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"IoT-Driven Daily Electricity Billing System For Sustainable Consumption:Managing 200 Units a Month"

[1]Swathi k,[2] Varsha S,[3] M R Rachana,[4] Nisarga T S
[1] Assistant Professor, [2,3,4] Student
Dept. of Electrical and Electronics Engineering
GSSSIETW, Mysuru, India

***Abstract*— The increased energy consumption followed by development in renewable energy generation have resulted in tremendous challenge to energy industry. Pursuing the requirement of increased energy efficiency have resulted in the research and development of intelligent energy networks as the future energy network. Smart Electricity Energy Meters can be considered as the basic fundamental component of the future intelligent network or smart grid, measuring the energy flow and exchanging information on energy consumption between utilities and consumers and also monitoring and controlling home appliances and devices with consumer information. The authors propose an IOT based Smart Energy Meter with ESP8266 Wi-Fi unit which can provide information of electricity bill by SMS and can also provide energy monitoring usage anytime and anywhere in the world.**

I. INTRODUCTION

In the era of rapid technological advancements, the integration of Internet of Things (IoT) has revolutionized various sectors, offering innovative solutions to streamline processes. This major project aims to implement an IoT-based Daily Electricity Billing System, transforming traditional billing practices for enhanced efficiency and accuracy. The conventional method of monthly electricity billing often poses challenges in real-time monitoring and cost control.

This project addresses these issues by introducing a system that enables daily billing based on the consumption of 200 units of a month used per day. Leveraging IoT, smart meters, and real-time data analytics, the system provides a comprehensive solution for both consumers and utility providers.

By embracing this IoT-based approach, the project seeks to empower consumers with a more transparent and responsive billing system, allowing them to monitor and regulate their daily electricity usage effectively.Simultaneously,utility providers benefit from real-time data insights, enabling them to optimize resource allocation, identify anomalies promptly, and enhance overall operational efficiency.

This major project explores the synergy between IoT and electricity billing, contributing to the evolution of smart infrastructure. Through the integration of cutting-edge technologies, it aims to pave the way for a sustainable and technologically advanced energy management system, fostering a more intelligent and responsive grid for the future.

II. LITERATURE SURVEY

[1] A Comprehensive Review of Smart Energy Meters in Intelligent Energy Networks Publisher: IEEE Qie Sun; Hailong Li; Zhanyu Ma; Chao Wang; Javier Campillo; Qi Zhang; Fredrik Wallin; The significant increase in energy consumption and the rapid development of renewable energy, such as solar power and wind power, have brought huge challenges to energy security and the environment, which, in the meantime, stimulate the development of energy networks toward a more intelligent direction.

[2] A Novel IoT based Smart Energy Meter for Residential Energy Management in Smart Grid Infrastructure. The increased energy consumption followed by development in renewable energy generation have resulted in tremendous challenge to energy industry.

[3] Remote Power Theft Monitoring Using IoT Publisher: IEEE M. Suguna Present days, the world can't envision the present existence without power, practically all the things, gear and machines are utilizing in everyday life are utilizing electric energy to run easily.

III. OBJECTIVES

1. To design the system which will be able to measure power consumption of homes and will be able to generate electricity bill for home automatically on the basic of daily consumption of current under the scheme of Gruha Jyothi.
2. To develop power theft monitoring system.

4. BLOCK DIAGRAM AND DESCRIPTION

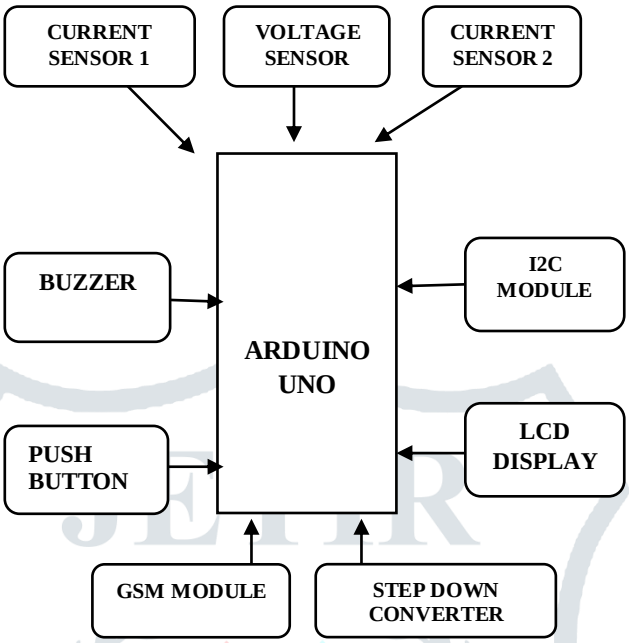

Fig 1: Block Diagram

We are making a IoT driven daily electricity billing system for sustainable consumption: managing 200 units a month which reminds the customers for not exceeding 6.6 units a day, if it's exceeded the emergency alerts message goes to the customers' number. While we pressing the push button, the electricity bill will generate with how much of power, current, and voltage used by the day with cost and units of amount will generate.

Connect the VCC or 5v pin of Arduino Uno to the ground and the Ao- pin is connected to the voltage sensor, A1 pin is connected to the current sensor 1 and A2 pin is connected to the current sensor 2. Connect the Vss pin of 16*2 LCD with negative rail on the I2C module. I2C module pins VCC, GND, SCL and SDL are connected to the Arduino UNO. Here we use the power adopter to use the voltage, the GSM module wants exact 4.2 V, so we use the stepdown converter to convert the exact 4.2V to GSM module.

The push button is connected to ground and the digital pin to work on closed loop. Then the buzzer is connected to the 5v reference and the A4 pin, when the units are exceeded, the buzzer will buzz with sound and the circuit is completed by sending a message to a registered mobile by displaying power consumption in the LCD and in the mobile SMS alert.

5. CIRCUIT DIAGRAM

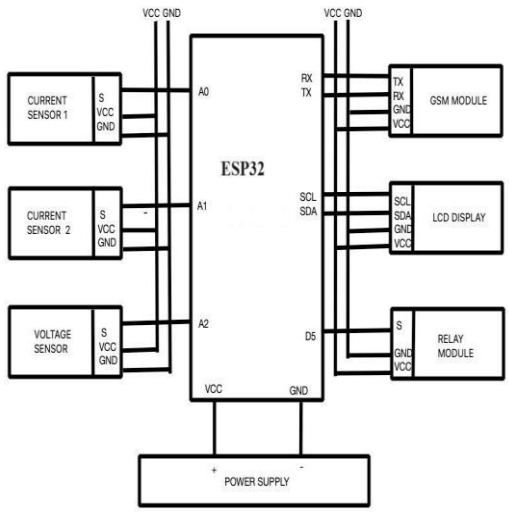

Fig 2: Circuit Diagram

In the pursuit of sustainable energy consumption, IoT-driven solutions have emerged as powerful tools. An IoT-driven daily electricity billing system is designed to manage consumption efficiently while promoting sustainable practices. This system operates by integrating smart meters, communication infrastructure, data processing systems, and sustainable consumption strategies.

At the core of the system are smart meters, which are installed at consumer premises to monitor electricity usage in real-time. These meters collect consumption data continuously and transmit it to a central system via various communication technologies such as Wi-Fi networks. The central system processes the incoming data, calculates daily electricity consumption, and generates bills based on predefined tariff rates. Consumers can access their usage and billing information through a web portal or mobile application.

To achieve sustainable consumption, the system employs several strategies. Real-time monitoring allows consumers to track their electricity usage and identify opportunities for conservation. Personalized recommendations based on usage patterns can help consumers adopt energy-saving practices. Incentives for reducing consumption during peak hours optimize energy distribution and lessen strain on the grid. Additionally, the integration of renewable energy sources like solar or wind power reduces reliance on conventional electricity sources.

Managing 200 units of electricity consumption a month requires a focus on efficiency and behavior modification. Daily monitoring and feedback mechanisms help consumers stay within consumption targets. Energy-saving tips and incentives encourage sustainable practices and reduce overall usage. The benefits of this system are multifaceted. Consumers can save costs by optimizing electricity usage. Environmental benefits arise from reduced carbon emissions and mitigated climate change. The stability and reliability of the electrical grid improve as consumption is managed more efficiently. However, several challenges and considerations must be addressed. Data privacy and security are critical concerns, requiring robust protection measures. Integration with existing infrastructure necessitates seamless compatibility with electricity distribution networks and billing systems.

6. FLOWCHART

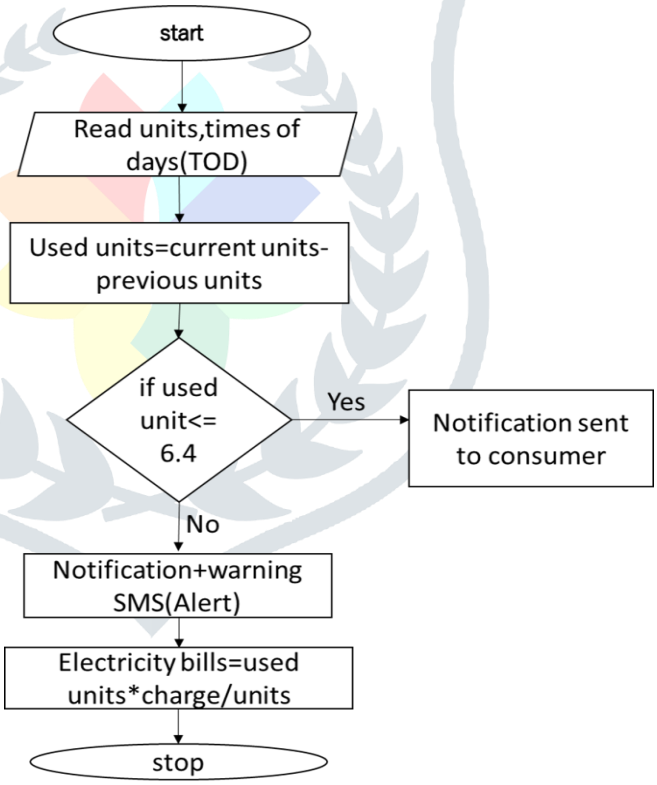

Fig 3: FLOWCHART

7. RESULTS

The outcomes of implementing the IOT-based daily electricity billing system are multi-faceted, providing benefits for both consumers and utility providers.

The outcomes include:

- Real-time monitoring consumers gain the ability to monitor their electricity consumption on a daily basis, fostering awareness and enabling proactive energy management.
- Cost control with daily billing based on a 200-unit threshold, consumers can better control their electricity expenses by adjusting their electricity expenses by adjusting their usage according to their daily needs.

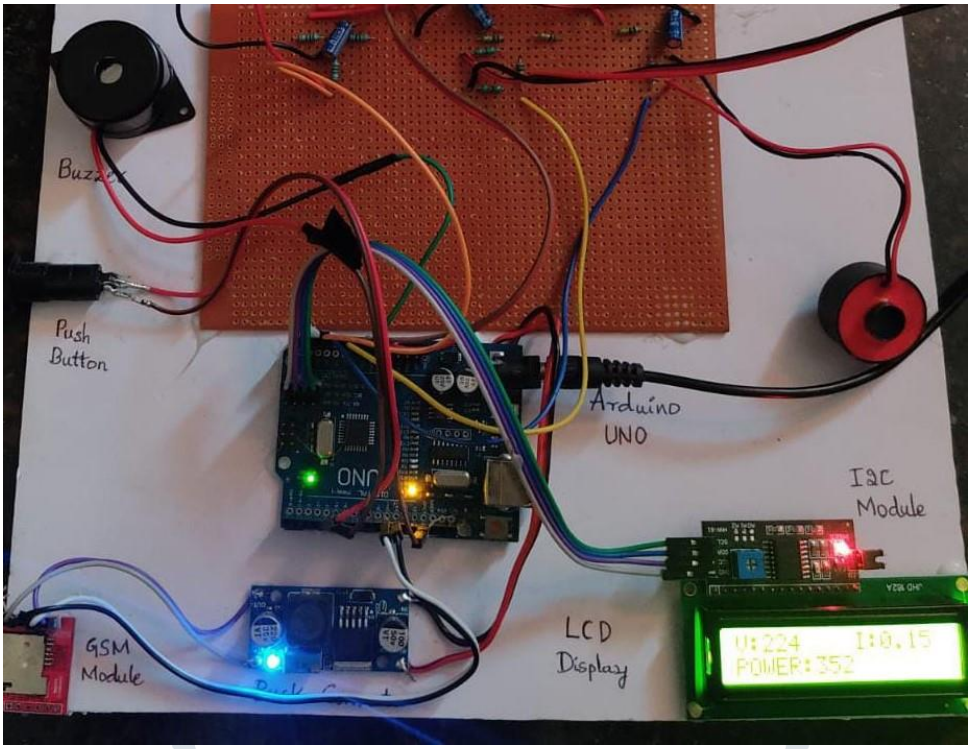

Fig 4: Snapshot of project

8. CONCLUSION

In this paper we have achieved the objective of automatic bill counting system by calculating the power input, in this phase we have achieved the input current and voltage measurement by using the current and voltage sensors and we have attached the voltage sensor to analog pin A0 and we have attached the current sensor pin to A1 of the Arduino uno board and for the live monitoring we have transmitted the current and voltage data to esp8266 microcontroller from Arduino uno microcontroller

After receiving the data from Arduino the data is transmitted through WIFI integrated in esp8266 microcontroller and then we are displaying the current in amps and voltage in volts and we are displaying the power consumed in the blink cloud.

It combines automation, real-time monitoring, safety measures, and anti-theft technology to create an intelligent and user-centric electrical ecosystem. With this system, we usher in a brighter, safer, and more sustainable future for all energy consumers.

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