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Review of an Internet of Things (IoT) Energy Monitoring and Home Automation System

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ABSTRACT

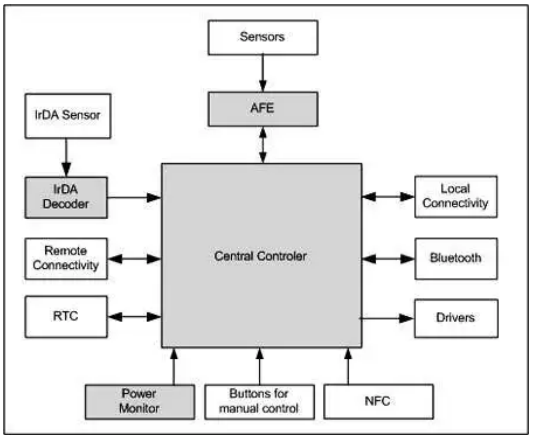
Collecting utility meter readings for power and identifying instances of unauthorized consumption is a labor-intensive and time-consuming ordeal in the majority of poor nations. Internet of Things (IoT) energy monitoring systems provide a practical and economical means of transmitting data on the consumer's energy use via wireless means. The purpose of this research is to find out how much power a home uses and then utilize Internet of Things (IoT) and telemetric communication methods to automatically create a bill for that amount. This article demonstrates how to implement a functionality of SMS notification using a GSM module. Through the website we developed, anybody may readily view the functioning meter. The online page displays the current reading along with the fee. We can automate the on and off functions of the meter. Furthermore, this initiative will also automate homes via the use of IoT technologies.

Keywords – IoT (Internet of Things), GSM, Energy Monitoring system, Home Automation.

1. INTRODUCTION

1.1. Internet Of Things (IOT):

More and more devices are connecting to the internet via the Internet of Things (IoT). A common definition is the expanding system of interconnected devices, or "things," that can transfer data across relatively slow networks. Several domains are making use of IoT, including logistics, healthcare, smart grid, and smart cities, as well as the automobile sector.



Source: Embedded.com

Fig-1.1.1. Connectivity amongst phases

The figure (1.1.1) illustrates the many benefits of the internet of things, such as the various ways in which we may connect our appliances and gadgets to the internet from anywhere in the world and integrate this connection with our house and linked devices. The Internet of Things (IoT) refers to the interconnection of disparate networks in embedded devices that are ubiquitous in modern life and linked to the web. Home appliances, healthcare, industrial, transportation, security, surveillance, electrical, and military systems are

just a few of the many that it intends to automate. Devices across domains need microcontrollers, transceivers, and protocols to standardize and enable communication between themselves and with other entities; otherwise, a completely automated process will not be possible.

2. LITERATURE REVIEW:

One of the most fundamental requirements in modern society is power usage. Thus, one of the world's tasks is to decrease power waste and increase the efficiency of all electrical equipment. In order to efficiently decrease energy consumption and use, it is necessary to create a system that monitors and controls electric appliance loads.

There are three main goals that guide the design of an IoT-based energy monitoring system. These are:

1. In order to provide real-time automatic load energy readings.
2. In order to make the most efficient use of the power.
3. Laid down the power use.

Distribution firms are unable to monitor customers' fluctuating maximum demand under the current invoicing method. Even with consistent bill payment, customers are still dealing with issues like unreliable power supply and low quality. The solution to all these issues is to monitor the consumer's load in real time. This will allow for precise invoicing, the identification of peak demand, and the detection of threshold values. When planning an effective energy billing system, these are all the factors that must be considered. The current "IoT Based Energy monitoring system" initiative seeks to resolve issues encountered by distribution corporations and customers alike. The smart energy meter is the primary focus of this article since it achieves its goals by integrating hardware and software, a characteristic of embedded systems.

3. EXISTING SYSTEM METHODOLOGY

Installed in your house, an electric meter permits the utility agency to bill you monthly based on the quantity of energy you have utilized. The electric meter is a device that monitors the current flowing into your individual electrical service panel from the service entry. Electric meters may be either mechanical, analogue, or digital, or "smart," as you probably already know. In the first scenario, a utility service representative would do the monthly meter reading at your house. Modern smart meters transmit data wirelessly via internet or radio waves.

Kilowatt hours are the standard unit of measurement for electrical usage. In other words, we are tracking the watts used over time. In other words, it is the job of the power consumption meter to keep track of the kilowatt-hours of energy drawn.

4. PROPOSED METHODOLOGY

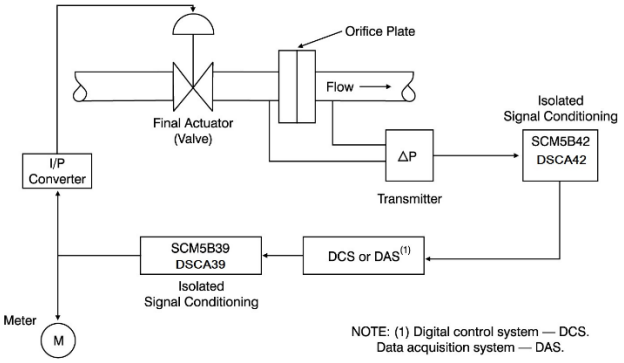
The power department may now take monthly meter readings using this technique instead of physically visiting each property. A permanent (non-volatile) memory location on an ESP32 unit, which continually monitors and stores the energy meter reading, may do this. This system keeps track of the readings in real time and, upon request, displays them on a website for the customer to see. You may also utilize this system to turn off the house's electricity when you need to.
The energy meter continually scans the readings as the different home appliances use energy, allowing one to see the consumed load on the meter.

- The meter's LED, which displays the reading, blinks incessantly. It is possible to count the units based on the blinking. The standard unit is 3200 blinks.
- The primary controller in our project is an esp32, and it continually monitors the energy meter.
- The ESP32 will determine the unit usage based on the flashing of the energy meter's LED.
- We have built a web page that will continually show the measured reading along with the cost estimate.
- With the use of Wi-Fi, the user may adjust the threshold value on the website according to their needs. It will notify the user when their reading is going to reach a certain threshold.
- Customers will be more aware of their energy use thanks to this threshold value notice.
- After receiving the alert, the customer may modify the threshold amount by going to the website.
- In the event that the user is unaware of the threshold notice, the meter will turn off automatically. After

that, they need to go back to the website and set a new threshold value. The meter will turn on automatically as the increment increases.

- Lastly, on the first of each month, both the consumer and the service provider will get a text message with the total monthly bill along with its associated costs.

4.1 SIGNAL CONDITIONER (P817)



Source: Dataforth.com

Fig-4.1.1: Signal Conditioning Circuit

We are using an optocoupler P817 as a signal conditioning block, and the above figure shows its basic internal functioning. One LED on a functional meter blinks continually; this does nothing more than show the power count. Whenever the LED blinks, it only generates 0.7v, which is too low for the ESP32 board to detect; so, we are using this block to rectify the problem. We are applying 5 volts to the transistor's output when the LED blinks, which causes the diode to conduct and the transistor to turn on. The ESP32 board will count the blinks and get a 5v power supply. In order to raise the voltage, we are making use of a signal conditioning block.

4.2 ESP32:

Low-power, system-on-a-chip microcontrollers with built-in Wi-Fi and dual-mode Bluetooth are part of the ESP32 family. Espressif Systems is a Chinese firm headquartered in Shanghai that designs and develops ESP32. TSMC uses their 40 nm technology to produce it. At its core, our system is ESP32. This board is crucial to the system's operation. ESP32 responds to the 5v supply from the opto-coupler by counting the supply, which it uses to determine the cost and power consumption. It keeps this information on file so that users may see their use history whenever they choose. It goes so far as to respond predetermined events, such as the transmission of a message at a certain threshold value, etc.

4.3 MAX 232:

With MAX232, we can send and receive serial data with the GSM and Wi-Fi modules, and we can adjust the amount of current flowing to each module based on our needs. Connecting GSM to ESP32 with MAX232 allows it to work with TTL. Depending on how it functions, certain Wi-Fi modules may need TTL, while others already have it built in.

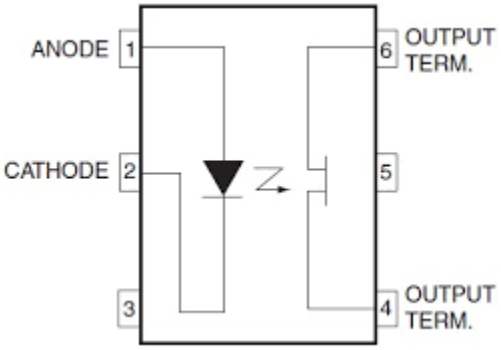
4.4 GSM MODULE (SIM900):

"Global System for Mobile communication" is what GSM stands for. All throughout the globe, people are using this mobile communication modem technology. GSM runs in the 850MHZ, 900MHZ, 1800MHZ, and 1900MHZ frequency bands and is an open and digital cellular technology that transmits mobile voice and data services. From 64 kbps up to 120 Mbps, it can handle it all. Using GSM, our system notifies consumers when they've reached a certain threshold and notifies service providers and consumers of their overall usage together with the cost of the unit.

4.5 WI-FI MODULE (ESP8266):

Wireless Fidelity is the abbreviation for these services. In order to power the Internet of Things, we are using Wi-Fi. The user may control the energy meter's on/off status and threshold value adjustments using Wi-Fi. The website updates its unit and cost measurements periodically. Through Wi-Fi, the user may have access to the ESP32 board and meter.

4.6 DRIVER CIRCUIT (MOC3071):



Source: Arduino Forum

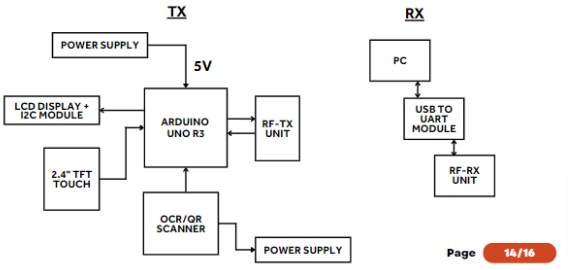
Fig-4.6.1: Driver Circuit

Opto couplers and opto isolators are terms for the same 6-pin device. To disconnect the AC power source, we're using an opto coupler in our project. You may turn off the AC power supply by connecting it to the SSR.

4.7 SWITCHING DEVICE (RELAY):

A relay controls high-power equipment by acting like a switch. Using a 5v relay to convert the 230v current into a form that ESP32 can handle is a workaround for devices that need higher voltages, since the operational voltage of ESP32 is just 5v. In order for a relay to regulate one electrical circuit, it must physically or electrically switch contacts in another circuit. With the NC pin connected to COM and INT1 set high, meaning the relay is not activated, we say that the relay is in open contact. There will be no power going to the relay since the contact is ordinarily closed (NC), or disconnected, while INT1 is high.

5. BLOCK DIAGRAM



Source: Arduino Forum

Fig-5.1: Block Diagram Representation

6. CONCLUSION

The development of an intelligent building has led to the creation of a system for monitoring and controlling smart electricity. Through a wireless network, this device is able to remotely monitor and manage the power usage of household equipment. Furthermore, shield the load from excessively high voltage. All of the components of the system are based on an embedded platform, which is small, cheap, simple to create, and

power efficient. So, a website and an Android app allow for constant monitoring of the electrical equipment. It is possible to expand this work to calculate the energy bill and power usage of the whole building. It is possible to control the load at the end of the line from the transformer by installing this project at the transformer and then checking the power in each transmission line to identify any unlawful connections for houses.

REFERENCES

[1] Himshekhar Das, L.C.Saikia, "GSM Enabled Smart Energy Meter and Automation of Home Appliances", PP-978-1- 4678- 6503-1, 2015 IEEE.
[2] Laura A.Chappell, Ed Tittel (2004), Guide to TCP/IP. Thomson.
[3] Transmission Control Protocol URL:http://en.wikipedia.org/wiki/Transmission_Control_Protocol
[4] Priyanka Kulkarni, & Dr. Swaroopa Shastri. (2024). Rice Leaf Diseases Detection Using Machine Learning. Journal of Scientific Research and Technology, 2(1), 17–22. https://doi.org/10.61808/jsrt81
[5] Shilpa Patil. (2023). Security for Electronic Health Record Based on Attribute using Block-Chain Technology. Journal of Scientific Research and Technology, 1(6), 145–155. https://doi.org/10.5281/zenodo.8330325
[6] Mohammed Maaz, Md Akif Ahmed, Md Maqsood, & Dr Shridevi Soma. (2023). Development Of Service Deployment Models In Private Cloud. Journal of Scientific Research and Technology, 1(9), 1–12. https://doi.org/10.61808/jsrt74
[7] Antariksh Sharma, Prof. Vibhakar Mansotra, & Kuljeet Singh. (2023). Detection of Mirai Botnet Attacks on IoT devices Using Deep Learning. Journal of Scientific Research and Technology, 1(6), 174–187.
[8] Dr. Megha Rani Raigonda, & Shweta. (2024). Signature Verification System Using SSIM In Image Processing. Journal of Scientific Research and Technology, 2(1), 5–11. https://doi.org/10.61808/jsrt79
[9] Shri Udayshankar B, Veeraj R Singh, Sampras P, & Aryan Dhage. (2023). Fake Job Post Prediction Using Data Mining. Journal of Scientific Research and Technology, 1(2), 39–47.
[10] Gaurav Prajapati, Avinash, Lav Kumar, & Smt. Rekha S Patil. (2023). Road Accident Prediction Using Machine Learning. Journal of Scientific Research and Technology, 1(2), 48–59.
[11] Dr. Rekha Patil, Vidya Kumar Katrabad, Mahantappa, & Sunil Kumar. (2023). Image Classification Using CNN Model Based on Deep Learning. Journal of Scientific Research and Technology, 1(2), 60–71.
[12] Ambresh Bhadrashetty, & Surekha Patil. (2024). Movie Success and Rating Prediction Using Data Mining. Journal of Scientific Research and Technology, 2(1), 1–4. https://doi.org/10.61808/jsrt78
[13] Dr. Megha Rani Raigonda, & Shweta. (2024). Signature Verification System Using SSIM In Image Processing. Journal of Scientific Research and Technology, 2(1), 5–11. https://doi.org/10.61808/jsrt79
[14] S. M. Amin and B. F. Wollenberg, "Toward a smart grid: power delivery for the 21st century," IEEE Power and Energy Magazine, vol. 3, no. 5, pp. 34-41, 2018
[15] Dr. Suvarna Nandyal, Prajita R Udgiri, & Sakshi Sherikar. (2023). Smart Glasses for Visually Impaired Person. *Journal of Scientific Research and Technology*, *1*(3), 21–31. https://doi.org/10.5281/zenodo.8021418
[16] Dr. Rekha J Patil, Indira Mulage, & Nishant Patil. (2023). Smart Agriculture Using IoT and Machine Learning. *Journal of Scientific Research and Technology*, *1*(3), 47–59. https://doi.org/10.5281/zenodo.8025371