iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 Issue: III Month of publication: March 2026

DOI: https://doi.org/10.22214/ijraset.2026.78417

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue III Mar 2026- Available at www.ijraset.com

IoT-Based Intelligent Monitoring System for Efficient Biogas Production

Thomas Manoj Chacko[1], Jerin Biju[2], Sankeerth Sadanandan[3], Aibel Jaison[4], Tintu George T[5]
Department of Electrical and Electronics Engineering, Vimal Jyothi Engineering College
APJ Abdul Kalam Technological University

Abstract: In semi-urban and rural regions, biogas plants play a paramount role in converting organic waste into clean, usable energy. The main issue faced by most small-scale biogas systems is that they do not have any capability for real-time measurement and control, leading to system failures and poor gas yield over time. The proposed system offers the capability of IoT-based smart biogas monitoring and control, which would enhance reliability as well as the performance of small-scale biogas plants. The embedded controller in the system monitors key parameters such as methane concentration, temperature, gas content, and pH. The real-time sensor data is updated on a cloud dashboard via the Wi-Fi integrated controller, where the user can visualize and take necessary actions on the web dashboard. The architecture is also implemented with automation functions, which includes system status control and safety alerts. The proposed model is developed as a research-oriented model for studying bio-digester behaviour, stability of operation using digital monitoring tools, validation of the model using sample slurry to ensure reliable communication of modules, effective system integration, and stable data acquisition. This framework lays out an expandable footwork for smart energy research, educational training, and fact-based engineering design.
Keywords: Biogas plants, Internet of Things (IoT), parameter monitoring, smart energy systems, embedded control, waste to-energy conversion, real-time monitoring, automation, sustain able engineering, environmental sensing, fact-based engineering.

I. INTRODUCTION

A. Background and Context

Through anaerobic digestion, biogas plats effectively con vert waste into renewable energy [2], [10], [11]. Biogas is a sustainable alternative to fossil fuels in regions where organic biodegradable waste is easily available [3], [14]. These biogas plats provide a low-cost energy source with simple and easier construction and operation [9]. Almost all small to medium scale biogas plats works without any controlling or monitoring features [4], [12]. The digester tank is extremely sensitive to pH, slurry composition, and temperature [4], [11]. Variations in such parameters can significantly affect the gas production and digester health [3], [14]. Recent developments in IoT and cloud-based platforms have provided us with the ability to remotely monitor and control all the important parameters and real-time visualisations [1], [5], [6], [13]. Existing solutions are focused on industrial-scale waste treatment plants, which are not suitable for small-scale applications [7]. This research gap showcases the need for a reliable and effective monitoring and control system for small to medium-scale biogas digesters [1], [4], [15]

B. Problem Overview

In households and small communities, a large amount of biodegradable organic waste is produced [2], [10]. These waste needs to be managed properly, else leading to significant issues [3], [14]]. Small scale biogas plants help to manage this but most of these systems are purely mechanical and hence do not have real time monitoring or feedback systems hence resulting in an unstable system with reduced efficiency and reliability [4], [12]. In traditional systems, the critical parameters remain unobserved and hence make fault detection and optimization difficult [11]. In such systems, users cannot assess the systems condition without any assistance, causing many plants to become inactive over time [3], [14]. Long term effectiveness of such traditional systems are limited due to absence of technology like IoT integration and automation [1], [5], [6], [13].

II. LITERATURE REVIEW

A. Conventional Biogas System

An effective method to convert organic waste into usable energy is through conventional biogas systems using anaerobic digestion [1], [2]. Organic wastes such as agricultural by-products, animal waste, and kitchen waste are used to produce biogas rich in methane, along with nutrient-rich organic fertilizer [2], [3]. The conventional system mainly includes a digester tank, slurry inlet, outlet for fertilizer, and a gas collection dome.

The most commonly adopted biogas systems for small-scale plants are fixed-dome or floating-drum systems, mainly due to their low initial cost and simplicity [2], [3]. The most structurally durable out of the two is the fixed-dome plant, which requires minimal maintenance. While floating-drum systems provide comparatively more stable gas pressure, their maintenance requirements are often higher than fixed-dome systems due to the use of materials that may corrode over time [3]. In household-level installations, gas output mainly depends on user experience, gas handling, waste feeding, and routine inspections. One of the major shortcomings of conventional systems is the lack of continuous monitoring mechanisms [4]. Critical operating variables such as temperature, pH, and gas content cannot be determined in real time [5]. The microbial activity of the anaerobic digester heavily relies on these parameters. Variations in these conditions may negatively impact microbial activity, leading to unstable digestion [5], [6]. Faults are usually noticed by the user only after performance degradation, which raises concerns regarding the safety and efficiency of the system [7]. The scalability and reliability of conventional biogas systems are limited due to their dependency on manual supervision, even though they contribute positively to waste management and renewable energy generation [2]. These factors have led to the implementation of affordable automated control and sensing systems to enhance performance, reliability, and safety in modern biogas systems [1], [6].

B. IoT in Renewable Energy System

To enhance safety through real-time monitoring and to improve the operational efficiency of biogas systems, IoT technologies are employed [1]. The framework typically employs embedded controllers, cloud platforms, and sensors for the collection and remote monitoring of system parameters. The system can be implemented for a wide range of renewable energy systems such as wind energy and solar power plants [8]. Implementation of IoT systems ensures fault detection before failure occurrence, performance tracking, and predictive maintenance [6]. Modern studies have implemented IoT-based controls in bio-energy systems, including biogas plants, whose stability depends on multiple interacting parameters [4]. Sensors are used to determine variables such as methane presence, temperature, and pH. The data is then forwarded to embedded micro controllers, which process it and upload it to cloud dashboards such as Blynk for graphical representation of parameters and alerts [1], [5]. Cloud platforms are also used for storing historical data, providing user-friendly access to system trends. Overall, the implementation of IoT systems reduces manual intervention and supports information-driven decision-making in renewable energy systems [6].

C. Smart Monitoring in Waste-to-Energy

Waste-to-energy systems such as biogas plants involve complex biochemical processes that are highly dependent on operating conditions [2], [3], [9], [10]. Parameters such as temperature, pressure, gas composition, and the quality of the input feedstock directly influence the efficiency of the system [11], [14]. Traditional waste-to-energy systems mainly rely on manual observation and periodic maintenance [12]. As a result, system performance can decline if proper monitoring and maintenance are not carried out, which may lead to significant gas losses or even system failure [7]. Smart monitoring integrates digital intelligence with waste-to-energy systems by incorporating sensors, embedded controllers, and communication devices for continuous data collection and analysis [1], [5], [6], [13]. Through real-time data acquisition, critical parameters can be continuously monitored, enabling early detection of abnormal conditions such as gas leakage, pressure imbalance, or inefficient digestion [4], [15]. This approach reduces the need for frequent manual inspections and provides data-driven support for effective maintenance and operation [6], [7]. Recent advancements in low-cost Internet of Things (IoT) technologies have enabled the adoption of smart monitoring in small-scale waste-to-energy systems [1], [5], [8], [13]. Compact micro-controllers, low-power sensors, and cloud-based dashboards allow data to be collected, transmitted, and analysed remotely [5], [6], [8]. These systems enhance transparency and safety while offering valuable insights for tracking the long-term performance of the system [1], [13]. However, most existing smart monitoring solutions are designed for large-scale waste-to-energy plants and are not well suited for domestic or small-scale applications [7]. High cost and system complexity remain the primary barriers to their adoption in smaller installations [6], [8]. This highlights the need for affordable, modular, and user-friendly smart monitoring frameworks that can effectively bridge traditional waste to-energy systems with modern digital technologies [1], [4], [15]. D. Limitations of Existing Approaches Currently, small-scale biogas plants rely on manual monitoring and control, limiting their operability and reliability [2], [3], [10]. Conventional installations lack parameter monitoring, reducing their productivity [11], [12].

Some research introduced sensor-based monitoring but are often designed for large-scale applications with high-cost requirements [4], [6], [7]. Also, current systems provide only limited availability of data for timely detection of faults and abnormalities [5], [15]. These limitations show the requirement for a reliable and affordable cloud and IoT-based monitoring and control system [1], [8], [13].

III.METHODOLOGY

A. Digester Design and Setup

The biogas digester designed is a demonstration-scale floating drum system apt for household-level organic waste pro cessing [9], [10]. The model consists of a digestion chamber, outlet, inlet provision for slurry feeding, and a gas collection dome [11]. The organic waste is segregated manually and mixed along with water to form a slurry with an appropriate solid-to-liquid ratio to be fed into the digester [2], [3]. The temperature range of operation is maintained within the appropriate mesophilic conditions to ensure stable anaerobic digestion [9], [14]. The system ensures regular feeding and controlled retention time to obtain consistent biogas production [10], [11]. The digestate produced as a by-product is collected through the outlet and is utilized as an organic fertilizer [2], [10].

B. Sensor Placement and Data Acquisition

One of the most important factors to be considered for accurate monitoring of the operating conditions is proper sensor placement. In the proposed system, the sensors are strategically positioned to determine the parameters that directly affect digestion efficiency and safety.

On the digester body, a temperature sensor is mounted to monitor internal thermal conditions, which is important for sustaining microbial activity. A pH sensor is placed in contact with the prepared slurry to monitor acidity variations during digestion. Near the gas outlet, a methane gas sensor is installed to detect methane presence and identify potential leakage conditions. IV. SYSTEM ARCHITECTURE A level sensor is added to measure the amount of slurry or gas accumulation within the system.

C. IoT Data Flow Model

The IoT data flow model describes the movement of data from the sensing stage of the system to the user interface for monitoring purposes [1], [5], [6], [13]. In the proposed system, the sensor data collected from the biogas digester is first acquired by the ESP32 micro-controller [5], [6]. The controller carries out basic processing such as checking and formatting of the sensor values before transmission [12], [15]. The processed data is then transmitted wirelessly using the built-in Wi-Fi capability of the controller to the Blynk cloud platform [1], [13].

The Blynk platform is used for data visualization and remote monitoring of the system [8], [13]. The received sensor data is displayed on a dashboard, allowing the user to observe real-time parameters including temperature, pH, gas level, and methane presence [5], [6], [15]. Alert notifications are generated when the monitored parameters exceed the predefined limits [7], [8]. The system supports access through mobile or web interfaces, enabling remote supervision without the need for direct physical interaction with the digester [1], [13].

This data flow architecture supports continuous monitoring and timely alert generation while maintaining reliable communication between the sensing hardware and the user interface [6], [8]. The implemented model forms a stable communication framework for smart biogas monitoring and control [1], [4], [15].

D. Control Logic and Automation Strategy

The control logic is designed to automate system operation based on real-time sensor feedback. Predefined threshold values are assigned to each monitored parameter, including temperature, pH, gas level, and methane concentration. The ESP32 continuously compares incoming sensor data against these reference limits to evaluate system conditions. When sensor readings remain within acceptable ranges, the system operates under normal monitoring mode. If deviations from safe operating conditions are detected, the micro-controller triggers appropriate control actions. These actions include activating an agitator motor to improve slurry mixing, regulating feeding operations, or generating alert signals through a buzzer for safety notification. In the event of abnormal methane detection, the system prioritizes safety by issuing immediate alerts to the user. This rule-based automation strategy minimizes manual intervention, enhances operational stability, and improves overall safety of the biogas system.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue III Mar 2026- Available at www.ijraset.com

IV. SYSTEM ARCHITECTURE

A. System Block Diagram

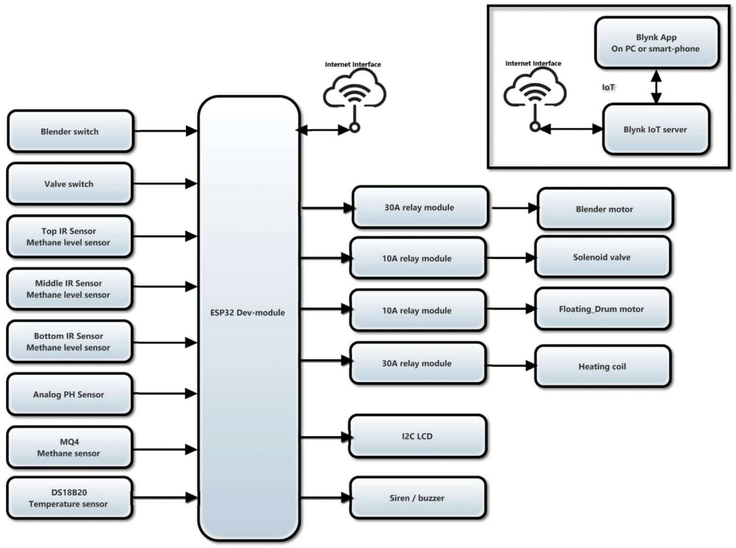


Figure 1: System Block Diagram

B. Hardware Architecture

The proposed system's hardware assembly is designed to ensure proper and reliable data acquisition, efficient operation, and ease of integration with small to medium-scale biogas plant digesters. The brain of the system is an ESP32 micro controller, which has integrated Wi-Fi and sufficient resources for monitoring and data transmission. Multiple sensors are used to monitor key parameters like methane concentration, temperature, level sensors, and pH sensor. All sensors are connected to the ESP32 through capacitor filters to ensure signal conditioning. Electrical isolation of low-voltage circuits from high-voltage actuators such as solenoid valve, shredder, and agitator motors is done through specialized relay modules. The power required by the controller, sensors, and actuators is provided from a regulated DC power supply. Proper earthing and insulation are ensured for maximum safety. All com ponents and wiring are properly waterproofed using silicon paste and protective sheaths. The assembly is modular, and it effectively helps to replace the parts and provides room for future expansions.

C. *Circuit Schematic*

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue III Mar 2026- Available at www.ijraset.com

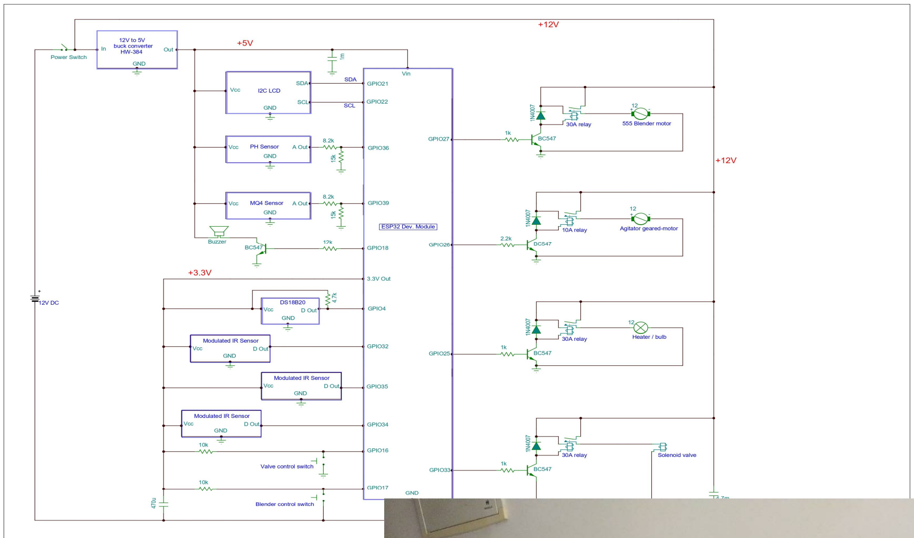


Figure 2: Circuit Diagram

D. Software Architecture

The software architecture is designed in such a way that it allows effective and reliable data acquisition, real-time communication with the digester, and visualization of parameters while reducing the requirement of computational power and memory [1], [5], [6], [13]. At the operational layer, the ESP32 micro-controller executes the firmware created using Arduino IDE, which handles periodic sampling of sensor data, filtering, and event detection [5], [6], [15]. Abnormalities such as pH increase, abnormal temperatures, and abnormal gas levels are monitored, and alerts are periodically generated accordingly [7], [15]. At the communication layer, the wireless transmission of data to the Blynk dashboard is done through Wi-Fi [1], [13]. The data packs are structured into compact formats to allow near real-time updates without network overload and congestion [6], [8]. Blynk dashboard is used for data storage, visualization, and user interaction [8], [13]. Incoming data are displayed through graphical plots within the dashboard; it also allows historical trend analysis and alert notifications for abnormalities [6], [8]. This specific software architecture allows future enhancements like predictive maintenance using artificial intelligence and advanced automation strategies [1], [4], [13].

V. IMPLEMENTATION

A. Hardware Implementation

Figure 3: Hardware Implementation

B. Firmware Design (ESP32 Logic)

The central processing and control is done by the ESP32 micro-controller. Its firmware is designed to collect real-time data, data filtering, and wireless communication. The datas are sampled into small packets and sent to the cloud dashboard for further processing. A threshold-based logic circuit is also implemented for detecting and providing warnings about unexpected abnormalities and faults. Communication scheduling is also given by the micro-controller to ensure a reliable connection with the cloud dashboard. This design allows fewer requirements for computational power and improves energy efficiency

VI. RESULTS AND ANALYSIS

A. Sensor Data Trends

The data collected through sensors during the test phase showed a consistent and effective anaerobic digestion process. Temperature readings remain in the optimum range suitable for the digestion process, with small deviations due to the influence of ambient environmental conditions. The continuous and real-time monitoring helped to maintain a stable pH value throughout the process, which provided stable gas production and good digester health. A gradual increase in methane concentration was obtained during the digestion phase. The IR sensor-based gas level monitoring showed gas accumulation within the collection dome, and the gas level showed periodic rise and fall patterns according to gas usage and production. These observations confirmed that real-time and periodic monitoring can provide effective analysis of digester performance and also help in preventing abnormalities and provide room for predictive maintenance

B. Gas Production Behaviour

The biogas production behaviour was observed under normal operating conditions after the digester setup and sensor integration. During stable operation, consistent gas accumulation was noted in the gas collection dome, indicating effective anaerobic digestion. Variations in gas production were observed during changes in slurry feeding and temperature conditions. When the digester operated within the recommended temperature and pH range, methane presence detected by the gas sensor showed steady readings. Temporary fluctuations in gas levels were observed during initial digestion and after feeding cycles, which gradually stabilized over time. These observations indicate that maintaining suitable operating conditions plays a key role in achieving consistent biogas generation.

C. System Stability Analysis

System stability was evaluated based on the consistency of sensor readings and the response of the automation logic during operation. Temperature and pH values remained within acceptable ranges for most of the operating period, supporting stable microbial activity. The system was able to detect deviations in sensor values and respond through alert mechanisms without manual intervention. No sudden or prolonged sensor failures were observed during continuous monitoring. Minor fluctuations in readings were noted, mainly during environ mental changes or feeding intervals, but these did not affect overall system performance. The results demonstrate that the integrated monitoring and control framework supports stable operation of the biogas system.

VII. APPLICATIONS AND USE CASES

A. *Academic Research*

The proposed IoT-based smart biogas monitoring and automation system is an empirical research setup to study the anaerobic digestion process under controlled conditions. The real-time monitoring of variables such as temperature, pH, and methane presence makes it possible to conduct controlled research. The proposed system allows researchers to study the effects of process variables on gas production, process stability, and safety. The proposed system allows researchers to study the effects of process variables on gas production, process stability, and safety. The proposed system also has relevance to research in the field of renewable energy systems and IoT-based process control.

B. *Smart Waste Management*

The system has relevance to smart waste management in terms of the promotion of efficient conversion of domestic and community-level organic waste into useful energy. Continuous monitoring and automation of the system result in improved stability of digestion, decreased dependence on human intervention, and improved safety of operation. Real-time notifications and system monitoring facilitate prompt measures to be taken, thereby reducing waste handling problems, odour, and gas escape. The system promotes the use of biogas plants and the Internet of Things (IoT) to facilitate decentralized waste management.

VIII. FUTURE SCOPE

A. *AI/ML Integration*

Future enhancement of the proposed system can move beyond basic monitoring and control toward predictive operation by integrating artificial intelligence and machine learning techniques. The historical data collected from sensors such as temperature, pH, and methane concentration and stored on the cloud platform can be utilized for training machine learning models.

By analysing time-series trends in parameters like pH variation and gas production, the system can identify early signs of unstable digestion conditions. For instance, a predictive model can be developed to forecast abnormal conditions such as slurry acidification or reduction in gas yield based on past sensor behaviour. Such models can assist in adjusting operational parameters like feeding intervals or agitation cycles in advance, rather than responding only after faults occur. This approach can improve digestion stability and overall system efficiency. By building on the existing IoT-based monitoring framework, the integration of predictive analytics can reduce manual supervision and support more informed decision-making during system operation. In the long term, this can lead to the development of a self-optimizing biogas digester suitable for extended research and field-level applications.

B. *Predictive Analytics*

Predictive analytics can be integrated into the system to anticipate its behaviour using previously recorded sensor data. Historical trends related to gas production, temperature variation, and pH fluctuations can be analysed to identify patterns that indicate possible faults or gradual performance degradation. By predicting such abnormal conditions at an early stage, corrective actions can be taken before the overall efficiency of the system is affected. This predictive approach can improve system reliability and reduce unexpected downtime during operation. It also supports long-term performance assessment of the biogas digester by continuously evaluating operating trends, while retaining the existing hardware configuration without requiring additional modifications.

C. *Industrial Scale Extension*

The proposed system can be further extended for application in industrial-scale biogas plants by modifying the sensor ranges, control logic, and communication setup. Although the present implementation is limited to a demonstration-scale model, the same system architecture can be adapted to monitor larger digesters handling higher volumes of organic waste. By incorporating industrial-grade sensors and additional safety mechanisms, the system can support large-scale waste pro cessing requirements. Such an extension can facilitate wider adoption of IoT-based monitoring and automation in commercial and industrial biogas installations, while maintaining the core design principles of the proposed system.

IX.CONCLUSION

This work presented a low-cost IoT-enabled Smart Biogas Monitoring and Control System developed as a research-oriented prototype for domestic and small-scale biogas ap plications. Embedded sensing, real-time monitoring, cloud-based control, and visualization of key parameters of a biogas digester plant were included in the system in an effort to improve biogas plant efficiency. Experimental monitoring and observation inferred that real-time monitoring and control help understand digester behaviour, and the implemented system successfully collected and communicated the data under various operating conditions. This prototype acts as a testbed for educational research rather than being just a product. This model acts as a base for studying waste-to-energy systems and their operational behaviours and improving general awareness. This study shows that low-cost IoT-based monitoring systems can effectively contribute to the sustainable utilization of biogas plants.

X. ACKNOWLEDGMENT

We express our sincere gratitude to Vimal Jyothi Engineering College, Chemperi, for providing the necessary facilities and academic environment to carry out this project work. We would like to thank the Department of Electrical and Electronics Engineering for their continuous support and encouragement throughout the course of this project. We are extremely grateful to our project guides Prof. Laly James, Associate Professor and HOD, and Dr. G. Justin Sunil Dhas, Professor, for their valuable guidance, suggestions, and constant motivation during the development of this project. Their technical insights and feedback played a significant role in shaping the progress of the work. We would also like to express our sincere thanks to our project coordinator Prof. Tintu George T, Associate Professor, for her guidance and support during the review phases of the project. We extend our gratitude to all faculty members of the department for their cooperation and constructive inputs. Finally, we thank our friends and family for their encouragement and support, which helped us successfully complete this work.

REFERENCES

[1] Aditya Pandey, Omeed Momeni, And Pramodpandey, "Design and Implementation of IoT-Enabled Device for Real-Time Monitoring of Greenhouse Gas Emissions, and Pressure in Anaerobic Reactors", 26 September 2024.

[2] D. I. Mass´e, G. Talbot, and Y. Gilbert, "On farm biogas production: A method to reduce GHG emissions and develop more sustainable livestock operations," Animal Feed Sci. Technol., vols. 166–167, pp. 436–445, Jun. 2011.

[3] D. Chadwick, S. Sommer, R. Thorman, D. Fangueiro, L. Cardenas, B. Amon, and T. Misselbrook, "Manure management: Implications for greenhouse gas emissions," Animal Feed Sci. Technol., vols. 166–167, pp. 514–531, Jun. 2011.

[4] S. N. Hida, S. Prabowo, M. Kirom, and A. Suhendi, "Monitoring system of biogas production volume and digester pressure control," in Proc. 5th Int. Conf. Appl. Sci. Technol. Eng. Sci., 2023, pp. 493–498.

[5] S. Yang, Y. Liu, N. Wu, Y. Zhang, S. Svoronos, and P. Pullammanap pallil, "Low-cost, arduino-based, portable device for measurement of methane composition in biogas," Renew. Energy, vol. 138, pp. 224–229, Aug. 2019.

[6] S. Yang, S. A. Svoronos, and P. Pullammanappallil, "Development of inexpensive, automatic, real-time measurement system for on-line methane content and biogas flowrate," Waste Biomass Valorization, vol. 13, no. 12, pp. 4839–4849, Dec. 2022.

[7] T. Reinelt and J. Liebetrau, "Monitoring and mitigation of methane emissions from pressure relief valves of a biogas plant," Chem. Eng. Technol., vol. 43, no. 1, pp. 7–18, Jan. 2020.

[8] P. Das, S. Ghosh, S. Chatterjee, and S. De, "A low cost outdoor air pollution monitoring device with power controlled built-in PM sensor," IEEE Sensors J., vol. 22, no. 13, pp. 13682–13695, Jul. 2022.

[9] van Haandel, M. T. Kato, P. F. F. Cavalcanti, and L. Florencio, "Anaerobic reactor design concepts for the treatment of domestic wastewater," Rev. Environ. Sci. Bio/Technol., vol. 5, no. 1, pp. 21–38, Feb. 2006.

[10] C.F.Matos,J.L.Paes,´ E.F.M.Pinheiro,andD. V. B. D. Campos,"Biogas pro duction from dairy cattle manure, under organic and conventional pro duction systems," Engenharia Agr´ıcola, vol. 37, no. 6, pp. 1081–1090, Dec. 2017.

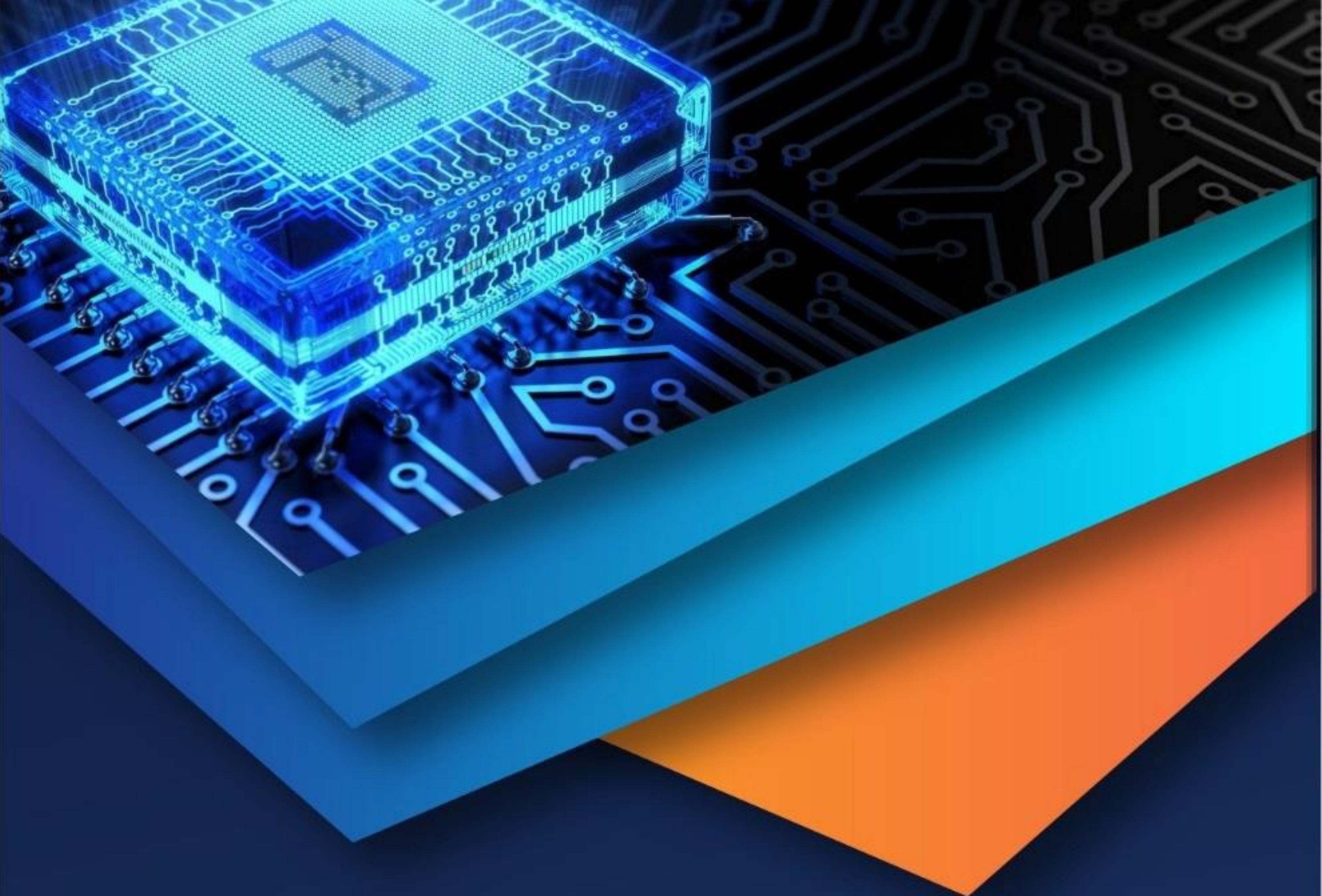
[11] Rico, J. L. Rico, I. Tejero, N. Mu˜noz, and B. G´omez, "Anaerobic digestion of the liquid fraction of dairy manure in pilot plant for biogas production: Residual methane yield of digestate," Waste Manage., vol. 31, nos. 9–10, pp. 2167–2173, Sep. 2011.

[12] R. C. Pereda, E. R. Mu˜noz, and G. H. Ruiz, "Automatic volumetric gas flow meter for monitoring biogas production from laboratory-scale anaerobic digester," Sensors Actuators B, Chem., vol. 147, no. 1, pp. 10–14, 2010.

[13] M. Kumar, T. Singh, M. K. Maurya, A. Shivhare, A. Raut, and P. K. Singh, "Quality assessment and monitoring of river water using IoT infrastructure," IEEE Internet Things J., 2023.

[14] M. Samer, "GHG emission from livestock manure and its mitigation strategies," in Climate Change Impact on Livestock: Adaptation and Mitigation, 2015, pp. 321–346.

[15] H. Rahadian, B. Sutopo, and I. Soesanti, "TGS2611 performance as biogas monitoring instrument in digester model application," in Proc. Int. Seminar Intell. Technol. Its Appl. (ISITIA), May 2015, pp. 119–124.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY