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Iot Based Smart Energy Meter System Using Arduino

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Abstract: Electricity is a crucial invention that would make life on Earth impossible. Electricity is a basic human requirement that is widely employed in home, industrial, and agricultural applications. As a result, there is a clear requirement to track the amount of electricity used. A representative from MSEB must go to each customer's home to measure power consumption and calculate the bill amount. As a result, it necessitates a lot of manual labour and takes time. In addition, IOT is a key notion in this project (Internet of things). The biggest disadvantage of this approach is that a person must walk from area to area, reading the metres of each house and handing over the payment.Errors such as an excess bill amount or a notification from the electric board even if the payment has been paid are typical. The concept of a smart energy metre employing IoT and ARDUINO is presented in this paper. We're utilising an ARDUINO in this manner since it's energy efficient (it uses less power), quick, and has two UARTs.

Keywords: Smart energy meter, Wi-Fi module, IOT, ARDUINO etc.

1. Introduction

Wireless technology is one of the many technologies that have been developed in today's society. This is important in automatic equipment and reduces human labour with the help of a microprocessor. We can see a person from the electricity board standing in front of our house, whose job it is to read the energy metre and give over the bills to the house's owner every month. This is just readout from the metre. We must pay the expenses, according to that reading. The biggest disadvantage of this approach is that a person must go from area to area, reading the metres of each property and handing them the bills. Errors such as an excess bill amount or a notification from the power board even if the bills have been paid are typical.

To address this flaw, we've devised a scheme that eliminates the middleman between the consumer and the service provider, as well as eliminating errors. To tackle the challenges outlined above, this study employs wireless technology in the form of an Automatic Meter Reading system. The suggested method communicates between the Electricity Board and the consumer section using the Internet of Things (IOT), conveying overall customer electricity usage, each load's power consumption, and The energy metre displays the number of units utilised and transmits the information to both the customer and the electricity board, eliminating manpower requirements. With the proliferation of wireless gadgets on the market, the concept is gaining traction. It uses the internet to link the hardware devices together bill information calculated with a microcontroller.
The Internet of Things (IOT) is a network of physical objects or "things" containing electronics, software, sensors, and network connectivity that collect and share data. Things can be recognised and managed remotely using existing network infrastructure, allowing for a more direct connection of the physical world and computer-based processes, resulting in enhanced efficiency, accuracy, and cost savings.In the IOT sense, heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring, or field operation devices that assist firefighters in search and rescue operations are all examples of "things." These devices collect essential data using a number of existing technologies and then transport it to another device on their own.

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2. System Design

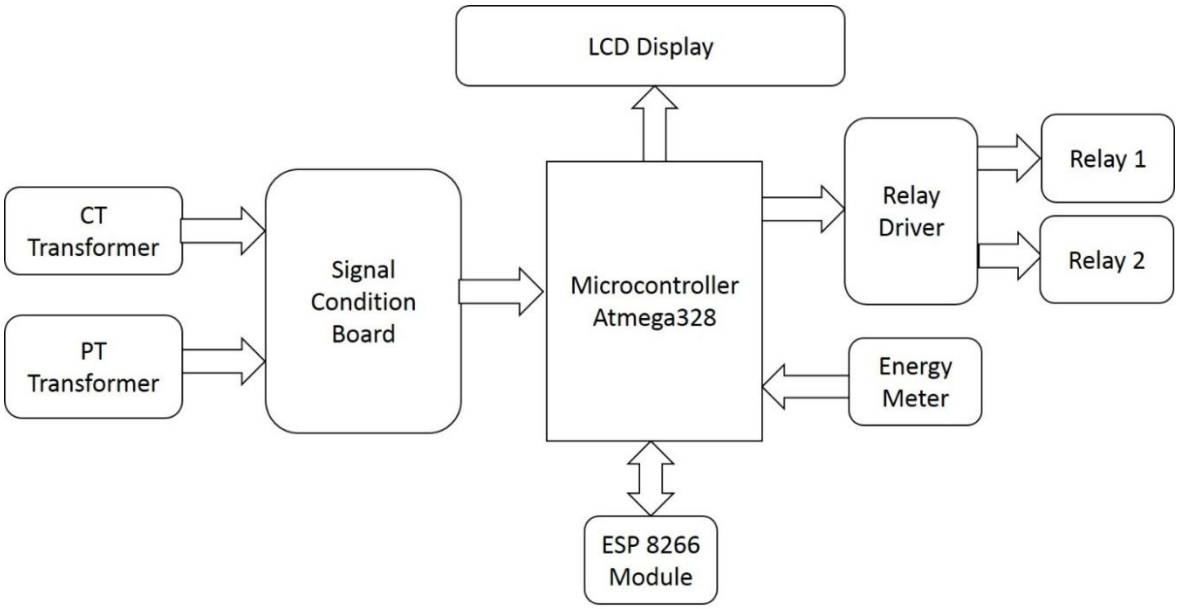

Fig.1.Block Diagram For The Proposed System.

The main purpose of the project is to produce an IoT-based energy meter reading that can be displayed in a chart and gauge format for units consumed and cost through the internet.For this creative project, we used a digital energy meter with a current and power transformer that is connected to a microcontroller via a signal conditioning board. The signal conditioning sends a readout to the configured microcontroller every time the meter LED flashes. The microcontroller takes this reading and sends it to the cloud via the ESP 8266. The ESP8266 is an internet-connected microcontroller with a Wi-Fi module. The data is sent serially from the ESP8266 to the thoughts speak web page, resulting in a multi-level graphical display that can be viewed from anywhere on the planet.The Node cu may be powered by a 5V source, whereas the ESP8266 is powered by a 7.5V adapter.The Node cu may be powered by a 5V source, whereas the ESP8266 is powered by a 7.5V adapter.The microcontroller is connected to the energy metre. The Arduino IDE is used to programme the Arduino, while the AT instructions are used to programme the Wi-Fi module. Power readings, as well as the cost of consumption, are provided in graphical and gauge formats on the thing speak website.

2.1 Voltage Excess

Overvoltage occurs when customers utilise more power than the tolerance limit. The over voltage signal is offered to help limit this problem. A step down transformer is used to step down single phase AC.
As a result, current and power transformers are used to measure stepped down voltage and current levels. If an overvoltage occurs, the values are passed to the PIC16F877A microcontroller. These readings are then communicated to the ESP8266 IoT module, which displays an overvoltage indication on the LCD display. The regulator then controls overvoltage by interrupting work and correcting the voltage, which is then corrected again. The microcontroller receives the revised data, which are then passed on to the IoT module. The balanced voltage message is presented on the LCD via the IoT module.

2.2 Conditioning Of Signals

The internal operation of the opto-coupler P817, which we use as a signal conditioning block. On a functional metre, one LED blinks continually, which is nothing more than a power count indicator. When the LED blinks, it produces just 0.7 volts, which is insufficient for the Arduino board to collect, therefore we use this block to fix the problem. When the LED blinks, the diode conducts, the transistor activates, and the transistor outputs 5 volts, which we supply externally. The Arduino board will receive a 5v supply whenever the LEDblinks, and it will count them. To raise voltage, we use a signal conditioning block.

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2.3 Uno Arduino (Atmega 328)

The Arduino board serves as the brains of the system. This board is responsible for the entire system's functionality and processes. Arduino reacts to the opto-5V coupler's supply by counting the supply and then calculating the cost and power consumed. This information is kept on the website indefinitely so that users can access it at any time and monitor their usage. It even responds to scenarios such as message passing/sending during threshold values as programmed.

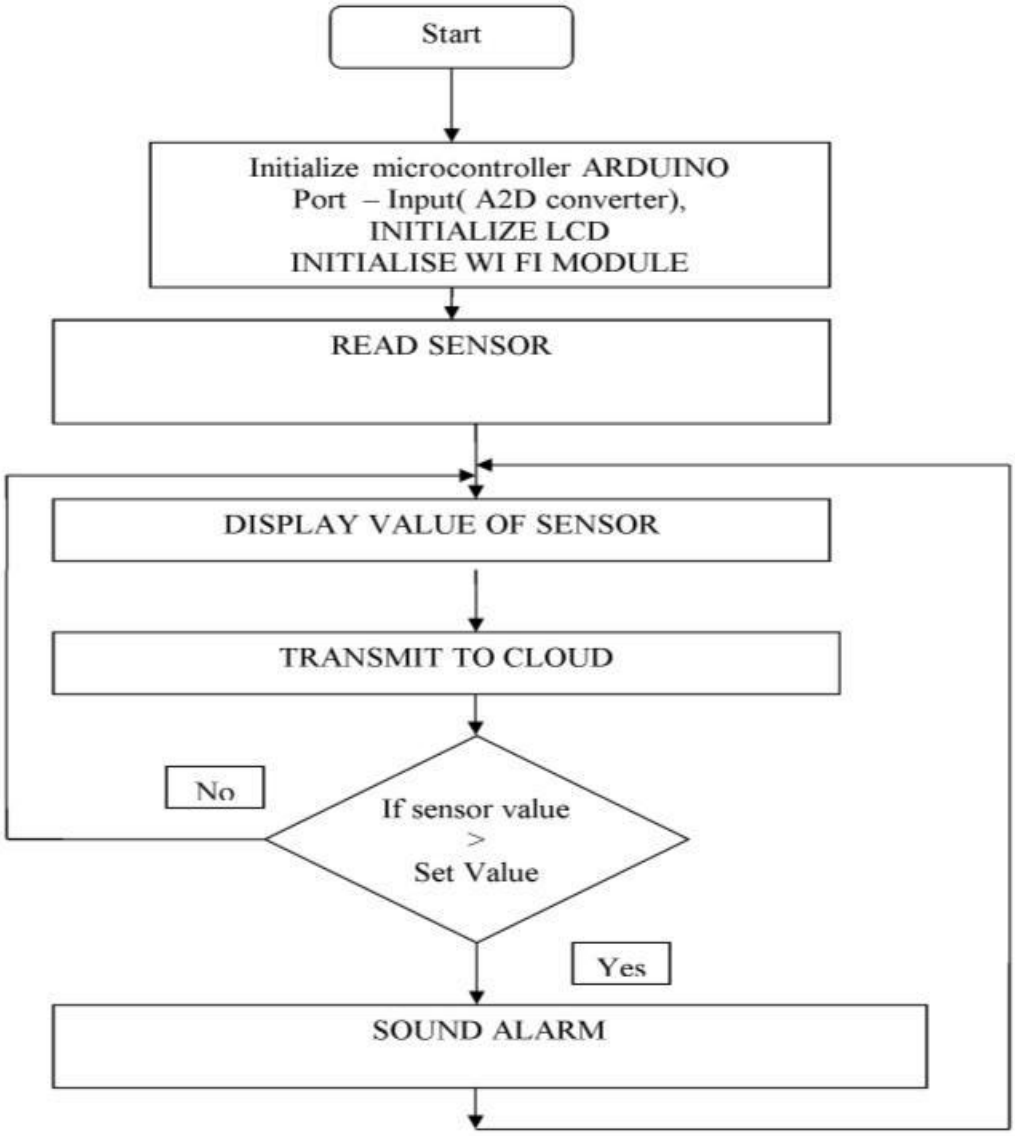

Fig.2. Flow Chart

2.4 An Experimental Energy Meter

A smart energy meter is an electronic device that analyses electrical energy use in hourly or less intervals and sends that information to the utility at least once a day for monitoring and billing.Smart meters allow for two-way communication between the meter and the central infrastructure. Utilities is one of the electrical departments that installs these devices in various locations such as households, industries, organisations, and commercial buildings to measure the electricity consumption by loads such as lights, fans, refrigerators, and other equipment. The voltage and currents are measured, the product is calculated, and instantaneous power is given. The overall quantity of energy utilised at that time is calculated by adding up this power over a period of time.

2.5 Module For Wireless Internet (Esp8266)

Wireless Fidelity is what Wi-Fi stands for. We're using Wi-Fi, which is critical in the IoT world. The consumer can adjust various threshold values according to their needs and turn on or off the energy metre via Wi-Fi. The readings of the units and the cost are shown on the webpage every month at the end of the month. The Arduino board and metre can also be accessed by the consumer via Wi-Fi.

2.6 The Things Internet (Iot)

The Internet of Things (IoT) is a network that connects everything in the universe. It can communicate with practically anything on the planet. To communicate, a control signal or identifiable data from the outside world can be employed. It's a common sort of internet data transmission that can be accomplished in a number of ways. The Internet of Things (IoT) collects data from automated devices and helps machines figure out where they need help. The information is saved in the cloud and transferred to the energy metre, which controls the lighting.

3.Conclusion

The primary goal of this research is to design and construct a fully working "Automated Energy Metering and Monitoring System" with new features such as remote metering and consumer control.

The goal of the study is to use a software system to manage all of the consumer's information concerning energy consumption. Using a microcontroller and an internet connection, this system precisely measures electricity costs and sends e-mails. The complexity of administration and counting in terms of the collected needs can be achieved with the use of technological technology.

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