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Introduction To Smart Energy Management Systems

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Abstract: ***Home and business owners have always been concerned about energy and electricity usage. As resources become scarcer and power rates rise, it's more vital than ever for households and companies to understand how they use energy and how to use it most efficiently. Installing an energy management system, which helps the user understand when they consume the most energy are the best tactics they can employ to conserve, is one way they can achieve this. We'll utilize telemetric communication to measure how much energy is used in the house and automatically issue a bill. This will aid in minimizing energy usage in the home because the owner will be constantly informed of the number of units that are being utilized. The main goal is to create the bill automatically by checking the house's electricity consumption in order to eliminate human labor and to gain forecast insights into energy consumption. The computations will be carried out automatically, and the bill will be updated online via an Internet of Things network. The amount of the bill can be reviewed remotely by the user.***
Keywords: Internet of Things, Telemetric communication, Forecast etc.

I. INTRODUCTION

In today's world of technological innovation and intelligence, people don't have nearly enough spare time to deal with issues that arise with their control electrical devices and other electrical devices that are frequently used. As we all know, automatic fault detection of electrical devices is a difficult task, so to deal with those faults that occur in any specific device, we've come up with this project of automatic fault detection in any device with the help of IoT, which can reduce the chaos of hiring a trained worker for initial detection and repair, thereby increasing the device's efficiency and saving time and energy. The distribution corporations are unable to keep track of the dynamic most demand of clients in the gift request system. Even when bills are regularly paid, the customer is concerned about things like getting bills for payments that have already been made on time and poor care for the availability and quality of energy. The answer to these issues is to routinely monitor the loads of the consumers, so that you may command to ensure valid requests, track most demand, and set a price threshold. These are all of the alternatives to think about while designing a cost-effective energy request system.

The current initiative, "Smart Energy Management System," addresses challenges that both customers and distribution companies encounter. The research focuses on a sensible energy metre that employs embedded system alternatives, such as a combination of hardware and code, to achieve desired functionality. The study compares Arduino and other controllers, as well as the use of GSM and Wi-Fi modems to implement a 'Smart' notion. With the use of GSM electronic equipment, both the client and the service provider can get the utilized energy reading with the individual number. Customers can also get a text message notification via GSM when they are about to reach their threshold price, which they have established. Additionally, using Wi-Fi technological equipment, the customer can track his consumed reading and set the brink price via a website. This technology allows the power department to scan metre readings on a monthly basis without having to visit each home. This might be accomplished by using an Arduino unit that continuously monitors and records energy metre readings in a nonvolatile memory location. This technology continuously captures the readings and also displays the live metre reading on a webpage for the patron's convenience.

The globe is currently dealing with a number of major concerns, including the energy crisis. The most effective treatment for this may not be increased energy production, but rather efficient utilization of currently available energy. The energy problem will be mitigated to some extent if we keep a close eye on our energy consumption and avoid wasting it. However, energy monitoring is ineffective because customers do not appear to be aware of their energy usage. Only if the electricity bills are issued would they receive inspiration regarding their utilization. Bills are issued once every month or every two months in India. As a result, customers tend to remain in the dark regarding energy usage during this duration. In an era of comprehensive medical care, no one can bear the inconvenience of travelling to check their power metre reading and comparing it to the prior reading in order to develop a consumption plan.

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This entire method must be repeated several times per month in order to effectively manage energy usage. This is a significant step forward in the energy management field of study if customers check their energy consumption using their mobile or laptop computer rather than examining the energy metre.

The Internet of Things (or IoT) is a network that connects physical items such as machines, vehicles, buildings, and other things that are equipped with sensors, actuators, software, and network connectivity to gather and exchange data. Energy metres are connected to the internet using the IoT architecture in the envisaged system. Hence as a result, there is an option that allows users to monitor their energy usage over time and adjust it as necessary.

II. PROPOSED SYSTEM

A. *Hardware Details*

1) *ESP 32 Microcontroller:* The low-cost, low-power ESP32 microcontroller family has a dual-mode Bluetooth and integrated Wi-Fi. The Ten silica Xtensa LX6 CPU is available in dual-core and single-core versions in the ESP32 series includes filters, power-management modules, low-noise amplifiers, power amplifiers, and built in antenna switches. Refer fig.1

2) *HLW 8012:* Using a 50% duty cycle square wave with frequency proportional to magnitude, The HWL8012 is a 5V IC that produces RMS voltage, current, and active power when measuring voltage and current. Refer fig.2



Fig.1.

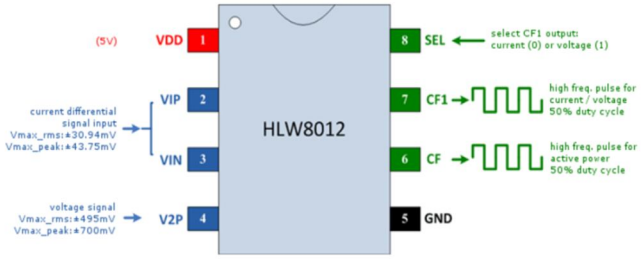


Fig.2

3) *Block Diagram*

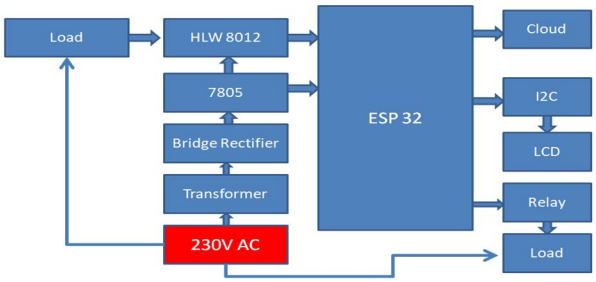


Fig.3

4) *Input:* Current is determined by measuring the potential difference across a milliohm resistor in series connection. VIP and VIN pins are subjected to differential potential. The resistor must be selected so that the VIP-VIN wave has a maximum peak potential of 43.75 mV. A 1 milliohm resistor has a dissipation of less than 1 watt and can measure currents of up to 30 amps. The voltage is measured in the usual way, but the potential has to be scaled down because the V2P pin supports up to 495mV RMS signals. According to the HLW8012 datasheet, a voltage divider should consist of six 470kOhm resistors upstream and 1kOhm resistor downstream. This translates to a scale factor of 2821, which converts 230V RMS to 82mV, which is well below the legal limit.
5) *Output:* The square wave is output by two pins on the MCU side of the IC. The CF pin pulse frequency rises in tandem with the active power. The relationship is affected by the reference voltage (2.43V), the internal clock frequency (typically 3579kHz), the voltage divider in the V2P input, and the milliohm resistor. A frequency of 1Hz equates to a 12W active power for the datasheet's indicated application, 10Hz to 120W, 100Hz to 1.2kW, and so on. Depending on the value of the SEL pin, The RMS current or voltage is inversely proportional to the CF1 pulse. If SEL is pushed high, the CF1 pin produces a square wave at a frequency equal to the RMS current sensed. If SEL is pulled low, the RMS voltage is output instead. For a 1Hz wave, the nominal values (according to the datasheet) are 15mA or 0.5V.
6) *IOT Platform:* You can collect, visualize, and examine real-time data streams with the cloud-based IoT analytics platform ThingSpeak. Data sent to Thing Speak by your devices is visualized in real time by Thing Speak. You can analyze and control data as it comes in real time with the option to run MATLAB code in Thing Speak. For IoT system prototypes and proofs of concept that require analytics, Thing Speak is widely utilized.

III. RESULTS AND DISCUSSION

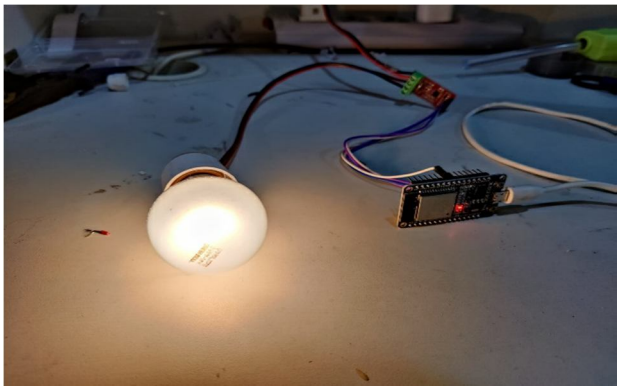


Fig.4

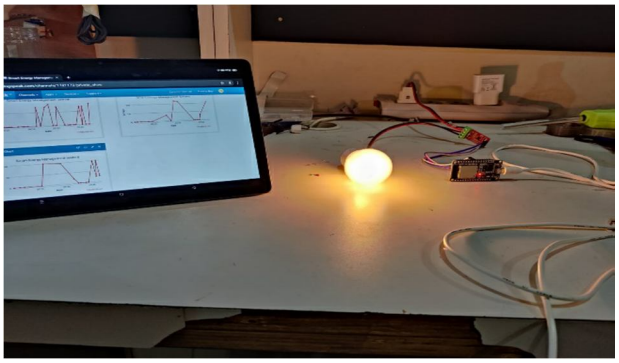


Fig.5

Output observed on the IoT platform. Thingspeak is the desired output.
We got accurate readings of Voltage, current, active power and total power consumption for the load which in the Fig.4 and Fig.5 can be seen as a bulb.

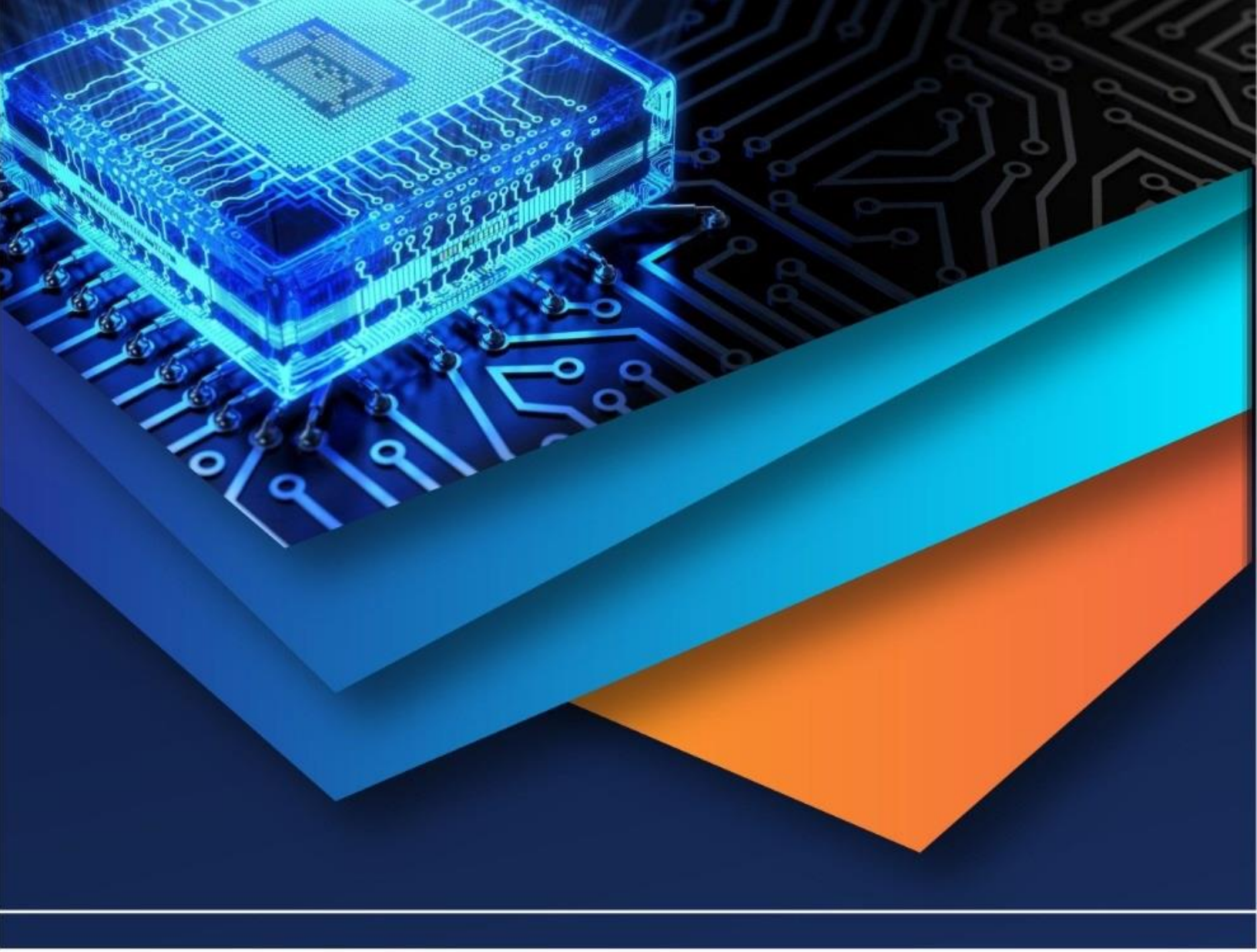
IV. CONCLUSION

In this project, a portable smart energy meter framework was designed, implemented, and tested. A feasible model of 'IOT Based Intelligent Energy Metering to Increase Efficiency & Accuracy in Current Billing Methodology' has been attempted. The propagating model is used to determine the household's energy use and even generate a convenient energy unit reading. As a result, it decreases energy waste and raises awareness among everybody. Even the manual intervention would be deducted.

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