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Integrated Smart Switch Using IOT

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ABSTRACT--This project has been designed to facilitate energy-saving and monitoring of the energy consumption of electrical appliances in both industrial and home settings. The project has utilized an Integrated Smart Switch and iottechnology to achieve this goal. The IoT-based system comprises Arduino-Uno and a mobile application that enables users to monitor the energy consumed by each switch connected to a load through their smartphones. The system also includes a Relay module that helps detect faults occurring in any of the loads connected to the switches, and the details of the fault can be retrieved through the mobile application.

KEYWORDS*:* IoT, Smart phone,Load monitoring, Energy consumption,Eqipment safety, Equipment protection

I.INTRODUCTION

Industries require energy audits to reduce unnecessary energy consumption, and an IoT-based remote energy parameter monitoring system has been developed to meet this need. The energy audit aims to identify energy usage in the industry and enable implementation of an energy management program. The remote monitoring of industrial sensors, machinery, and power panels is in high demand, and many organizations are working on developing this technology. However, many embedded systems and devices require redesigning to enable communication through the internet. The Internet of Things (IoT) has played a crucial role in connecting different devices to the internet and revolutionizing the industrial sector by enabling remote monitoring and control of various energy parameters.

II. PROBLEM STATEMENT

This application is an energy-saving system that utilizes the Internet of Things (IoT) technology. Its main purpose is to design a remote energy monitoring system by incorporating various technologies such as digital instrumentation, communication networks, software, and databases. The system aims to achieve centralized management, decentralized control, and remote monitoring to improve energy efficiency as well as other aspects. The application also focuses on reducing power loss due to contact losses of switching and fan-speed regulation, which can result in increased power consumption. However, using relays for fault measurement for every domestic purpose can be expensive and inconvenient. Therefore, fault detection in domestic settings can be challenging, and using cheaper methods may lead to inaccuracies and cause greater damage to equipment.

III. METHODOLOGY

This system is a smart home automation system that can control and monitor a lamp load remotely using a smartphone. The system consists of a 230V single-phase power supply, voltage and current sensors, an ESP32 WiFi module, and a relay.Thevoltage and current sensors are used to measure the voltage and current respectively, and the measured data are sent to the ESP32 WiFi module. The module then sends this data to the smartphone using WiFi as the communication medium. The relay is used to control the lamp load, acting as a switch.In case of a short circuit or overload, the current and voltage will change, which will be detected by the current and voltage sensors. The measured data will be sent to the ESP32 module, which will check if the measured value is within the threshold value or not. If the value is above the threshold, the ESP32 module will send a signal to the relay, which will cut off the power supply to the load. Additionally, an alert message will be sent to the smartphone using WiFi as the communication medium.The system also displays the live current and voltage consumed by the system, which can be viewed on the smartphone screen. The user can also remotely control the switching on and switching off of the load using the smartphone. Overall, this system provides a convenient and efficient way to control and monitor a lamp load remotely.

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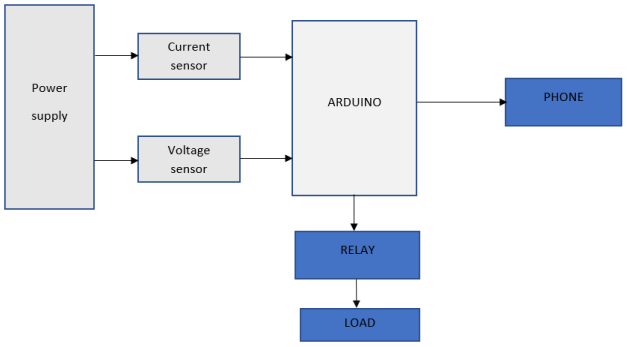

Fig.1 Block Diagram of Integrated Smart Switch

IV. SYSTEM DISCRIPTION

1. SCT013 Sensor

The SCT013 current sensor is a highly versatile and convenient device for measuring AC current without requiring any physical connection to the conductor. Its ferrite core, primary and secondary windings, and load resistor together allow for precise measurements of currents up to 100A. The primary winding is connected in series with the conductor, and the secondary winding is connected to the load resistor, allowing for the induction of a proportional voltage in the secondary winding as the current in the primary winding changes. This voltage can be measured and used to determine the current being carried by the conductor.

2.ZMPT101B Voltage Transformer Module

The ZMPT101B is a module that is designed for measuring and monitoring AC voltage in a circuit. It is commonly used in applications such as power supplies, lighting control systems, and industrial automation. The module operates by transforming the AC voltage in the circuit to a lower level suitable for microcontrollers or other control devices to measure. It has a high accuracy of up to 0.5% and low power consumption, making it ideal for use in energy-efficient applications. The module also has a built-in voltage regulator to ensure stable and accurate voltage output and an isolation transformer to protect the measuring device from voltage spikes and other electrical disturbances that can occur in the circuit. The module has a compact size and is easy to install, with screw terminals for connecting to the circuit. It is typically powered by a DC voltage source and has an output signal that is proportional to the input voltage.

3. ESP32 wifi module

The ESP32 is a system on a chip (SoC) developed by Espressif Systems, known for its low cost and low power consumption. It is the successor to the ESP8266, which gained popularity for its built-in WiFi capabilities. The ESP32 offers not only built-in WiFi, but also Bluetooth and Bluetooth Low Energy, making it a powerful and versatile microcontroller-based SoC suitable for a wide range of IoT and embedded applications. The ESP32-D0WDQ6 chip is based on a TensilicaXtensa LX6 dual-core microprocessor, with a maximum operating frequency of 240 MHz. Its dual-core processor, extensive peripheral interfaces, and wireless connectivity options make it a popular choice among developers.

4.Relay

A relay is an electronic switch that can control the flow of current in a circuit. It is made up of a coil that generates a magnetic field when energized, which then activates one or more contacts to open or close a circuit. Relays have a variety of uses, including in industrial control systems, automobiles, and electronic devices. They are often used to switch high-voltage or high-current circuits using a low-voltage or low-current signal, providing electrical isolation between the control circuit and the load circuit.

5. Lamp

A lamp is an electrical device that produces light. It typically consists of a bulb or a tube containing a filament, gas, or LEDs (light-emitting diodes), which when connected to an electrical power source, emits visible light. Lamps come in a variety of shapes and sizes, and they are used for various purposes such as illumination, decoration, and signaling.

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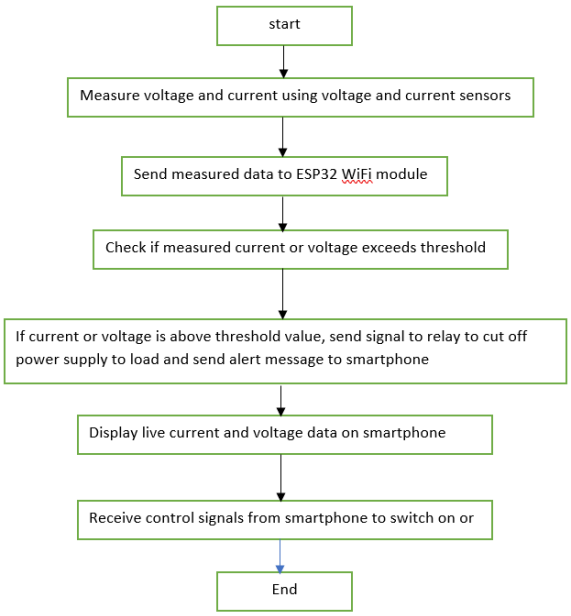
V. FLOWCHART



VI. ADVANTAGES

- User can calculate unit consumed per a day by specific electrical appliances.
- Inbuilt Relay helps in giving protection to electrical appliances from fault current.
- Switch can be operated without manual operation.
- Faults such as Short circuit and Over current can be easily identified.

VII.CONCLUSION

This smart home automation system offers an innovative solution for controlling and monitoring a lamp load remotely using a smartphone. The system includes a 230v single-phase power supply, voltage and current sensors, an esp32 wifi module, and a relay, which work together to measure the voltage and current, control the lamp load, and send data to the smartphone via wifi communication. The system's ability to detect short circuits and overloads and to send alerts to the smartphone ensures the user's safety, while the live display of current and voltage consumption on the smartphone screen provides valuable information for monitoring and managing energy usage. This system represents an excellent example of how technology can be used to make our lives more comfortable, convenient, and efficient.

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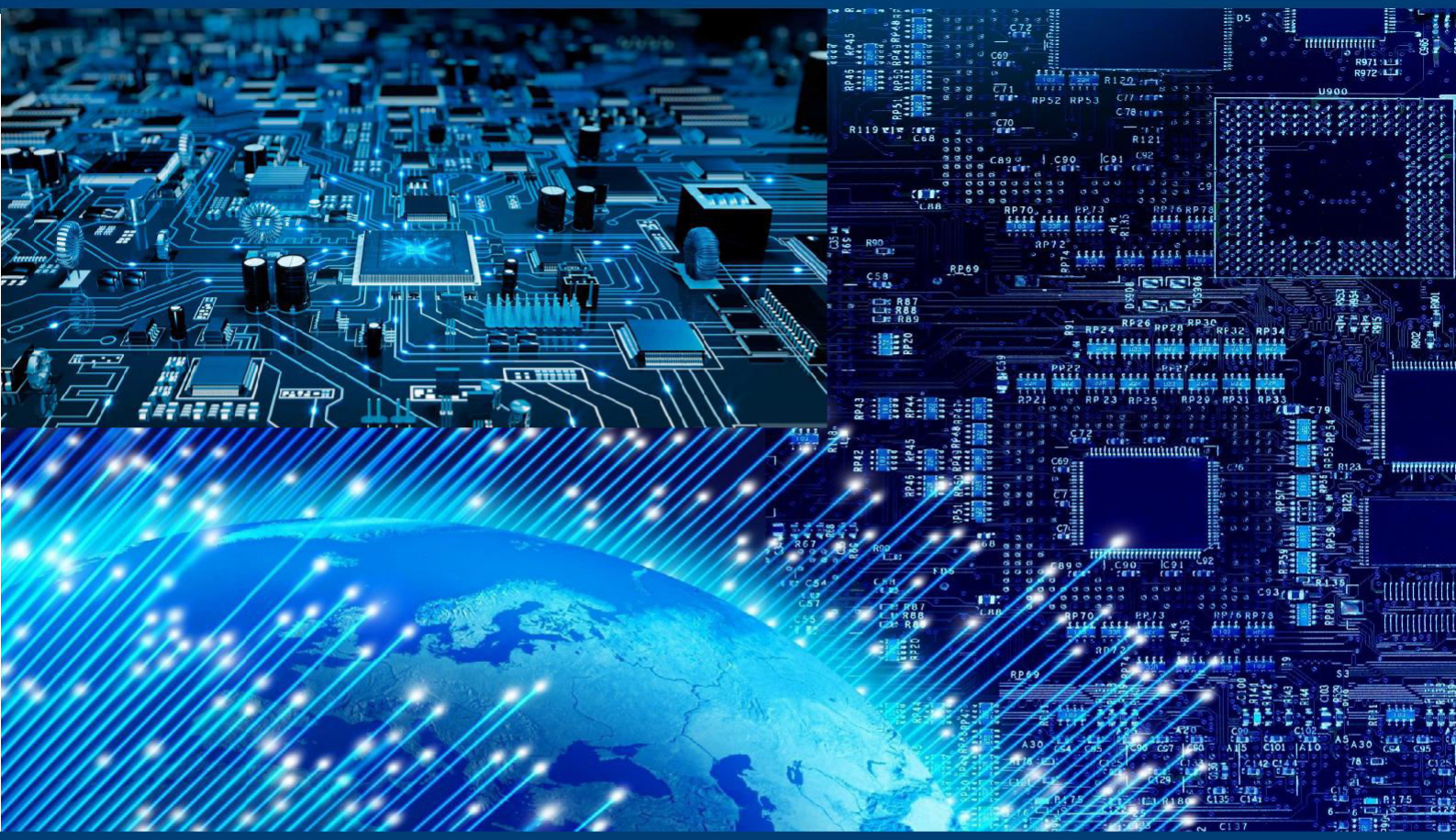

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