EVOLUTION IN ELECTRICAL AND ELECTRONIC ENGINEERING
e-ISSN: 2756-8458

EEEE

Vol. 6 No. 1 (2025) 92-97
https://publisher.uthm.edu.my/periodicals/index.php/eeee

Smart Meter Power Disconnection: Utilizing IoT for Power Meter Electricity Cut-Off

Khairulanwar Iskandar Hayat Mubarak[1], Rohaida Mat Akir[1*]

[1] *Faculty of Electrical & Engineering*
Universiti Tun Hussein Onn Malaysia, Batu Pahat, 86400, Johor, MALAYSIA

*Corresponding Author: rohaida@uthm.edu.my
DOI: https://doi.org/10.30880/eeee.2025.06.01.012

Article Info

Received: 11 January 2025
Accepted: 24 April 2025
Available online: 9 May 2025

Keywords

IoT, Smart Meter, Power Disconnection, Durian Uno, Blynk Application, Remote Monitoring

Abstract

The creation of an Internet of Things (IoT)-based Smart Meter Power Disconnection system is presented in this study. This innovative approach provides Tenaga Nasional Berhad (TNB) with a modern alternative to their conventional method of disconnecting the fuselink near the electrical meter to cut off the electricity supply. The proposed system enables TNB workers to control the power supply remotely using the Blynk app and the Durian Uno platform. By connecting their smartphones to Durian Uno, employees can toggle the power supply on or off with a simple command, eliminating the need for physical visits to customer premises. The system integrates a relay connected to the main power supply, which responds to commands from the Blynk app, ensuring seamless remote operation. The developed system was tested under various network conditions, demonstrating high reliability and responsiveness. Results indicate that power disconnection and reconnection commands are executed within seconds, providing a fast and efficient solution for TNB. The system successfully reduced the time and labor required for manual disconnection, lowering operational costs while improving service efficiency. Furthermore, its compatibility with mobile data allows operation from any location with network coverage, enhancing accessibility and convenience. This smart solution streamlines power management, optimizing TNB's workflow while ensuring a more responsive and cost-effective approach to electricity supply control.

1. Introduction

Single phase meter is a device used to measure the electricity consumption by residential users, business premises, government buildings, etc. The electric meter is calibrated according to the official billing unit, which most commonly is in kilowatthours, kWh. The electric meter is read periodically according to the electricity billing cycle (usually once a month); therefore, the electricity bill records the electricity usage during that billing cycle [1]. TNB has started cutting off power to customers who have not paid their monthly bills using a method called "plug-out fuselink." Normally, TNB workers disconnect electricity by removing the main fuse at the TNB meter. However, since the TNB meters are often located inside the customer's property, many workers face difficulties when stubborn customers keep their gates locked [2]. TNB cannot enter fenced houses to cut off electricity supply without permission because it is subject to the law (Section 441 of the Penal Code (Act 574). If they do so, TNB will face serious punishment [3]. Even though electric meters have been used for many years, they mostly still work in the same way, measuring electricity with analog or digital meters [4-6]. However, with the rise of smart meters and the Internet of Things (IoT), the way we track and manage energy use is changing, offering more accuracy and better user experience and can cut-off electricity using application. IoT applications

Evolution in Electrical and Electronic Engineering Vol. 6 No. 1 (2025) p. 92-97

are designed to monitor power systems, detect issues, communicate effectively, and resolve problems automatically without the need for human intervention [7]. This article introduces a smart meter power disconnection system that uses IoT technology to improve how electricity is managed and controlled. The system uses a Durian Uno microcontroller and a PZEM-004T sensor to track things like voltage, current, power, and energy usage. A mobile app called Blynk lets workers turn the power on or off remotely, making it easier and faster to manage electricity supply. The system is designed to replace the old method of cutting power by manually removing fuses near the meter. This new approach is faster and doesn't require workers to visit customer homes, saving time and reducing costs. The smart meter uses advanced tools but is simple to operate, making it a practical solution for both utility companies and customers.

These smart meters are commonly used in homes, businesses, and industries where tracking electricity use is important. The system is easy to use because all the readings are displayed on the Blynk app, and workers can control it from anywhere with an internet connection. This makes it a convenient and reliable way to handle power disconnections and reconnections. As the need for better energy management grows, systems like this smart meter are becoming more popular. It's a modern solution that is easy to set up, affordable, and effective, helping utility companies work more efficiently while keeping customers happy.

2. Methodology

The block diagram in Fig. 1 represents a system divided into three sections. The system is powered by a power source in the input area, and the power flow is managed by a cut-off switch that is operated through the Blynk app. An AC to DC converter in the system part converts the input power to DC, which is then used by an ESP8266-equipped Durian Uno microcontroller for processing and wireless communication. A relay controls connected devices in response to system inputs, while a PZEM-004T module detects important output data including voltage, current, and energy. In order to ensure smooth power management, the measured data is sent to a database in the output part, made available via the Blynk app, and shown on a smartphone for user monitoring and control.

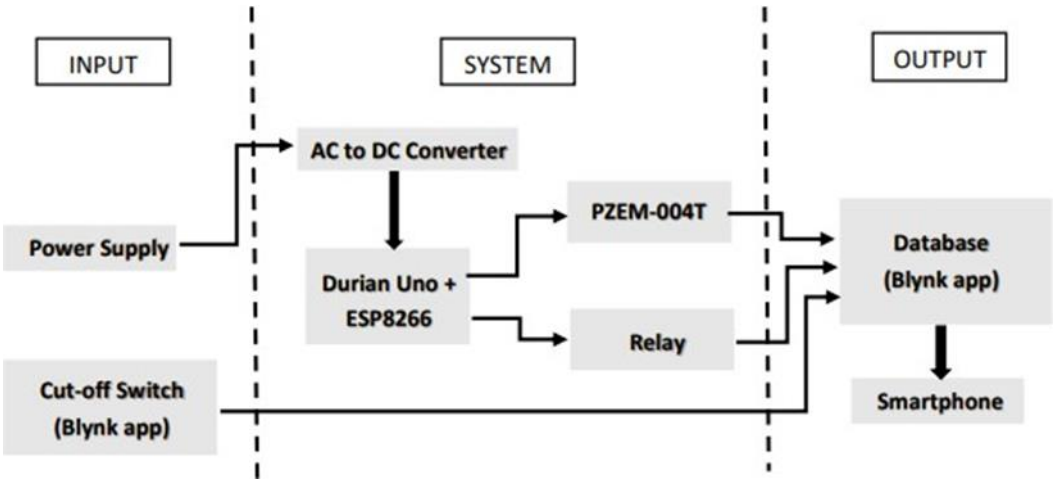


Fig. 1 *The block diagram of the full system*

The system starts by checking the consumer's electricity bill and initializing the Durian Uno microcontroller. It then connects to a Wi-Fi network to standby for cut-off and start monitoring the parameters. If the consumer has paid, the system ensures continuous electricity supply. If the payment is not made, the relay is activated to disconnect the electricity. The system then monitors the voltage and current to ensure operational safety and make sure the supply has been disconnected if the consumers did not pay the bill. This process continues until the payment is successfully received, at which point electricity is restored and maintained. Fig. 2 show a flowchart for this project.

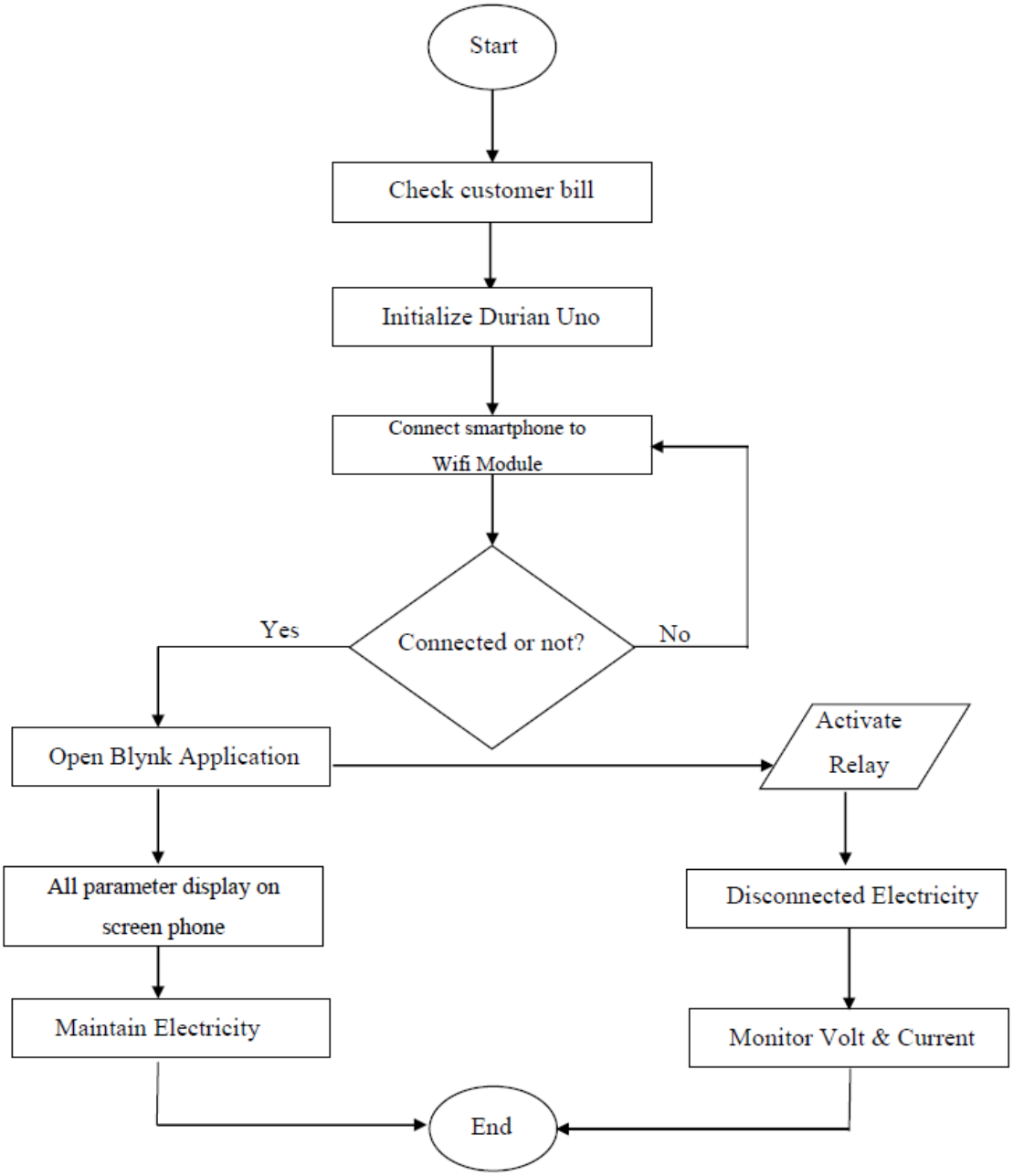


Fig. 2 *Flowchart of system development*

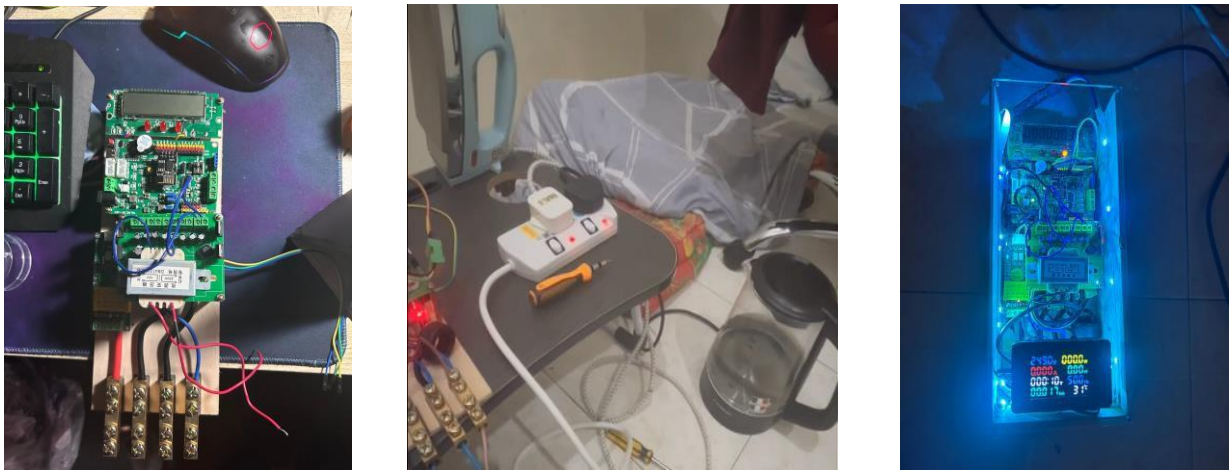
3. Results and Discussion

The main objective of this chapter is to develop an IoT-based system for remotely disconnecting power using a smart meter. Additionally, this chapter will evaluate the performance and reliability of the prototype. The results obtained from system testing and analysis are discussed in this chapter. Several experiments were conducted to ensure the system functions accurately. The project involves the integration of hardware and software components. After coding, the Arduino IDE will be used to upload and run the program. As a result, the system will display real-time data on the Blynk app, allowing remote monitoring and control of power supply disconnection.

3.1 Hardware Connection

Fig. 3(a) shows the connection of components in this project. Fig. 3(b) shows other equipment used to test the smart meter, including an extension plug as the Main Switch Board (MCB) commonly used in homes or premises. Fig. 3(c) shows the smart meter prototype for this project, which includes a digital display for users to monitor parameter readings.

Evolution in Electrical and Electronic Engineering Vol. 6 No. 1 (2025) p. 92-97



(a) (b) (c)

Fig. 3 *(a) The image of connection to all components on base; (b) image of the extension plug used in project; (c) image of the smart meter*

3.2 Circuit Design and Software Development

Fig. 4 shows a smart meter power disconnection system designed using IoT technology. The system consists of a Durian Uno microcontroller (represented as an Arduino Uno in the schematic), a PZEM-004T module, an AC to DC converter, and a 30A relay. These components work together to monitor electrical parameters like voltage, current, power, and energy, while also allowing remote control of the electricity supply through the Blynk app. The Durian Uno microcontroller acts as the central unit, managing communication between the sensors and the Blynk app to ensure reliable performance. The PZEM-004T module is responsible for accurately measuring electrical parameters and transmitting this data in real- time to the app. Through the app, users can remotely send commands to the relay module, which is controlled by the Durian Uno, to disconnect or reconnect the power supply as needed. The AC to DC converter ensures that the Durian Uno receives a stable and suitable power supply for continuous operation. All components are interconnected with durable and properly insulated wiring, ensuring accurate data transmission and safe disconnection of the electrical supply. This setup makes the system efficient and user-friendly for monitoring and managing electricity usage remotely.

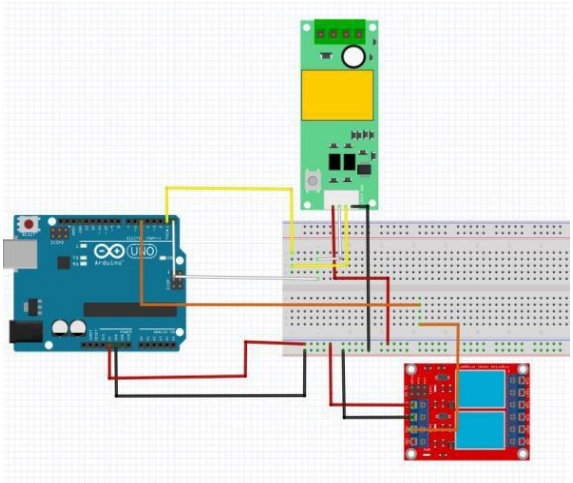


Fig. 4 *The circuit design for prototype*

Fig. 5 shows the Blynk app interface used to monitor and control the smart meter system. The app displays important information such as voltage, current, power, and energy usage. It also has a relay control button that lets the operator turn the electricity supply on or off remotely. When the power is disconnected, the app updates to show the current status of the supply. The app gives real-time feedback, showing voltage and current values dropping to zero when the power is cut, confirming that the command was successful. It also includes clear indicators for energy usage and connection status, helping utility providers easily monitor the smart meter's performance and quickly spot any problems. This

makes managing electricity simpler and more efficient.

Fig. 5 *The circuit design for prototype*

The next interface discussed is the Blynk application display, which provides real-time monitoring and control of the smart meter system. The interface displays parameters such as voltage, current, power, and energy consumption, along with the operational status of the relay module. The switch will display the word "OFF" when the relay module is activated to cut off the power supply. The voltage, current, and power readings update in real time on the dashboard, and the energy consumption value is logged for monitoring purposes. Table 1 presents the observed voltage and current values during different test conditions, including scenarios with and without loads connected to the meter.

Table 1 *Parameter Readings for Test Conditions*

Status	Voltage(V)	Current(A)	Power(W)	Energy(kWh)
OFF	0	0.04	0	0.055
ON	230 - 250	0.04	0	0.055

Fig. 6(a) shows the readings when tested with an iron. The current increased, and the power also went up. Next, Fig. 6(b) shows the readings when tested with a water heater, which showed higher current and power readings than the iron. Finally, Fig. 6(c) shows the readings when both the iron and water heater were tested at the same time. This caused the current reading to reach about half of the maximum current. The project's maximum current is 30A. This test checks the strength of the wiring and meter to prevent fire or explosions. Table 2 shows the readings from the three different device such as iron, heater and combination of both iron and heater.

(a) (b) (c)

Fig. 6 (a) *The image of reading tested by iron; (b) the image of reading tested by water heater; (c) image reading for both device*

Table 2 *Three Stage Value During Test*

Device	Voltage(V)	Current(A)	Power(W)
Iron	242.5	4.24	1028
Heater	237.4	8.91	2114.9
Both	233.6	12.81	2997

4. Conclusion

In conclusion, the development of an IoT-based smart meter power disconnection system has proven to be an effective solution for remotely managing electricity supply. This system utilizes IoT technology to monitor voltage, current, and power consumption in real time, providing a more efficient and accurate method for power disconnection and reconnection. By integrating the Durian Uno microcontroller, PZEM-004T sensor, and the Blynk app, the project successfully enables remote monitoring and control, reducing the need for manual intervention. The primary objective of creating a reliable and user-friendly power disconnection system has been successfully achieved. The smart meter operates efficiently, allowing authorized personnel to disconnect and restore power through a mobile application interface. The project leverages the Arduino IDE as the coding platform, ensuring smooth communication between the hardware and software components.

The results of this project highlight significant advancements in electricity management, benefiting both utility providers and consumers. The ability to remotely monitor and control power usage enhances operational efficiency, minimizes costs, and improves overall service delivery. This IoT-driven system represents a step forward in modernizing traditional power management methods, addressing key challenges in power supply disconnection while promoting smarter and more sustainable energy solutions.

Acknowledgement

The authors would like to thank the Faculty of Electrical and Electronic Engineering, Universiti Tun Hussein Onn Malaysia, for its great support.

Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors attest to having sole responsibility for the following: planning and designing the study, data collection, analysis and interpretation of the outcomes, and paper writing.

References

[1] Tenaga Nasional Berhad (2016). 2015 TNB Annual Report.
[2] A. Adam,(2024, May 10). Smart Meters vs Digital Meters vs Analog Meters.[Online]. Available: https://nerdplusart.com/smart-meters-vs-digital-meters-vs-analog-meters
[3] Single Buyer Code of Conduct (Peninsular Malaysia), Single Buyer Department, Version 1.0, 2017
[4] The NoBroker Times. (2024). Types of Electric Meters.
[5] M. Kadri & Salleh., "A Comparative Study of Meter Accuracy Between Single Phase Analog Energy Meter and Digital Energy Meter Under Various Load Condition." 2024
[6] C. L., Nwagbo & B. Baah, "A comparative study of basic types of energy meters and metering", Global Journal of Engineering and Technology Advances, 2022, 10(01), 117–124.
[7] R. F. Harrington, Field computation by moment methods, 3rd ed., New York: The Macmillan Co., 1989, doi: https://doi.org/10.1007/s11277-022-09956-9