POWER MONITORING AND CONTROLLING SYSTEM

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Abstract - *A Power Monitoring and Controlling System (PMCS) is a high-tech digital device that measures, monitors, and records energy consumption in real time within a collage, institutions, households, or facilities. Unlike traditional meters that require manual readings, PMCS automates the process, providing real-time, accurate energy usage data. These meters use cutting-edge technologies, such as digital displays and communication modules, as well as sensors, to collect all necessary information about energy usage. The primary purpose of a PMCS is to measure the amount of energy used or utilized in a section, usually in kWh, and transmit this data to the utility provider and to the consumer using wifi /Bluetooth module . automation should be done for energy efficiency. The real-time data enables users to better control and understand energy consumption parameters, allowing them to make better energy management decisions by using mobile device.*

Key Words*: *Power Monitoring, Controlling, energy consumption, consumption patterns, kilowatt-hours (kWh),Data management, etc.

1.INTRODUCTION

In an age characterized by swift technological progress and mounting environmental concerns, the fusion of Internet of Things (IoT) technology with energy management systems has emerged as an enlightening solution. The integration of IoT with power monitoring and controlling represents a pivotal advancement in the manner in which we oversee, regulate, and optimize energy usage. This innovative system combines state-of-the-art hardware components, advanced communication protocols, cloud computing capabilities, and user-friendly applications to establish a comprehensive approach towards enhancing energy efficiency. By facilitating real-time monitoring, remote control, and intelligent analysis of energy consumption patterns, this system empowers users to make well-informed decisions, curtail expenses, and contribute to sustainable practices. This overview provides insights into the system's architecture, communication protocols, cloud integration, user interfaces, benefits, and groundbreaking technology that is balanced to revolutionize our interaction with energy consumption. Power monitoring and control are vital for managing electrical systems in different settings, ranging from homes to industries. They involve continuously measuring, analyzing, and regulating electrical power to ensure its efficient and dependable use. Power monitoring and control systems are crucial for optimizing energy consumption and minimizing operational expenses. This article will provide a comprehensive overview of the goals and applications of power monitoring and control.

2.METHODOLOGY

1.Hardware and Software Selection: components for tracking and measuring consumption, cloud storage for data

2.Data Collection:Place the devices in the allotted spots, close to the meter. Gather information from meter users and safely store it.

3.Database Setup:For storing data, create a cloud-based database.

4.Units Tracking:Keep track of every single unit's electricity use.

5.User Interface: A user-friendly interface for record management by admins.

6.Testing: To make sure the tracking is accurate and the system is reliable, test the system.

7.Training:Train users and administrators how to use the monitoring system efficiently.

8.Feedback and Improvement:Collect feedback from users and adjust the system accordingly.

3. EASE OF USE

Energy Efficiency: One of the main goals of energy monitoring and control is to enhance energy efficiency. Through careful monitoring and analysis of power consumption, users can detect inefficiencies in the system and take corrective action to reduce energy wastage. This can result in substantial cost savings and an improved environmental footprint.

Cost Management: By tracking power usage trends, businesses can gain a better understanding of their electricity costs and budget. By controlling power consumption during peak demand hours, businesses can reduce demand charges. Demand charges make up a significant percentage of commercial and industrial electricity bills.

4. PROBLEM STATEMENT

There is a growing demand for enhanced and precise monitoring of energy usage in residential, commercial, and industrial environments. Conventional energy meters frequently do not offer real-time data gathering capabilities or remote access.

The problem statement for a Power Monitoring and Controlling System is to create an all-encompassing solution for overseeing and regulating power consumption in different environments like homes, businesses, and factories. This system is designed to tackle challenges related to energy efficiency, cost-effectiveness, and equipment upkeep by offering live monitoring of power usage, pinpointing inefficient areas or possible malfunctions, and allowing for remote management or automation of power equipment. Important factors to take into account involve data collection, interpretation, display, automation, and compatibility with current infrastructure or IoT.
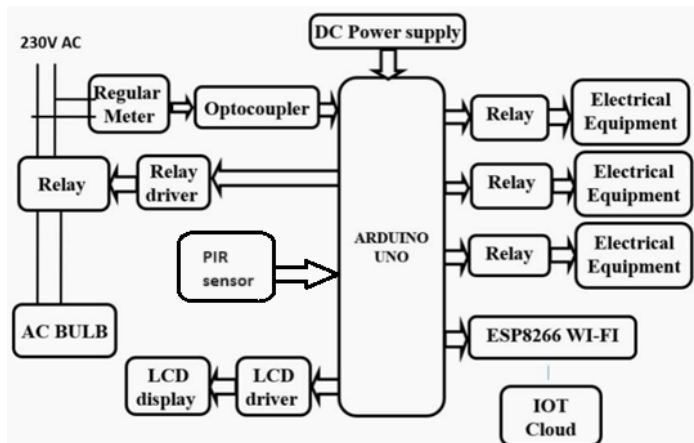
5. BLOCK DIAGRAM

Fig -1: Block diagram of proposed system

The proposed initiative is focused on developing and executing an IoT-based smart energy meter system to offer a holistic solution for efficient energy management and dynamic real-time monitoring. The fundamental architecture involves the seamless integration of essential hardware components such as precision energy meters, intelligent microcontrollers, IoT modules, current and voltage sensors, and communication interfaces leveraging MQTT and HTTP/HTTPS protocols. These protocols enable the smooth transmission of data to a robust cloud platform optimized for

agile storage and comprehensive analysis. Concurrently, a user-centric mobile/web application serves as a conduit for users to access real-time energy consumption data and control remote devices. Thorough validation and testing phases ensure the accuracy of energy measurements and the flawless operation of the system. The data collected provides valuable insights into consumption patterns, facilitating discussions on the system's accuracy, efficiency, and overall performance. The project also addresses challenges encountered and outlines future enhancements, including the integration of renewable energy sources and innovative machine learning models. This project sets the stage for redefining energy management practices and driving sustainable changes in energy consumption.

Energy Meter –

An energy meter is a device that calculates the power consumed by electrical appliances. Electric distributors utilize energy meters installed at consumers' premises to track power consumption for billing purposes. The energy meter features a calibration LED that indicates real-time power consumption. By counting the number of LED blinks, the power consumption can be calculated.

Real Time Clock (RTC) –

The Real-Time Clock (RTC) is utilized for monitoring date and time in order to produce bills periodically. It is connected to Arduino to activate the GSM and WIFI module for transmitting data to both consumers and distributors.

Arduino UNO -

The Arduino board will tally the number of pulses received from the optocoupler, which accurately represents the real-time power consumption of the consumer. It will then proceed to calculate the corresponding cost for the power consumed. These values, along with the power consumption and cost, will be showcased on the LCD screen. Additionally, at predetermined intervals set by the Real-Time Clock (RTC), the Arduino will transmit the detailed information to the consumer via the distributor, utilizing the WIFI module.

Liquid Crystal Display (LCD) -

The 16×2 LCD screen is utilized to showcase the amount of power being utilized by the consumer, along with the corresponding cost of the electricity consumed at the user's location.

PIR Sensor –

A passive infrared sensor (PIR sensor) is an electronic device designed to detect and measure the infrared (IR) light emitted by objects within its range. These sensors are commonly utilized in motion detectors that rely on PIR technology.

WIFI Module –

The utilization of Wireless Fidelity (WIFI) technology enables seamless connectivity between the distributor's PC and the consumer's device, thereby facilitating the updating of power consumption and associated costs on the distributor's end.

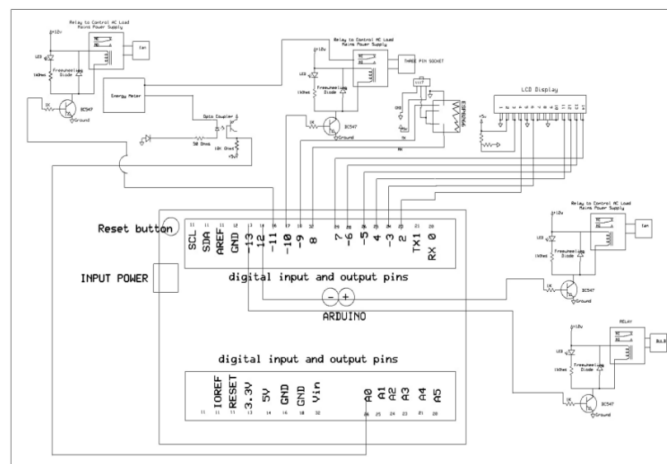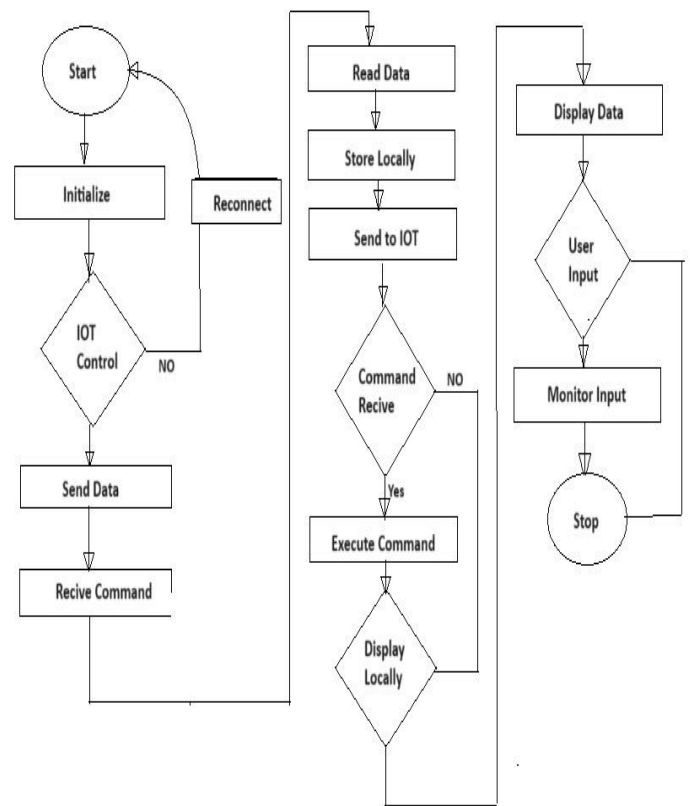**Fig -2**: Circuit diagram

6. FLOW CHART
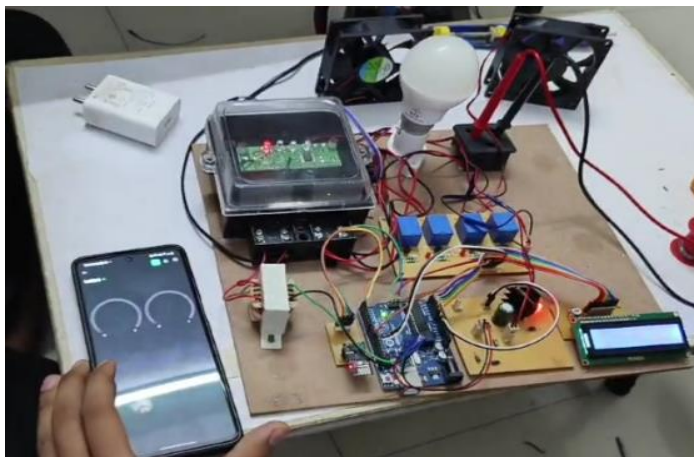

7. ACKNOWLEDGEMENT

We express our profound gratitude for the chance to work together on this project. It has been a voyage of commitment, innovation, and collaboration. Your confidence in our skills and vision has played a crucial role in making this endeavor successful. We offer our sincere thanks to each member of our team whose hard work and knowledge have influenced this project. Furthermore, we acknowledge our stakeholders and supporters for their steadfast faith in our abilities. Together, we have reached a significant milestone that showcases our joint dedication to excellence. We anticipate future partnerships and trust that this project will stand as proof of our mutual commitment to success.

8. SURVEY

In 2013, Using Arduino microcontroller board, an ENC28J60 ethernet module, and a current transformer sensor in proposed system. The method of current sensing employed is non-invasive type. The User Interface of the device is to be developed in android and the data will be uploaded onto a server using the ethernet connection. The final output will be a smart plug that can monitor a remote device usin g Arduino android platform. [3]

In 2016, design and implementation of an energy meter using Arduino microcontroller which can be used to measure the power consumed by any individual electrical appliance.Internet of Things(IoT) is an emerging field and IoT based devices have created a revolution in electronics and IT. The main intention of the proposed energy meter is to monitor the power consumption at the device level, upload it to the server and establish remote control of any appliance. The energy monitoring system precisely calculates the power consumed by various electrical devices and displays it through a home energy monitoring website. [2]

In 2018, Using Wi-Fi module entire system will be controlled. Internet of Thing (IoT) is internally related to computing tricks transferring the dataunder the network with no any help of a human to human or human to computer interrelation. The load to the consumer is to consume regularly with regular monthly payment of the bill.When the electricity bill is paid then the supply will continuously flow or provides. [1]

9. CONCLUSION

The final Result matches with estimated objectives of system we considered previously . Furthermore, it could acknowledge the significance of real-time data analysis and remote control capabilities also automation for effective power management. Ultimately, the conclusion highlights the energy efficiency and sustainability objectives across different industries.

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