebox, producing heat as a byproduct. The heat generated from waste incineration is utilized to generate electricity through a heating grid. The electricity generated is stored in a storage circuit, typically using batteries or capacitors, for future use. The stored electricity is supplied through a supply circuit to power various components of the system. If there is a demand for electricity, such as the activation of LED bulbs, the stored electricity is supplied, and the LED bulbs illuminate. If the LED bulbs are not illuminated, electricity generation ceases until there is demand, ensuring energy is produced only when needed.

IV. RESULTS

In the proposed system we used Node MCU which is connected to the mobile application in which the output is viewed. We need to observe the temperature difference across the Peltier module. The greater the difference between the hot and cold sides, the more electricity is typically generated. It also uses IoT sensors to continuously monitor the electrical output of the module and also create a user interface (UI) for visualizing the electricity generation data. Enable remote access to the electricity generation data. With this we can analyse the relationship between the temperature gradient across the Peltier module and the amount of electricity generated and also determine the optimal conditions (temperature difference) for maximizing electricity production and evaluate the accuracy and reliability of the data collected over time.

V. CONCLUSION

In conclusion, the generation of electricity using waste materials presents a promising solution for sustainable and eco-friendly energy production. This innovative approach not only addresses the escalating issues of waste management and renewable energy production but also contributes to reduce the energy demand by generating electricity. The main advantages of this paper, is that it is cost effective, it is efficient. This paper can be further developed to utilize the generated heat to produce steam which can be also used to produce electricity. By harnessing the energy potential of various waste streams, such as biomass, municipal solid waste, and industrial by-products, we can create a circular economy that maximizes resource efficiency. Embracing these technologies can play a pivotal role in the global transition towards a greener and more resilient energy landscape.

REFERENCES

[1] "Waste to Energy: Generation of Electricity Using Waste Materials" by Abhishek Pandey, Ashutosh Singh, Prabhu Dayal Singh and Dr. Akhilendra Yadav in International Journal of Creative Research Thoughts (IJCRT)Volume 9, Issue 7,2021

[2] "IoT Based Waste Management System and Utilisation of Wet Waste to Generate Electricity" by Apurva Karn, Anagha S, Misha Saara and Krishnapriya Sharma in International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET) Volume 9, Issue 6,2020

[3] "Electricity Generation by Non-Biodegradable Waste and Its Applications" by Savitra Totad, Rajendra Prasad J, Pavan J Katagi, Ajaykumar G S in IJERT Volume 11, Issue 5,2023

[4] "Generate electricity by using waste materials" by Rohit Patil, Rushikesh Ghate, Vinayak Karande, Amol Bhingardeve, Bhagyashri Patil in IRJMET Volume:04, Issue:12, 2022

[5] "Electricity Generation from Waste Materials" By Harshit Sharma, Aditya Jain, Dr. Sanjiv Kumar Jain in IJRTI Volume 8, Issue 5, 2023

[6] "Generation of Electricity from Food Waste" by Kusumika Krori Dutta, Kavya Venugopal, Assistant Professor, MSRIT, Members IJIREEICE, International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, Vol.4, Issue 4, April 2016.

[7] "Generation of electricity from municipal solid waste" by A. Gopi Raju, M. Hemanth Kumar in IEEE Connect,2021

[8]. S S P M Sharma and Kaushal Barot,'Design and Development of Intelligent Waste Monitoring System for Generation of Electricity with Cloud Based Online Access Control System',
Proceedings of the 4th International Conference: Innovative Advancement in Engineering & Technology (IAET) 2020