IOT BASED AUTOMATIC READING AND BILLING SYSTEM OF ENERGY METER

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ABSTRACT

This project describes the implementation of energy meters using IoT concept and microcontroller based designs. The proposed system design eliminates human involvement in maintaining electricity. The power transmission can be switched off autonomously by the remote server if the buyer does not pay a bill within a duration provided to them. The user can control the energy consumption in units from a web page by providing the IP address of the device. The theft detection unit connected to the energy meter notifies the company when meter tampering occurs, it sends theft detection information through the modem, and the detected theft is displayed in the terminal window on the company page. The IoT process is carried out by the Wi-Fi unit, which sends data from the energy meter to a web page that can be viewed via the IP address. The hardware interface circuit consists of ATMEGA 328 microcontroller, MAX232, LCD display, ESP8266 Wi-Fi module, GSM modem. The Wi-Fi unit performs the IOT process by sending data from the energy meter to the web page.

Keywords: IoT, ATmega328 Microcontroller, Arduino, GSM Modem, ESP8266 Wi-Fi.

I. INTRODUCTION

In the Internet of Things (IoT) model, many of the creatures and non-living things that surround us are somehow present on the Internet. Driven by the popularity of gadgets supported by wireless innovations such as wireless Bluetooth, wireless frequency identification, Wireless Fidelity, and built-in sensors, the IoT has gone through the early stages and is trying to transform the current fixed Internet into a well-equipped Internet. is. Come to the internet. Currently, there are nearly 9 billion connected devices, and it is estimated that nearly 50 billion devices will be used by 2020. Today, the world is facing an environment that presents challenges. The energy crisis is a major problem in our society. Proper power consumption control and monitoring systems are one solution to this problem. One approach to dealing with today`s energy crisis is to reduce household electricity consumption. The number of consumers is increasing rapidly, and the burden on electric power companies is also increasing rapidly. Consumers need to be reassured by the ideal solution. In other words, the concept of the Internet of Things (IoT) meter and the service provider can also use the theft detection unit to be notified about the theft of electricity. By maintaining the above elements, the concept of an IoT meter consisting of a microcontroller unit and a WiFi unit has flourished. Users can monitor energy consumption on a per-unit basis from a web page by providing the device's IP address.

II. LITERATURE SURVEY

"GSM based automatic energy metre system with instant billing," International Journal of Advanced Research in Electrical, Electronics, and Instrumentation Engineering, page no 44-49, 3, April 2014. E.Moni Silviya, K.Meena Vinodhini, "GSM based automatic energy metre system with instant billing," International Journal of Advanced Research in Electrical, Electronics, and Instrumentation Engineering, page no 44-49, 3, April 2014.They suggest a system in this research that uses an IR sensor unit to measure the current consumption unit. The IR transmitter is installed in the EB meter's spinning unit. The receiver photo diode is set in a certain location to determine the number of rotations. We can calculate current consumption by multiplying the number of rotations. The ARM processor will reduce the unit given to a certain user after obtaining the current consumption. The unit is a numerical value in this case. If the unit is reduced to its bare minimum, the user will be notified via an alarm and an LCD display. If a user wishes to add more units for him, he must contact the EB section and submit a message. The required value will be delivered to the ARM controller via GSM modem from the EB section. The ARM will increase the unit in the memory based on the acquired value. As a result, the recharge process is completed fast and with fewer manual interactions. Our technology may be used in a variety

of settings, including industrial control, medical systems, and access control. "Design of electric Energy Meter for long-distance data information transfers based on GPRS," ISA 2009. International Workshop on Intelligent Systems and Applications in 2009. Yujun Bao and Xiaoyan Jiang, "Design of electric Energy Meter for long-distance data information transfers based on GPRS," ISA 2009. Electric energy metres send data and control commands remotely and wirelessly as the Internet has become more popular in China and GPRS service has improved. It not only completes the power data measurement and processing, but also realises TCP/IP by cutting, based on the present electric energy metre and the well-functioning ARM kernel microprocessor. The electric energy metre might be connected to the Internet via the GPRS service by using an ARM kernel microprocessor to control the GPRS module. Because it is handled by the C/OS-II operating system, the whole system is stable and reliable. This is especially true in some rural regions where the Cable Network has yet to gain traction. It not only improves the efficiency of acquiring and transitioning electric energy metre data information, but it also dramatically improves the national measure management of electric energy.

III. BLOCK DIAGRAM
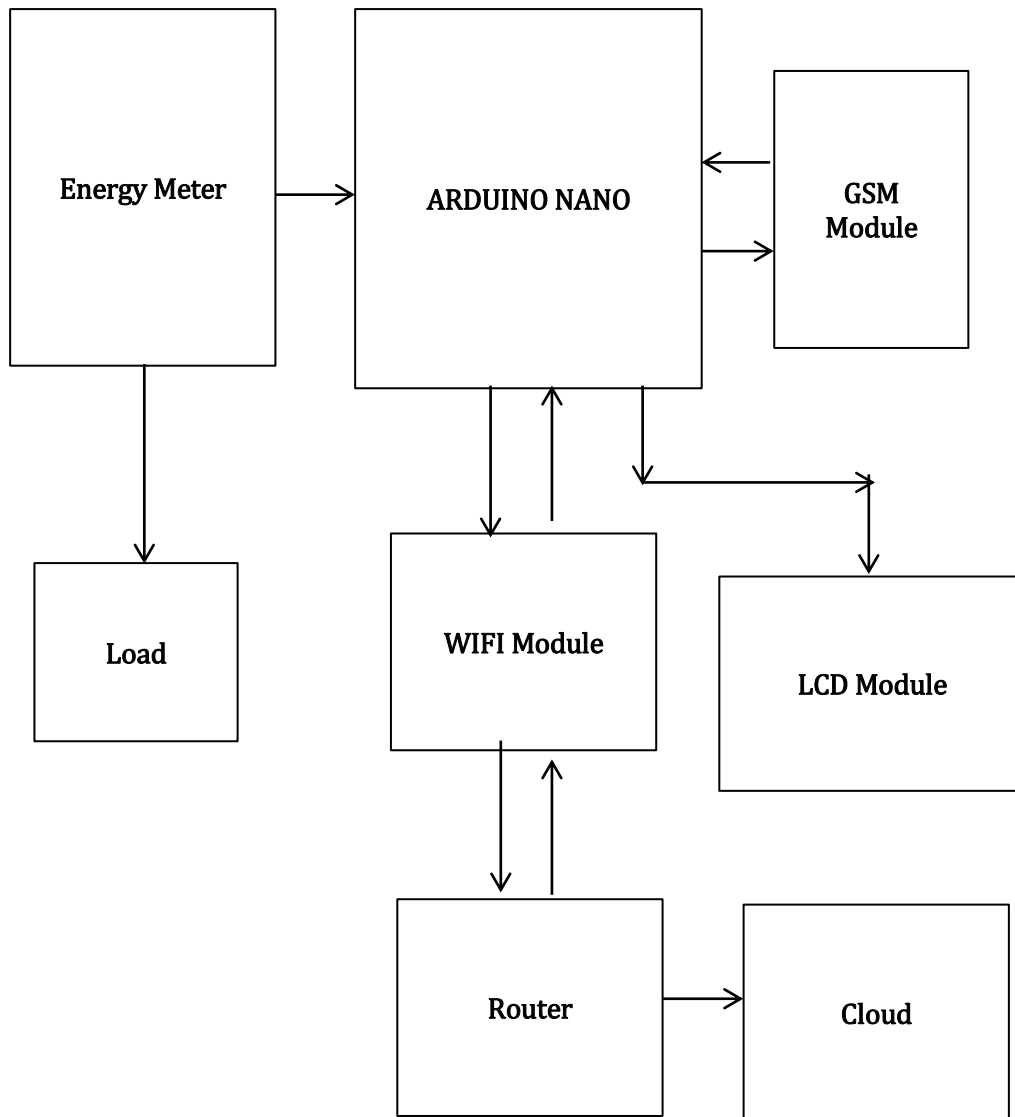
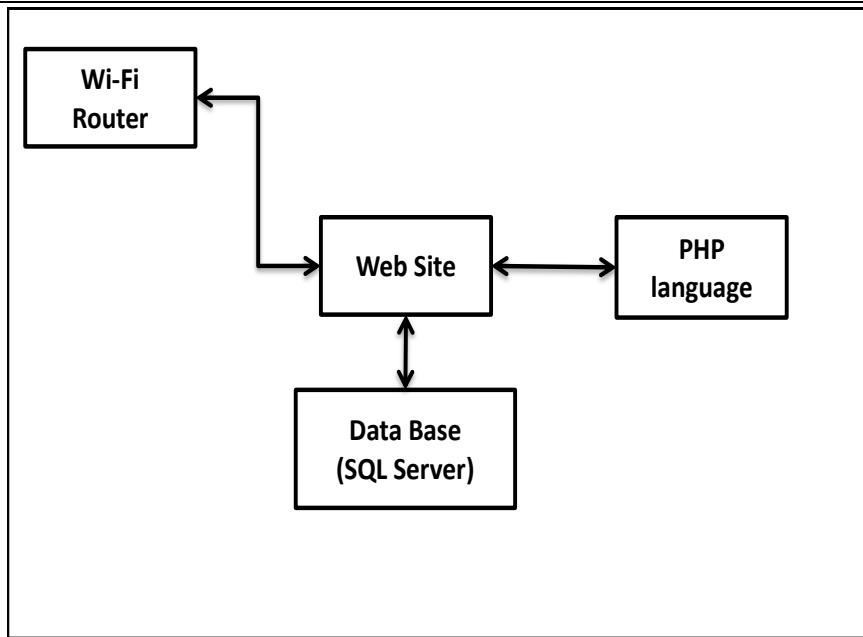**Fig 3.1 a:** Block Diagram of transmitter side

Fig 3.1 b: Block Diagram of server side

IV.   BLOCK DIAGRAM DESCRIPTION

ARDUINO NANO

Based on the ATmega328P launched in 2008, the Arduino Nano is a compact, comprehensive, and breadboard-friendly board. It has the same connectivity and specifications as the Arduino Uno board, but in a smaller package. The Arduino Nano has 30 male I/O headers in a DIP30-style arrangement that can be programmed using the Arduino Software integrated programming environment (IDE), which is common to all Arduino boards and can be used both online and offline. The board can be powered by a 9 V battery or a type-B mini-USB connection. The Arduino Nano Every, a pin-equivalent evolution of the Nano, was introduced in 2019. It has a faster ATmega4809 processor and twice as much RAM.

ENERGY METER

Energy meter is an electronic component which is used to display the units consumed by customer.

GSM-MODULE

GSM is the abbreviation for global system for mobile communication and is a mobile communication modem (GSM). In 1970, Bell Laboratories came up with the idea for GSM. It is most widely used mobile communication system in the world. GSM uses the 850MHz, 900MHz, 1800MHz, and 1900MHz frequency bands to provide mobile voice and data services.

WI-FI MODULE

The ESP8266 WiFi Module is a self-contained SOC with an inbuilt TCP/IP protocol stack that can provide access to your WiFi network to any microcontroller. The ESP8266 may either host an application or offload all WiFi networking functionality to a separate application processor. Each ESP8266 module comes pre-programmed with AT command set firmware, so you can just plug it into your Arduino and get about as much WiFi functionality as a WiFi Shield (right out of the box)! The ESP8266 module is a low-cost board with a large, and rapidly increasing, community.

LCD-MODULE

An LCD screen is an electrical display module that generates a visible image using liquid crystal. The 16x2 LCD display is a fairly basic module that can be found in many DIY projects and circuits. The 16x2 corresponds to a two-line display with 16 characters per line.

V.   WORKING PRINCIPLE

The automatic smart energy meter is developed with the help of ARDUINO NANO processor. The processor is the heart of the system as, all the devices are connected to the processor. Energy meter pins are connected to

the digital pins of D5. Program calculated the unit pulse coming from the energy meter and displayed on the LCD module. On the LCD, also the month displayed on it. GSM Modem is used to send the status of the energy meter, like the bill has been paid by the customer or not. GSM Modem is connected to the USART pin of ARDUINO NANO.GSM Modem get initialized through AT Commands. When we initialize the system, GSM Modem send a message to the customer phone number, that his energy meter get initialize. ESP8266 module i.e. WIFI Module is used to initialize with the WIFI Router. When the router gets initialize, on the serial monitor, status of connection shows on it i.e. WIFI Module gets connected to router. The WIFI Module gets connected with the user name and password of the router. The XAMPP Server is used as a web server. The database is created like meter id, customer name, units, month by using myphpadmin . For the connection with database php language is used. WIFI Module is used to connect the webserver through IP address of the webserver. In this project local host is used. When the month get change, at that time, WIFI module get command from the processor, that month has change, send the units and month to the database automatically at the particular meter id. If the customer doesn't pay the bill, then the bill department can disconnect the energy line through SMS. If customer then paid the bill then the line will be restore, through SMS.

VI. ADVANTAGES

- Easy & automatic billing.
- Saving of costing of meter reading.
- No paper work requires.
- The System is very reliable and fast.
- It's a consumer friendly system.

VII. RESULT AND DISCUSSION

This experiment results each hardware and package part. 1st of all the units displayed on energy meter are going to be received by Arduino Nano. Then this information is being displayed by the Wi-Fi module on server on the internet. The computer program of web site accessed by client is shown as follows. Machine-readable text mark-up language, hypertext markup language is side language. It's the part which is visible to the user. it's going to comprises graphical user interface which provides higher user interface for the user. PHP may be a all-purpose scripting language that's particularly suited to server-side net development, during which case PHP usually runs on an internet server. Any PHP code during a requested file is dead by the PHP runtime, sometimes to form dynamic website content or dynamic pictures used on websites or elsewhere. PHP is essentially side language. Its main task is to attach hypertext markup language page to actual remote webserver. It acts as interface between user window and actual server (database).
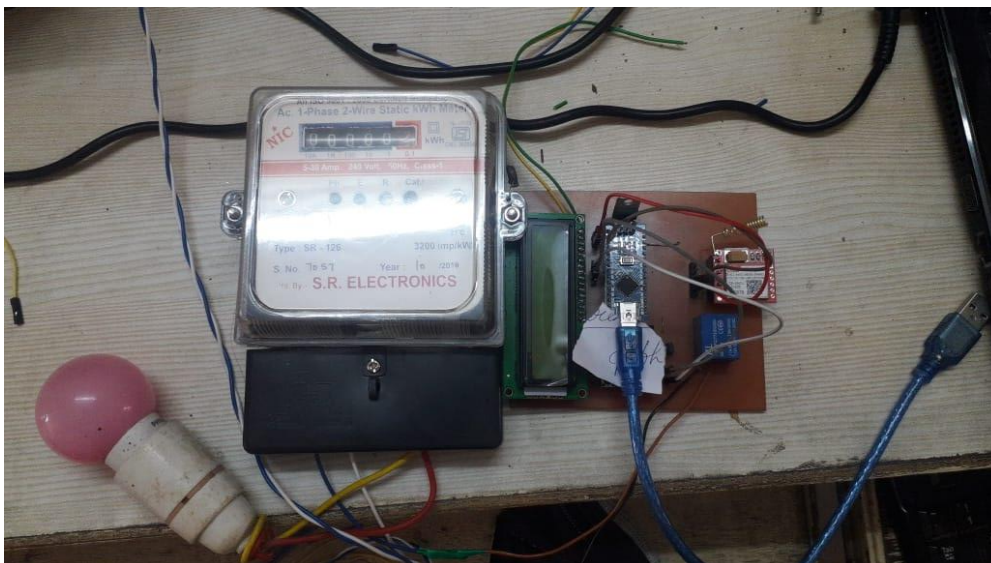
Fig 7.1: Snapshot of hardware of IoT Based Automatic Reading and Billing System of Energy Meter.
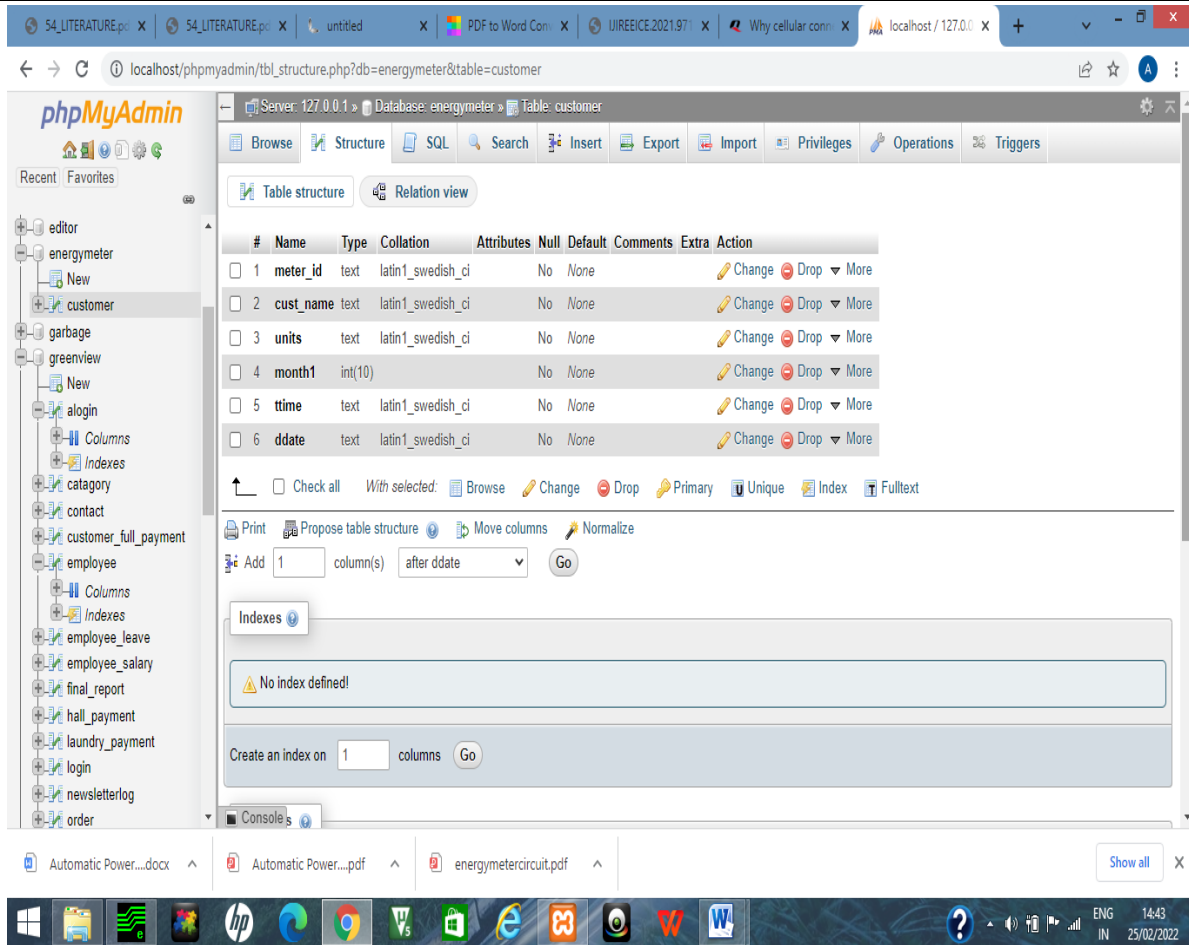
Fig 7.2: Snapshot of database structure of IoT Based Automatic Reading and Billing System of Energy Meter.
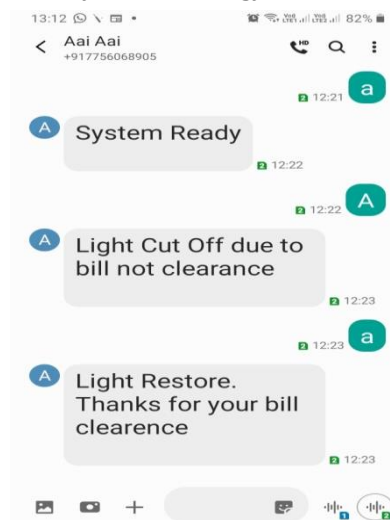

Fig 7.3: Messaging System of IoT Based Automatic Reading and Billing System of Energy Meter.

VIII.   CONCLUSION

- The GSM Modem get initialize by sending system ready
- WIFI connected to the internet router through user name and password
- On LCD Shows the units of the energy meter
- These units get send to the database, when the month get change
- The Packet get send to the server successfully

- GSM read and send the data successfully.

IX. REFERENCES

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