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Smart Energy Meter by Using IOT

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Abstract: ***It is an IOT based paper electricity is one of the fundamental necessities of human beings which is commonly Used for Domestic, Agriculture, Industrial purpose. Power theft and Meter billings are biggest problems in recent days which causes a lot of loss to electricity board. If we can prevent these thefts we can save a lot of power. This is done by Smart Energy Meter by using IOT, present an efficient and cost-effective way to transfer the information of energy consumed by consumer wirelessly as well as it provides facilities to detect illegal usage of electricity. Smart Energy meter by using IOT basically consists of three major components namely controller, Wi- Fi, theft detection device. Whenever there is any fault or theft, the theft detector sensor detects the error. The controller plays a crucial role in keeping all the components in the working state. In this system the energy meter is connected to internet. The proposed system is capable of continuously monitoring and being notified about the number of units consumed to energy provider and consumer. The energy consumption is calculated automatically, and the bill is updated on the internet by using a network of internet of things. This automation can eliminate the manual work in electricity maintenance. In this paper mainly focuses on automatic billing, theft detection, power optimization and providing the relevant energy consumption information to user.***

Keywords: IOT(Internet Of Things), Theft detection device, Wi-Fi, Automatic Billing

I. INTRODUCTION

In recent days, Electricity is the essential commodity in the world for human life today Every home, offices, companies, industries requires electricity connection for their functioning. Due to rapid increase in human population and the human's dependency towards electrical energy. Internet of Things (IOT) technology can be employed to energy consumption and distribution in different scenarios. Latest development in IOT and digital technology, the concept of smart city is becoming smarter compared to earlier years. Therefore, it is necessary to switch over to innovative and better alternatives such as smart grid, smart meter. The energy consumption can be monitored by electric device called energy meter. The cost and 1/4 usage of Power consumption are informed to the user to overcome high bill usage. The Energy meter shows the amount of units consumed and transfers the data to both the customer and to the electrical board so this helps in reducing man-power.

The user can check their Power usage from anywhere and at any time interval. The IoT is used to Turn on/off the household appliances using relay and Arduino interfacing. The objective of this system is to monitor the amount of electricity consumed. The distributor and the consumer both will be benefitted by eventually reducing the total Power consumption. On Worldwide electrical energy consumption has been increasing in the past and has a tendency of growing in the next years. The demand for living comfort with increasing use of electrical appliances and the simpler use of electricity against gas or other forms of energy has increased household electrical energy consumption. Measurement of energy consumption is a key issue. There are many devices commercially available to measure and monitor household energy consumption.

II. LITERATURE SURVEY

Smart energy meters utilizing IoT technology provides a comprehensive overview of the current state-of-the-art solutions, challenges, and opportunities in the field of energy management. With the increasing emphasis on energy efficiency, sustainability, and smart city initiatives, there is a growing interest in leveraging IoT devices to modernize traditional energy metering systems.

1) Title-1

Smart energy meter using GSM "Visalatchi S and Kamal Sandeep K" This is described to, measure energy consumption in the houses and generate bill automatically using telemetric communication.

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2) Title-2

Smart energy meter "Jithin jose.k ,Tony C Benny" Even the latest energy meter is not tamper proof .Hence considering all the factors it is possible to design an energy meter that is tamper proof. It helps in finding the fault location of transmission lines.

III.OBJECTIVES

1) Develop IoT-based Smart Energy Meter.
2) Real-Time Monitoring.
3) Power Theft Detection.
4) Over load Protection.

IV. METHODOLOGY

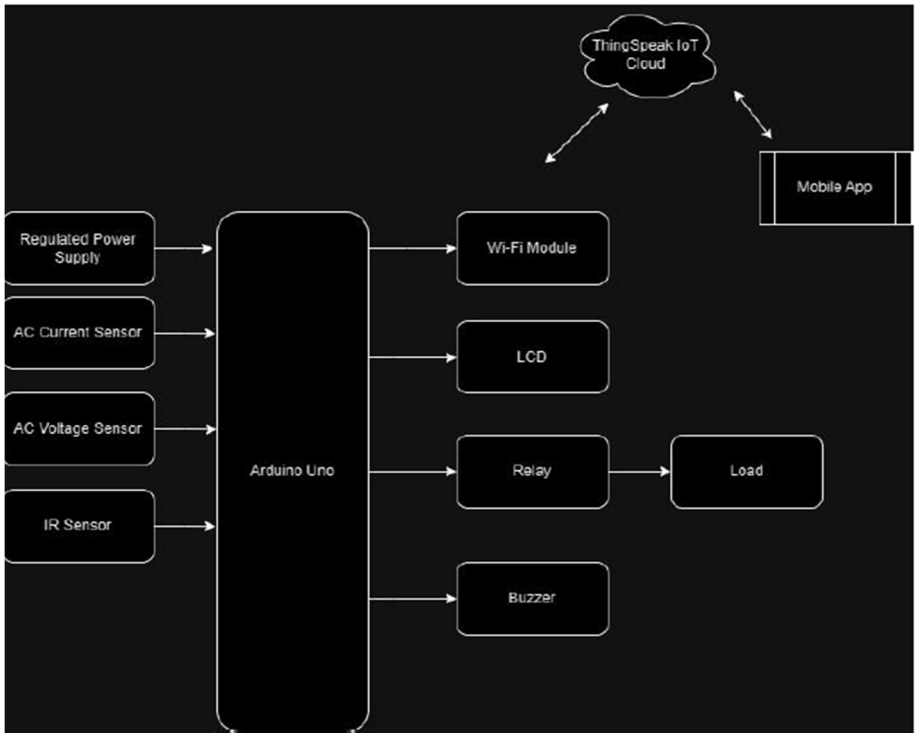


Fig-1: Block diagram for proposed System

In this project Arduino UNO one side is connected to IR Sensor, AC Current Sensor, Regulated Power Supply and AC Voltage Sensor. In Arduino UNO another side is connected to Wi-Fi Module, LCD, Relay, Buzzer and Loads. In this project I am using Thing speak IOT Cloud for update the real time information to server and as well as user.

V. WORKING

In this paper, here we have interfaced electricity energy meter with ESP8266 using the pulse LED(Calibration or Cal) of electricity Energy meter. The pulse LED can connect to ESP8266 through an Optocoupler IC. When we power up the system microcontroller reads the how many times pulse LED will blinking a minute using following equation.

- Pulse= (Pulse rate*watt*time)/ (1000*3600)
- Power Factor=watt/(hour*pulse)

Thing Speak is IoT platform for user to gather real-time data, for instance, climate information, location data and other device data. In different channels in Thing Speak, you can summarize information and visualize data online in charts and analyse useful information. Thing Speak can integrate IoT bit (micro:bit) and other software/ hardware platforms. Through IoT bit, you can upload sensors data to Thing Speak.

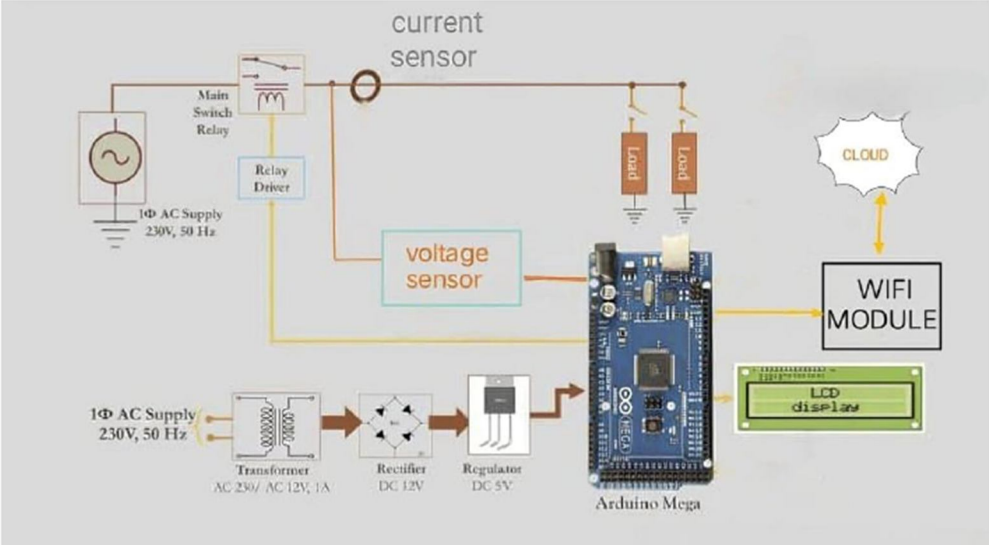


Fig-2: Circuit diagram for smart energy meter

In conclusion, integrating equations and mathematical calculations into a smart energy meter through an IoT project offers numerous benefits. Firstly, it enables accurate measurement and analysis of energy consumption patterns, allowing for more efficient resource management. Secondly, it facilitates real-time monitoring and control, empowering users to make informed decisions about their energy usage.

VI. FUTURE SCOPE

Smart meters have come a long way since their introduction, and they continue to evolve and improve. As technology advances, the future of smart meters looks brighter than ever before. Here are some key advancements and innovations that we can expect to see in the future of smart meters.

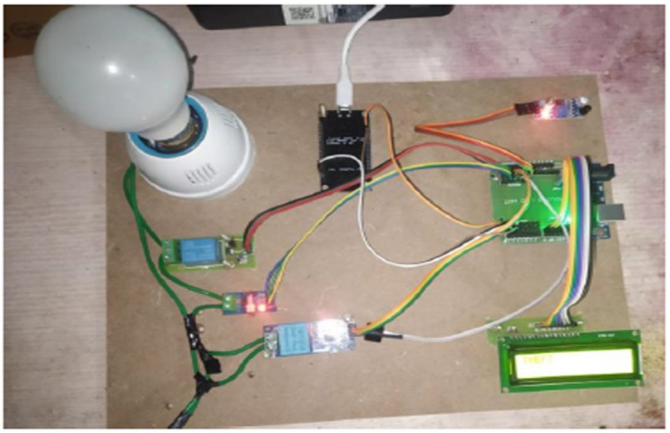
1) Predictive maintenance
2) Integration with renewable energy sources
3) Increased connectivity

VII. CONCLUSION

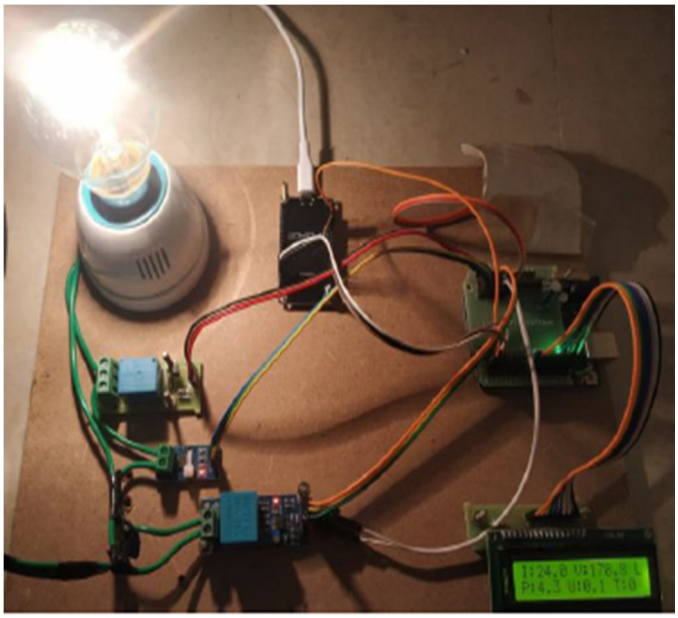
In conclusion, the integration of Alexa into a smart home automation system offers more convenience and efficiency. Through voice commands, users can effortlessly control various devices, from lights to thermostats, creating a seamless and interconnected living environment.

VIII. RESULTS

A. *When Loads Off Condition*



B. When Loads On Condition



In conclusion, the proposed IoT-based smart energy meter with a power theft alert system presents a comprehensive solution for efficient energy monitoring, security, and control. By leveraging advanced technologies including Arduino microcontrollers, sensors, IoT connectivity, and cloud-based platforms, the system offers several benefits and functionalities.

The utilization of Node MCU, Wi-Fi modules facilitates seamless connectivity to the IoT network, enabling real-time data transmission to external platforms such as Thing Speak. Through Thing Speak integration, users can remotely access energy consumption data and receive alerts via a mobile application or web interface, promoting energy efficiency and enabling proactive management of energy usage patterns**.**

Overall, the proposed system offers a sophisticated and innovative solution for addressing the challenges of energy monitoring, security, and control in residential, commercial, and industrial environments. By empowering users with real-time data and alerts, the system promotes energy efficiency, prevents potential losses due to power theft, and enhance

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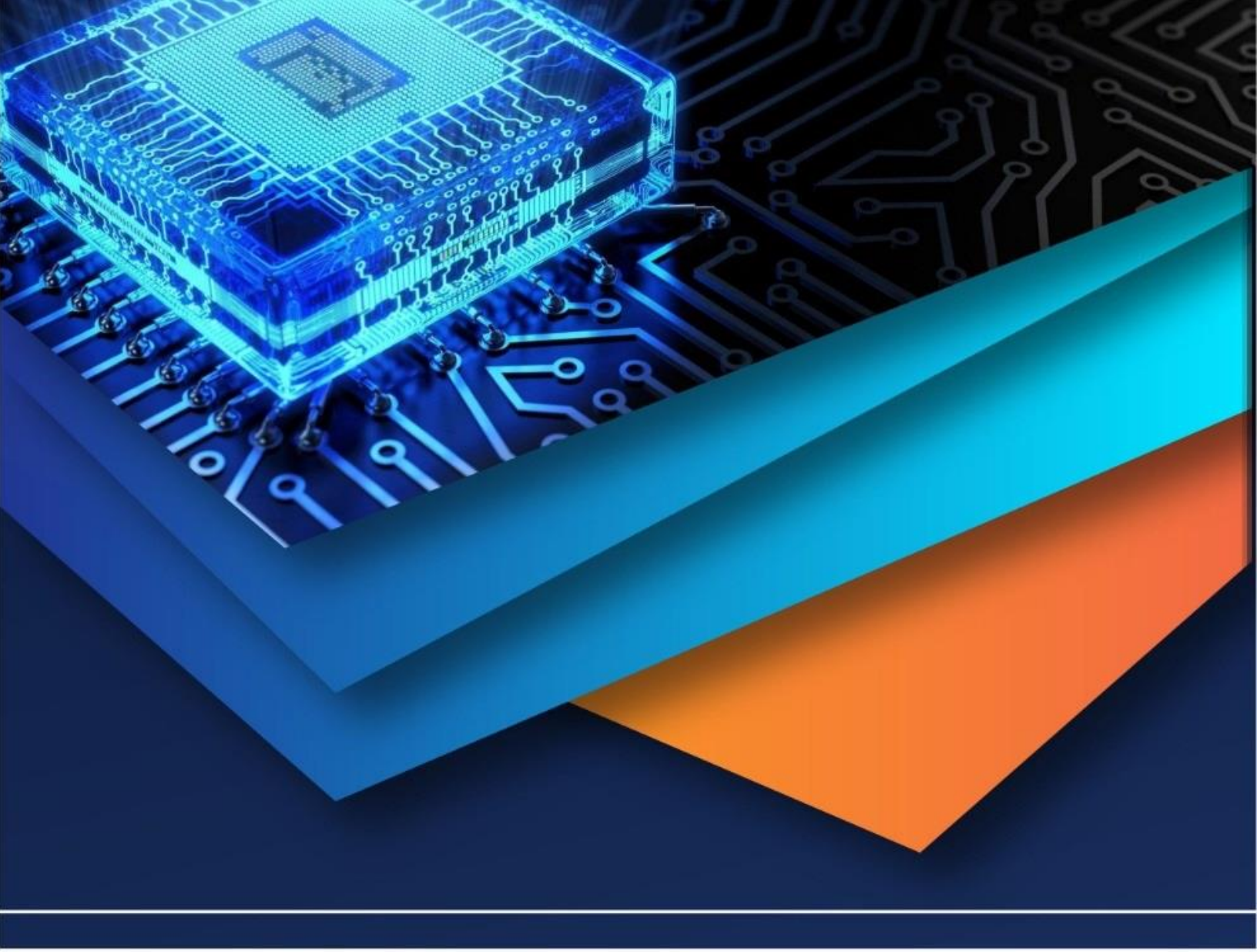
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