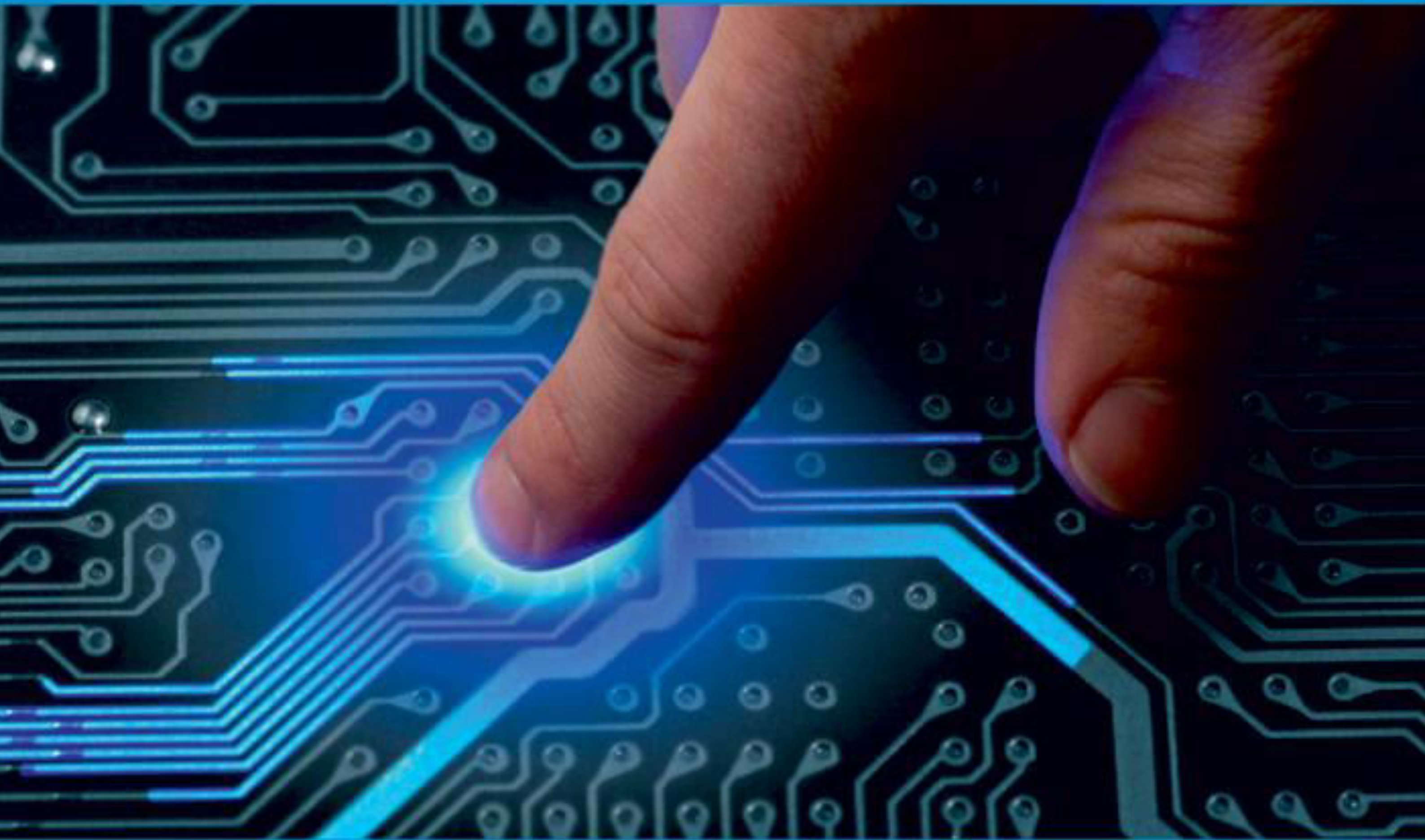
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 11, Issue 4, April 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 4, April 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1104029 |

IOT Based Smart Energy Meter With Theft Detection System

Dr.S.Zulaikha Beevi[1], D.Madhu[2], S.Kavin[3], S.Muthuganesh[4]

Professor, Department of Computer Science and Engineering, V.S.B Engineering College, Karur, Tamilnadu, India[1]

Student, Department of Computer Science and Engineering, V.S.B Engineering College, Karur, Tamilnadu, India[2]

Student, Department of Computer Science and Engineering, V.S.B Engineering College, Karur, Tamilnadu, India[3]

Student, Department of Computer Science and Engineering, V.S.B Engineering College, Karur, Tamilnadu, India[4]

ABSTRACT: The energy use of electricity consumers may be tracked in real time using automated and smart meters. They are regarded as important technological enablers of the smart grid because the real-time consumption data they can gather allows for the creation of novel, complex charging systems. It could enable more effective operation of the power distribution system and might result in a number of value added services. Using power monitoring techniques enables power monitoring systems to receive information remotely, in relation to coordinates, and at certain times. This project's primary goal is to alert the electricity board about instances of electric power stealing. Via embedded technology, it persists. This system is able to measure both the power transmitted over the load and the power used by the load over time. IOT is used to monitor parameters. This method will notify the user of the payment via the user. The machine will automatically trip if the user doesn't pay the bill.

KEYWORDS: Smart Grid, Power Consumption, Demand Side Management System.

1. INTRODUCTION

When a system can act autonomously and make decisions without being told what to do, this is referred to as intelligence. An energy or electric meter counts the number of electrical units consumed by all of the devices that draw power from the primary power source[1]. The LCD or LED in an electronic meter is used to display the reading. On the meter, a calibration led is utilised to display the spent units. To read the meter and record the reading, labour is needed. The reading on the meter, which is used to calculate the power bill, is rising. A smart electricity meter and billing system powered by IOT completes the same work automatically.

The widespread installation of AMI (advanced metering infrastructures) in the current smart grid makes information sharing more effective and dependable. Depending on the location, which is essential to the end user, the AMI can be separated into several sectors. Smart meters and IOT (Internet of Things) monitoring equipment that can gather data quickly and in huge numbers are included in AMI [3]. Today's developers of smart homes concentrate on system design, routing algorithms, and forecast tools. Home users now have access to superior technologies for energy monitoring, management, and dependability thanks to these developments.

To better manage and control power usage for smart homes, the DSMS (Demand Side Management System) was established. The study on enhancing DSMS techniques such load shifting, dynamic pricing management, demand forecasting, and demand reporting system expanded as a result of this power conservation idea.

SG, dishonest users who tamper with their short message service to reflect lower usage readings in order to fraudulently cut energy bills can initiate power theft assaults. The misleading measurements used for load monitoring systems may impact the choices made by the SO about grid management, which may result in the instability of the grid or, in extreme situations, a blackout [5]. This dishonest behaviour not only results in financial losses.

Machine learning based algorithms that are trained on finely-grained power consumption estimates have been suggested in order to detect the fraudulent users. Yet, there is a severe privacy issue when the SO is given access to the consumer's fine grained power consumption measurements for the purposes of detecting electricity theft, load monitoring, and invoicing. The reason for this is that the fine grained readings reveal the customer's daily routines and including whether they are at home or away on vacation, how many people are there, which appliances they use [2-5].

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 4, April 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1104029 |

This might lead to criminal activity, such as burglars breaking into homes while residents are away. On the other hand, these private information may be offered to insurance firms so that they can modify their policies in response to client activity. In conclusion, the research challenge we address in this work is how to allow the SO to monitoring loads, calculate bills, and reporting suspicious users while protecting their privacy by without knowing the fine-grained power consumption data of the consumers. The rest of this paper is structured as follows. In Part II, the literature review is covered. The discussion of our suggested system models in Part III. The results are in Section IV. In Section V, the paper is concluded.

II. LITERATURE SURVEY

[6] The presented system uses an IR sensor unit to detect power usage. The ARM processor will recognize the unit pulse after obtaining the power consumption. The unit will then be translated to our currency using governmental tariff values and displayed on the LCD display screen for a specific user. Shortcomings are the system is complicated and time-consuming, and the data is not saved.

This technology pioneered the AMR (automated meter reading) idea, which transfers the automatically gathered data to a central database for invoicing [7]. AMR automatically collects energy usage. Zigbee is utilized in the system, thus there is a range restriction. Moreover, there is a processing issue with images.

A smart energy meter for an autonomous metering and billing system is presented in this paper [8]. The quantity of energy used in this meter and its corresponding amount will be continually shown on the LCD and transmitted to the base station in charge. Its time constraints and limitations affect its job.

[9] The project's major goal is to use GSM to update our billing system. The GSM is a method that uses the TDMA (time division multiple access) concept and runs at a frequency of 900 Mhz. The mobile device receives information about power lost from the energy meter, but it is less effective.

This paper [10] proposes a wireless technique that emphasis reading IEMs (Intelligent Energy Meters) and creating bills utilizing Arduino Mega and Ethernet Shield. The monthly produced bill will be communicated to the customer through SMS; negatives include a complex system and challenging data management.

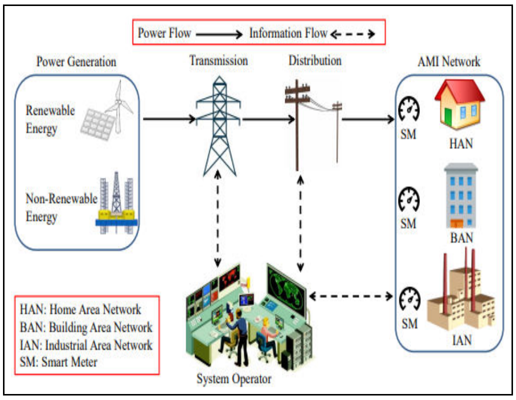


Fig.1. Conceptual architecture for the smart grid

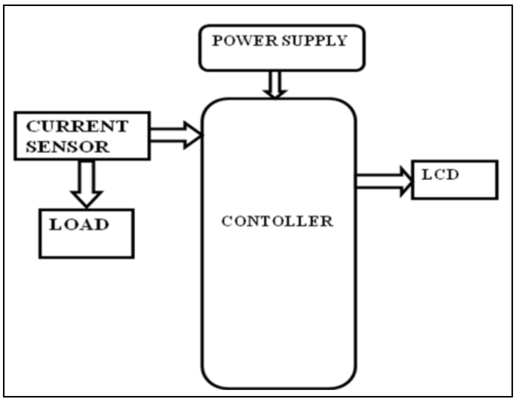


Fig.2. Block diagram of existing system

III. EXISTING SYSTEM

The energy meter will track the user's energy use and relay that information to the controller. The load is not controlled by it. It only notifies the user of a bill via the user. This method will notify the user of the payment via the user. The measured value is shown on an LCD screen. The figure 2 depicts the block diagram of existing system.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 4, April 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1104029 |

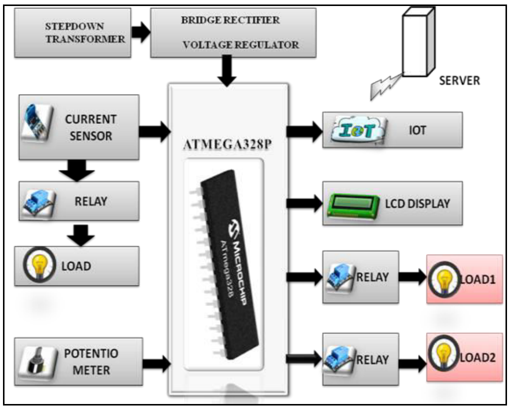


Fig.3. Block diagram

IV. PROPOSED SYSTEM

The energy meter will track the user's energy use and relay that information to the controller. The controller will continuously track energy use and update the IOT with the measured use value. The utilisation in a certain IOT website might be seen by the user or the official. Via IOT [11], this system will notify the user of the payment. The system will automatically trip if the user doesn't pay the bill. This system has a power theft detecting feature. This system is able to measure both the power transmitted over the load and the power used by the load over time. This power theft is discovered as a result. The IOT is updated together with the LCD display of the monitored parameters.

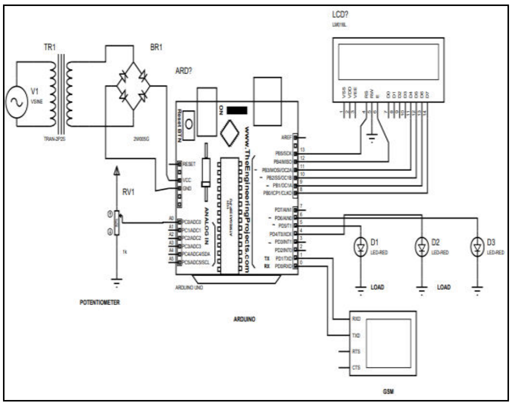


Fig.4 (a). Circuit diagram of simulation

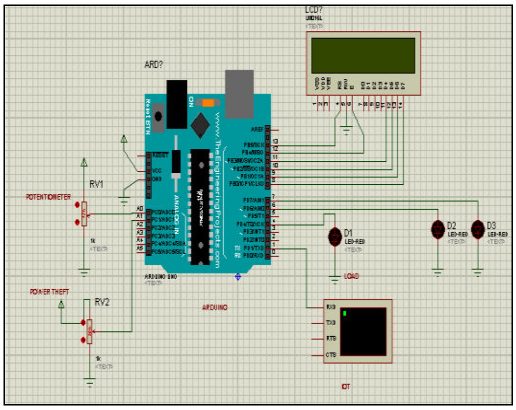


Fig.4 (b). Proteus Simulation

4.1 SOFTWARE AND HARDWARE REQUIREMENTS:

The programming language used is embedded C.

4.2 ARDUINO IDE

The compiler is Arduino Ide 1.8.3 is shown in Fig 5.

The cross-platform Arduino integrated development environment (IDE), which is accessible on Windows, macOS, and Linux, was developed using Java. It is used to write and upload programs to an Arduino board. Arduino is an open-source electronics platform with straightforward hardware and software.

An Arduino board may be used to take inputs like light on a sensor, a finger on a button, or a tweet, and then be used to start a motor, switch on an LED, or post anything online. You can control your board's operations by giving its microcontroller a set of instructions.

4.3 . PROTEUS

Simulation tool used is Proteus before being implemented into a real-time application.

Proteus is a simulation and design tool for electrical and electronic circuit design that was produced by Labcenter Electronics. The Proteus simulation feature. Several components of Proteus can be realistically replicated. Two techniques exist for simulating: Run the simulator or examine each frame one by one.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 4, April 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1104029 |

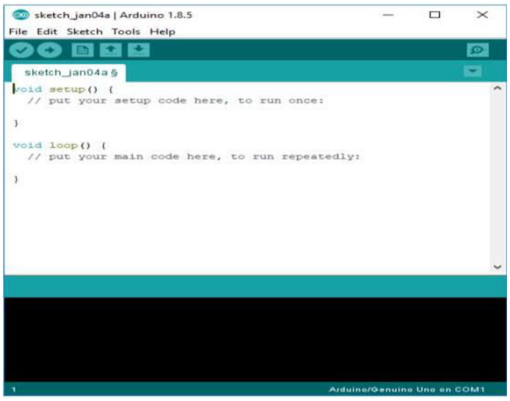


Fig.5. IDLE of Arduino

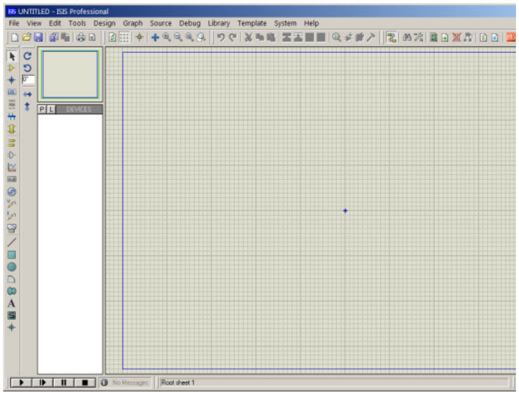


Fig.6. Proteus Application

The circuit is simulated at ordinary speed using the "Run simulator" option (If the circuit is not heavy). The "Advance frame by frame" option waits until you click this button once more before moving on to the next frame. This is useful for debugging digital circuits. Figure 6 depicts the proteus at rest.

Hardware needed includes an Arduino microcontroller, a current sensor, a load, Potentiometer, an LCD to display values, relay and Nodemcu to do an IOT part.

V. RESULTS

The results of simulation in a proteus application is given figure 7(a) and figure 7(b).

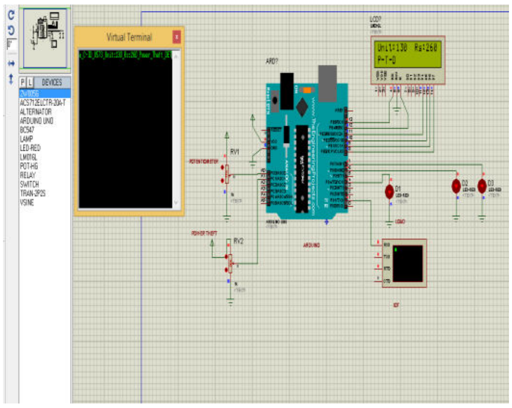


Fig.7 (a). Simulation in proteus (P-T-D)

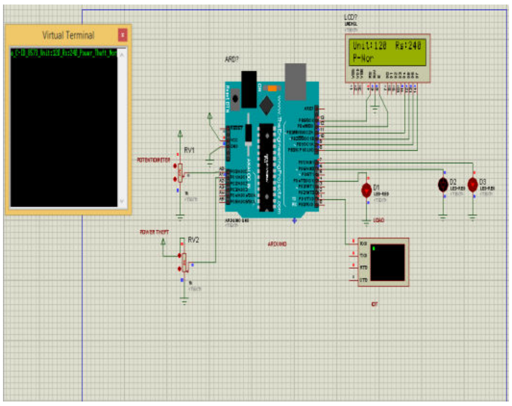


Fig.7 (b). Simulation in proteus (P-Nor)

5.1 ADVANTAGES AND APPLICATION

The benefits of the suggested system include user friendliness, ease of installation, and time savings in invoicing. The programs are the system may be utilized for water delivery, gas supply lines, and electric supply in residential and commercial areas.

VI . CONCLUSION

This research proposes a novel SETS (Smart Energy Theft System) for the detection of energy theft. As a component of SETS, a Multi Model Forecasting System was created. It is based on the integration of machine learning models such MLP (Multi Layer Perception), RNN (Recurrent Neural Network), LSTM (Long Short Term Memory), and GRU (Gated Recurrent Unit). Moreover, SMA (Simple Moving Average), a statistical model, was further refined into SETS. SETS can effectively identify instances of energy theft thanks to these algorithms. Finally, SETS strengthens the protection against energy theft of Internet of Things (IOT)-based smart home devices and can be further applied in commercial and industrial sectors.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 4, April 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1104029 |

REFERENCES

[1] P. Gope and B. Sikdar, "Privacy-aware authenticated key agreement scheme for secure smart grid communication," IEEE Transactions on Smart Grid, vol. 10, no. 4, pp. 3953–3962, Jul. 2019.

[2] P. Jokar, N. Arianpoo, and V. C. M. Leung, "Electricity theft detection in AMI using customers' consumption patterns," IEEE Transactions on Smart Grid, vol. 7, no. 1, pp. 216–226, Jan. 2016.

[3] Z. Zheng, Y. Yang, X. Niu, H. Dai, and Y. Zhou, "Wide and deep convolutional neural networks for electricity-theft detection to secure smart grids," IEEE Transactions on Industrial Informatics, vol. 14, no. 4, pp. 1606–1615, Apr. 2018.

[4] K. Gajowniczek, T. Zabkowski, and M. Sodenkamp, "Revealing household characteristics from electricity meter data with grade analysis and machine learning algorithms," Applied Sciences, vol. 8, no. 9, p. 1654, Sep. 2018.

[5] G.W. Hart, Departmant of Electrical Engineering and Center of Telecommunications Research, "Nonintrusive appliance load monitoring."

[6] Krishnarao.Kundeti, Saikumar Pallagani "Smart Electricity Billing System "

[7] Manisha V Shinde, Pradip W Kulkarni "Camera Click Energy Meter Reading System ".

[8] V. Preethi, Harish "Design and implementation of the smart electricity meter".

[9] P. Loganthurai, M. Veeralakshmi, A. Vanmathi, Professor, Department of EEE, K.L.N College of Engineering, "Smart Energy Meter Billing using GSM with Warning System",IEEE 2017.

[10] OsmiJaiswal, Dilip Chaubisa, B.E, Student Department of ECEL.D College of Engineering,"Arduino Mega and IOT based Intelligent Energy Meter (IEM) to Increase Efficiency and Accuracy in Current Billing Methodology" ICE-CDS-2017.

[11] A.Ramachandhran, K Gayathri, R.H.Aswathy and S.Zulaikha Beevi, "Modeling of internet of things enabled sustainable environment air pollution monitoring system", Global NEST journal, vol 25, Issue 4, No x, p. 172 – 179 ,2023.