

Digital Electricity Meter with Unit and Cost Display

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Abstract: Who doesn't know about technology in the twenty-first century? According to the current scenario, the demand for electricity has increased throughout the world, and power departments are meeting the demand. There are numerous issues with metering and construction processes, such as travelling to each customer's meter to physically take the meter reading, the possibility of the customer not being present at their houses at the time, and the lack of honesty and reliability of some meter readers. The smart meter for safety of meter readers and the remote areas offers a disadvantage that must not be overlooked. The system has been designed based on the use of an energy digital electricity meter with unit and cost display to read electrical energy consumed in order to obtain an accurate reading. The system in charge of the electrical department takes readings and processes them, extracting the bill that the customer must pay. The complete cost must be paid every month, which will benefit the uneducated people in the rural who do not know how to read a meter.

KEYWORDS: Digital Electricity Meter, Smart meter, Energy consumed.

I. INTRODUCTION

The world is shifting in this generation toward automatic wireless technology, which is not only decreasing human efforts but also assisting in making automatic and effective. An electric or energy meter, as we all know, monitors the total electrical energy in units consumed by equipment that draw power from the main power source. Because it measures the amount of electrical energy consumed by the meter, this technology enables systematic pricing of consumption by individual consumers.

LCD (liquid crystal display) is a material that combines the properties of both liquid and crystal and is used in electricity meters to display the entire amount that customers must pay. Furthermore, customers who are illiterate are unable to obtain information about the building without the assistance of a meter reader. As a result, people who are experiencing difficulties will benefit from this project. It is feasible to solve the problem. Smart meters for advanced metering infrastructure (AMI) are being developed in a number of countries throughout the world. The smart meter has the ability to capture information such as the combination of electric energy voltage labels, current, and power factors. The data from the smart meter is sent to the consumer for better understanding of their behaviour, as well as to the power supplier for system monitoring and consumer billing. A digital electricity meter, for example, often monitors energy in near-real time and generates data at regular intervals throughout the day.

A smart meter, also known as a digital electricity meter, allows the meter and the central system to communicate in two directions. AMI stands for (advanced metering infrastructure), which allows for two-way communication between the meter and the supplier. It may be more motivated to take advantage of incentives in order to alleviate traffic congestion, particularly during peak demand hours, and save money. Automatic meter reading (AMR) systems send SMS messages with meter reading, power cut, total load utilized, power disconnect, and tempering information on demand or at regular intervals. This has the goal of measuring and monitoring the electricity consumed by users in a given area, communicating the consumed power to the station, and issuing a bill for the consumed electricity. A GSM module serves the server station for data transmission and reception as well as energy auditing. Accurate metering, energy theft, and the establishment of a correct tariff as well as bill are all constraints.

The goal of the project is to use a digital display to display the voltage, current, power, and energy consumption. The microcontroller reads and stores the quantity of electricity consumed by the electrical equipment. It calculates voltage, current, power, and energy consumed using a digital electrical meter with a heart East micro controller. The amount of energy used is displayed in watthours. When the energy meter first turns on, it displays the amount of energy consumed in watthours, and it is ready to measure the amount of energy consumed on the LCD display in real time, so voltage, current, and real power. The most recent technology relies on a GSM (global system for mobile communication)-based system. This system will take the place of Bluetooth technology and data supplied to customers via short message services (SMS).

II. REVIEW OF THE LITERATURE

The history of the energy meter may be traced back to the 1880s, just before the widespread adoption of electricity. During the era of gas lighting, there was also an energy metering system that calculated the quantity of energy consumed each home. With Electric lamps quickly displaced gas lamps with the discovery and use of electricity, proving to be brighter and more cost effective. A new system for measuring consumption was required. Charge was measured in ampere-hours by DC meters. The DC meters proved to be insufficient over time. Then there were Edison's meters, which were divided into two categories: electrolytic and electrochemical meters. Although the electrochemical meters served their job, reading them was time consuming. As a result, users are not pleased. In 1889, a Hungarian called Otto Blatty invented and patented the first AC meter that used the kilowatt-hour as the standard unit, which is still used today.

III. METHODOLOGY

The main goal of this project is to create an energy metre that not only displays the unit but also the cost of your entire electricity usage. The hardware components that we have used are an electricity metre and an Arduino Nano GSM module sim900 for delivering monthly

billing details to a certain number. There are a few other components that we have used. There is an LCD here that is required, with a 16 X 2 character LCD display for unit and cost display.

IV. MODELING AND ANALYSIS

LIST OF COMPONENTS USED

- 1) 230AC
- 2) DC power supply
- 3) Electricity meter
- 4) Arduino nano
- 5) GSM module (Sim900A)
- 6) 16×2 Character LCD
- 7) SMS Alert
- 8) Load

230AC

The AC 230 V Power Supply is a single-phase power supply that offers the necessary power for single-phase experiments when connected to the AC line voltage. A conventional C13 power cord connects the power source to the AC line voltage, which is then safeguarded by a built-in circuit breaker.

DC power supply

One of the most prevalent power sources in use today is the 5V power supply (or 5VDC power supply). Using a mixture of transformers, diodes, and transistors, a 5VDC output can be created from a 50VAC or 240VAC input.

Electricity meter

An electricity metre, also known as an electric metre, an electrical metre, an energy metre, or a kilowatt-hour metre, is a device that measures the amount of electricity used. of electric energy consumed by a home, a business, or an electrically powered item.

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.

GSM module (Sim900A)

The SIM900A GSM Module is the smallest and cheapest GPRS/GSM module available. The module uses GPRS/GSM technology to communicate with a mobile sim card. It operates on the 900 and 1800 MHz frequency bands and allows users to make and receive phone calls as well as SMS messages.

16×2 Character LCD

The 162 LCD display is a fairly basic module that can be found in many DIY projects and circuits. The 162 corresponds to a two-line display with 16 characters per line. Each character is presented in a 5x7 pixel matrix on this LCD.

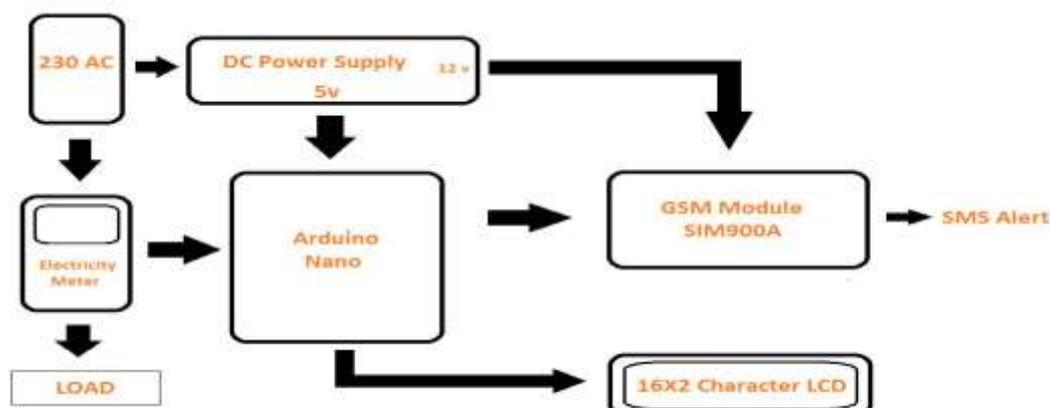
Load

Electrical loads, such as electrical appliances and lights in the home, are electrical components or portions of circuits that consume electricity. The phrase can also apply to a circuit's power consumption. This is in contrast to a power source that generates electricity, such as a battery or generator.

SMS Alert

It keeps track of electrical pulses and calculates how many units are utilized and how much it costs. This information is shown on an LCD screen and communicated to the user through SMS. The customer will be able to receive SMS warnings when their credit is running low or has expired.

V. BLOCK DIAGRAM



VI. BLOCK DESCRIPTION

The input data from the metre as an impulse is computed, and the values are calculated using the data provided in the coding. It's a free and open-source electronic platform with simple hardware and software. Arduino boards may read inputs such as light from a sensor, a finger on a button, or a tweet, and then turn on an LED and publish anything online. C++ is a human-readable programming language, and Arduino code is written in it with the addition of additional methods and functions that we'll discuss later. When we build an Arduino sketch, it gets analysed and compiled into machine language. Our integrated development environment, Arduino software, is used to programme the Arduino software UNO.

DC power supply are those that produce a DC voltage as an output. Devices that give electric power to one or more loads are known as power supplies. They convert an input signal into an output signal to generate the output power (in this case, a DC output)

Any load can be connected to another load. It's good for both AC and DC applications. It refers to any equipment that is connected to a signal source, regardless of whether it uses power. Stress, deformations, or accelerations are caused by forces. A structure or its components are subjected to these loads, which induce stress or displacement. There are various sorts of structural loads, including dead loads, living loads, and so on. DC power supplies generate a DC voltage as its output. Power supplies are devices that provide electric power to one or more loads. They convert an input signal into an output signal to generate output power (in this case, a DC output)

230 volts is a representation or measurement of a potential difference or voltage in the electric field. Voltage is now associated with electrical power. The higher the voltage, the more power. If you contact a wire with 5 volts, for example, you will experience a tingling sensation or a little shock.

It's a 16-bit resolution character display. In real time, the units and price are displayed. A liquid crystal molecule prefers to untwist when an electrical current is delivered across it. The angle of light travelling through the polarized glass molecule, as well as the angle of the top polarizing filter, changes as a result of this. It works by preventing light from passing through it. A liquid crystal substance is sandwiched between two pieces of polarized glass, also known as substrate, in order to create an LCD. The first substrate is where light from a back light travel.

The module uses GPRS/GSM technology to communicate with a mobile sim card. It operates on the 900 and 1800 MHz frequency bands and allows users to make and receive phone calls as well as SMS messages. A GSM modem, also known as a GSM module, is a physical device that connects to a remote network using GSM mobile phone technology.

VII. APPLICATION

- In the traditional method of taking energy meter readings, the energy department sends a related person to do so, which is both time consuming and costly, but by employing this power meter billing and load control using GSM technology, the energy department can save both time and money.
- For power meter billing and load control, this GSM-based power meter billing and load control system might be placed in both residential and commercial buildings.

VII. RESULTS

The primary goal of this study is to create a smart energy meter that can be used to assess the load and energy costs of a traditional grid. People who don't know how to read an electrical bill will benefit from this initiative because the total cost and unit will be plainly displayed on an LCD.

The pulse and unit (meter-reading) count in this project continuously according to the associated load. Sending an SMS to the respective meter according to their demand of meter reading energy provider business. This SMS is received by microcontroller via GSM modem, so that an interrupt signal occurred due to SMS. Microcontroller read pulse and device and send the same to the approved number. The pulse and device are read by the microcontroller, and the same is sent to the predetermined number at all three levels, product design considers aesthetic design, technology design, and ergonomic design. The energy service company must notify the government. After careful study, send an e-mail or a letter to the consumer. Payments can be made by the customer. Online or offline. The ability to deliver power-cut information is a key aspect of this system. AMR will send an SMS if there is a power outage in a specific area. The energy supplier service was turned off due to a power outage. In the event of a power outage, AMR is powered by a rechargeable battery loss of power.

IX. CONCLUSION

The GSM-based energy meter is simple to set up and advantageous to both energy providers and consumers. AMR not only eliminates manual meter reading, but also adds functions like power disconnection due to unpaid responsibilities, power reconnection after pay dues, power cut alarm, and tempering alert.

AMR also provides information on total load used in a building upon request at any time. If a person consumes more over the specified load cap, it sends an SMS warning to the energy provider. Customers will be able to better manage their energy consumption thanks to the statistical load and profile that was employed. This device is safe and effective because it can only be accessed by those who have been approved. This device notifies the energy provider as well as the illegal individual. This method has the ability to change the energy meter sector, as well as aid country revenue by preventing current fraud and punishing dishonest consumers.

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