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AN USER FRIENDLY MONTHLY ELECTRICITY BILLING WITH SMS FEATURE

Aarthi N, M.E.,
Assistant Professor/ EEE
Dr. Mahalingam College Of Engineering and Technology
Pollachi, India

Priyadharshini A
EEE
Dr. Mahalingam College Of Engineering and Technology
Pollachi, India

Naveen kumar M
EEE
Dr. Mahalingam College Of Engineering and Technology
Pollachi, India

Karventhan G
EEE
Dr. Mahalingam College Of Engineering and Technology
Pollachi, India

Abstract - **This initiative improves efficiency, transparency, and customer convenience by introducing a novel approach to automated billing and monitoring of electricity consumption. The system allows for cost calculation and real-time usage monitoring by integrating an SMS module and an LCD display. The system gives users instant access to accurate consumption statistics, doing away with the need for manual metre readings. This gives users the power to monitor usage trends and make well-informed decisions. By providing consumption data and payment information via automatic notifications, the SMS module enables remote accessibility while improving transparency and doing away with the need for physical metre readings. With a focus on real-time monitoring, the project encourages proactive load control and sustainable energy practices.**

Index Terms **– SMS Module**

I. INTRODUCTION

Electricity billing systems nowadays need to find innovative solutions to fulfill evolving client demands while increasing efficiency and transparency. To address these problems, this study presents a new approach to automate billing and track electricity usage. By using state-of-the-art technologies such as SMS modules and LCD screens, the system provides real-time access to cost and usage figures for clients. Because manual meter readings are no longer necessary, the initiative reduces human error, enhances client satisfaction, and expedites invoicing procedures. Furthermore, promoting resource efficiency and sustainable practices is aligned with the emphasis on remote accessibility and transparent invoicing. methods related to energy. The framework for a thorough analysis of the project's implementation, methodology, and potential impacts on the landscape of power billing is established by this introduction.

II. LITERATURE SURVEY

2.1 GSM based automatic energy meter reading system with instant billing.

Automation Meter Reading (AMR) systems are becoming more and more necessary as e-metering (Electronic Metering) technology improves at a rapid pace. In order to manage the data collected globally and automate billing, this article offers the design of a low-cost, basic wireless GSM energy meter along with a web interface that goes along with it. Traditional meter reading techniques are replaced by the suggested technology, which also gives the energy provider remote access to the current energy meter. Furthermore, without having to visit each home, they may routinely check the meter readings. Each entity's electronic energy meter is integrated with a GSM-based wireless communication module, allowing for remote access to electricity usage data.

2.2 Smart energy metering and power theft control using arduino & GSM

In nations like India, where energy consumption rises steadily along with population growth, energy theft is a somewhat prevalent issue. Annually, energy theft by utilities in the electrical grid is decimating income. The idea and operation of a new automated power metering system are revealed by the newly developed AMR utilized for energy measurements; nevertheless, because customer checkouts are not conducted on a regular basis, this has led to an increase in administrative losses from electricity theft. Reaching every customer's door to investigate and solve theft is nearly impossible. The energy meter is protected against power theft in this study by a novel process that uses a Microcontroller Atmega328P to detect and regulate the theft and remotely disconnect and reconnect the service (line) belonging to a certain customer.

2.3 Design and implementation of digital energy meter with data sending capability using GSM network

As energy prices start to rise, energy efficiency becomes even more important. Using Energy Meters is crucial since

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energy management is needed to specify how much energy is used in a given amount of time. One can use a basic energy meter to determine the amount of energy used. However, there are occasions when these meters' restricted capability limits the range of situations in which they can be used; this is particularly true in places that are difficult to reach or when sight of the meter is low. Wireless Energy Meters (WEMs), which may transmit data wirelessly to a central server for easy data monitoring and analysis, are one potential option.

III. BLOCK DIAGRAM

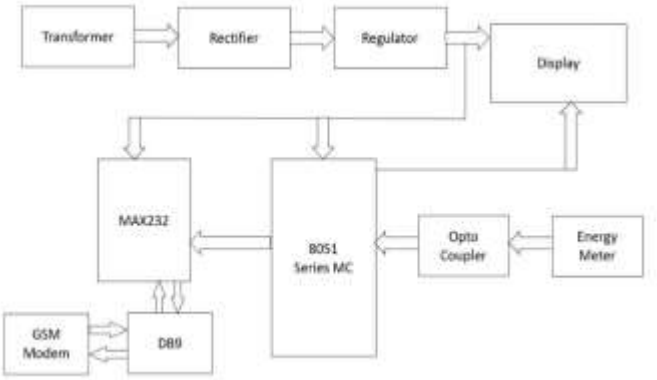

Fig 3.1 block diagram

Transformers facilitate energy transfer by electromagnetic induction. Rectifiers convert AC to DC to ensure unidirectional current flow. A dependable power source must have stable output levels, which regulators maintain. LCD screens enable crisp visual output from electronic gadgets. MAX232 ICs enable signal conversion between RS-232 and TTL levels. The 8051 series provides versatile microcontrollers for embedded applications. Opto couplers guarantee the electrical isolation of circuits. For invoicing and monitoring purposes, energy meters provide exact measurements of usage. GSM modules enable cellular connectivity, which includes SMS feature.

IV. METHODOLOGY

In order to provide transparent invoicing using LCD displays and SMS notifications, the project would design a complete system for monitoring electricity consumption. To define the project scope, goals, and expectations of stakeholders, a thorough requirement analysis is first carried out. Next, based on the project parameters and financial constraints, appropriate hardware components are chosen, such as microcontrollers, LCD screens, SMS modules, and sensors. The next step is to create a comprehensive system architecture that describes the relationships and exchanges between hardware elements, the LCD display's user interface, and the SMS message format that will be conveyed to users. After the hardware is configured, firmware is developed so that the microcontroller can read sensor data about electricity use, figure out how much is being charged, and incorporate SMS features for delivering expense alerts and consumption readings. Unit testing, integration testing, validation of consumption readings, and billing computations are only a few of the stringent testing methods used to guarantee the precision and dependability of the system. The system is deployed at the customer's location following successful testing, and in order to guarantee seamless functioning and client satisfaction, installation, configuration, and user training are carried out. A system's performance is tracked, problems and anomalies are addressed, and users receive the required technical help through ongoing monitoring and maintenance protocols. User input is also gathered and examined in order to pinpoint areas that require enhancement and to provide iterative modifications to the system's functionality and design, guaranteeing the system's continuous relevance and efficacy.

V. EXPLANATION OF HARDWARE COMPONENTS

5.1Energy Meter

FIG 5.1.1 Energy Meter

A device used to gauge how much electrical energy a home, business, or industrial facility uses is called an energy meter. It is also sometimes called an electricity meter or just a meter. It serves a vital role in appropriately charging consumers for the electricity they use and is a necessary part of any electrical distribution system. Current and voltage transformers, measuring elements, a display mechanism, and other essential parts are usually found in an energy meter. Differentiating between voltage and current transformers, current transformers sense the electrical current passing through the system. After that, the measuring elements interpret these measurements and determine how much electrical energy was used during a given time frame. Information regarding electricity use is provided to customers by the energy meter's display mechanism; results are usually

expressed in kWh or other comparable units. This data can be sent electronically to a central billing system for remote monitoring and billing, or it can be shown on an actual LCD or LED display. Some further characteristics that energy meters might have are communication capabilities for remote management and monitoring, and tamper detection technologies to stop unwanted access or manipulation. In order to help utilities and consumers alike manage energy use effectively and fairly, energy meters are crucial instruments for precisely monitoring and metering electricity usage.

5.2 GSM Module

5.2.1 GSM Module

Communication via cellular networks is made possible by small electronic devices called GSM (Global System for Mobile Communications) modules. The system is comprised of multiple interconnected parts, each with a distinct purpose to enable wireless communication. The primary function of the GSM module is to establish and sustain connectivity with the mobile network through a cellular modem. Voice calls, SMS messages, and internet data are all transmitted and received over the cellular network by the modem using GSM technology. To ensure interoperability with network infrastructure, it runs on certain frequency bands allotted for GSM transmission. A SIM card slot, which enables the insertion of a SIM card, is also included in the GSM module. Unique identity data and authentication data are stored on the SIM card. To send and receive radio signals to and from the mobile network, the GSM module also has an antenna. By absorbing and enhancing radio signals, the antenna permits the GSM module to stay connected even in isolated or under-served places, ensuring dependable communication across a large area. Moreover, power management parts, voltage regulators, and interface circuits are among the supporting circuitry that the GSM module has. The GSM module can be connected to other electronic devices or microcontrollers through these components' interfaces, which also govern voltage levels and power usage. A variety of form factors are available for GSM modules, such as standalone modules with external connectors for integrating with other hardware components and embedded modules for incorporation into electronic devices.

5.3 LCD Display

5.3.1 LCD Display

The advanced flat-panel display technology known as Liquid Crystal Display (LCD) is so common in contemporary electronics because of its efficiency, dependability, and versatility. A layer of liquid crystal molecules, a set of polarizing filters, transparent electrodes, and a backlight make up the fundamental layers of an LCD panel. A backlight that evenly distributes white light over the display panel is the first component of an LCD to operate. The polarizing filters in this light govern the direction and intensity of the light waves as they flow through them. Once inside the layer of liquid crystal molecules which may twist and untwist in response to an electric current the filtered light begins to penetrate. As soon as the transparent electrodes get an electric current. The polarization of the light traveling through them is changed by this change in direction, letting some wavelengths of light through while obstructing others. Liquid crystal molecules can be oriented in different ways to produce patterns of light and dark pixels on a display by carefully adjusting the electric current supplied to the electrodes. When combined, these pixels give the viewer's eyesight text, graphics, and images. High-quality visuals with crisp definition and brilliant colors are one of LCD technology's main benefits. Furthermore, LCD screens are well-known for using less power than other display technologies, which makes them perfect for battery-powered gadgets like laptops, tablets, and smartphones. Wide viewing angles are another feature of LCD screens that enable users to see the screen well from a variety of angles without noticeably losing contrast or color. For gadgets like televisions and computer monitors that are regularly viewed from various perspectives, this capability is especially crucial. With regard to adaptability, LCD technology may be used in a variety of settings and for a wide range of products, such as industrial equipment, consumer electronics, vehicle displays, and medical equipment.

5.4Arduino NANO

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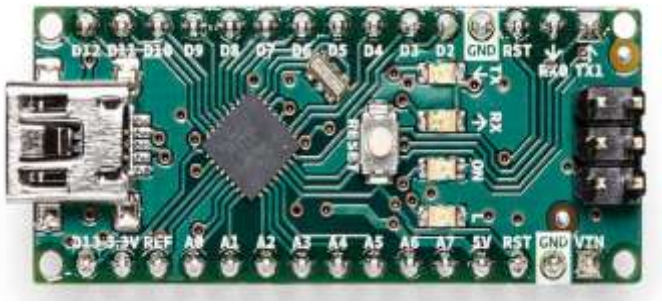

5.4.1 Arduino NANO

Built around the ATmega328P microcontroller chip, the Arduino Nano offers a wide range of functionalities and capabilities, including multiple digital and analog input/output pins, as well as built-in features like timers, communication interfaces, and analog-to-digital converters (ADCs). Its small form factor, affordability, and ease of use make it an ideal choice for embedded systems and Internet of Things applications. In this project, the Arduino Nano acts as the brain of the system, coordinating and controlling various components to achieve the desired functionality. It can be programmed to perform tasks like reading data from sensors, processing the data, managing external. One way to monitor energy usage in real time is by using the Arduino Nano to interact with sensors that measure electricity consumption. These sensors provide the data, which is read, processed, and then shown on the LCD screen to determine the amount of electricity used. In order to provide consumers with updates on their electricity usage and payment details, the Arduino Nano can also connect with the GSM module. The Integrated Development Environment (IDE) for Arduino is used to write, compile, and upload code to the microcontroller board while programming the Arduino Nano. It is an intuitive platform. Developers may easily get started and swiftly implement their project requirements with the Arduino IDE's extensive library of pre-written code and examples, thorough documentation, and community assistance. To further facilitate smooth integration with a broad range of sensors, actuators, and communication modules, the Arduino Nano supports many communication protocols, including I2C, SPI, and UART. The system may be easily expanded and customized to meet the needs of individual projects because to its versatility. This project is primarily supported by the Arduino Nano, which offers the intelligence and control required to integrate SMS alert features and real-time monitoring of electricity consumption. Developers and enthusiasts alike may quickly prototype and develop cutting-edge embedded systems and Internet of Things applications thanks to its adaptability, cost, and simplicity of use.

5.5Voltage Regulator

5.5.1 Voltage Regulator

Designed to produce a regulated output voltage from an unregulated input voltage source, the 78xx family of voltage regulators comprises integrated circuits, which include versions like L78xx, LM78xx, and MC78xx. Electronic circuits that demand a steady and reliable power source frequently use these voltage regulators. Being self-contained, or requiring few external components to operate well, is one of the family's primary characteristics. To maintain correct operation and stabilize the voltage, a few extra parts are usually all that are required, such as input and output capacitors. Utilizing an inbuilt pass transistor to eliminate excess voltage from the input source, the 78xx voltage regulators function according to the linear regulation concept. No matter how the input voltage varies or the load changes, this pass transistor modifies its resistance to keep the output voltage steady. Depending on the type, these regulators come with a set output voltage of 5V, 12V, or 15V being the possible options. For example, they can power digital integrated circuits and microcontrollers and supply voltage rails for analog circuitry. This makes them appropriate for a broad variety of needs. Simple operation is a primary benefit of the 78xx family. For thermal management, they can be conveniently installed on a PCB or connected to a heat sink in their conventional TO-220 or TO-92 package. They are a well-liked option for both commercial and amateur projects because of their inexpensive price. It is imperative to acknowledge that the 78xx voltage regulators are unsuitable for applications requiring high current or great efficiency. They work well in low- to moderate-power applications where affordability, dependability, and ease of use are more crucial than efficiency. In conclusion, the 78xx family of voltage regulators provides an easy-to-afford way to get controlled and steady power supplies in electronic circuits. They are a flexible option for many different applications due to their self-contained

construction, simplicity of usage, and large range of potential output voltages.

VI. CONCLUSION

In summary, by providing consumers with an all-inclusive and intuitive solution, the project signifies a substantial development in electricity usage monitoring and billing systems. The technology improves transparency and accessibility for customers by giving them access to real-time readings of their electricity consumption via SMS warnings and an LCD display. Utility companies can streamline their billing process and cut operating costs by doing away with the requirement for human meter readings through the incorporation of an SMS module. Further ensuring consumers have numerous ways to obtain their consumption statistics, the two-way reading functionality further encourages simplicity and flexibility. Ultimately, the project's emphasis on potential load control, transparent invoicing, and real-time monitoring shows a dedication to giving customers insightful information about their energy consumption and fostering sustainability and efficiency in the management of electricity resources.

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