Smart Home Automation System Using Wireless Sensor Networks

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Abstract. The architecture explains how load energy consumption readings can be digitised and shared through the internet. Human presence in electricity maintenance is eliminated with the proposed machine style. By having a channel id for the load, A webpage can be used to monitor energy usage in watts. The webpage makes use of THINGSPEAK analytics to look at energy use and provide a detailed overview and visual representation of the data. The Wi-Fi unit performs Cloud computing by providing load energy data to a website usable via the device's channel id. Client can control resources inside the proposed framework by tracking energy consumption over time. The Arduino microcontroller is used in this system. The created unit is frequently shown on the webpage via the Wi-Fi module. Wireless Sensor Networks, Power, Voltage, Current, and ZigBee are some of the terms used in this paper.

1. Introduction

The idea of the Internet of Things (Internet - of - things) helps the United States to bind ordinary objects through the internet. The networks connected to the Internet of Things are often examined from away. The Internet of Things architecture provides the tools and opportunities needed to link the physical world with computer-based systems. With a lot of and a lot of wireless devices that are growing at a rapid rate within the industry, the build has been gaining significance [1]. Hardware devices are linked to one another through the internet. The system's second sight 8266 Wi-Fi module provides the property with access to the internet. Electricity demand is growing at an increasing pace among the population, and it is being used for a variety of purposes, including agriculture, industry, unit operations, hospitals, and so on. As a result, coping with power maintenance and requirements is getting more difficult [2]. As a result, there is an immediate demand to stop losing the full amount of energy possible. Since the demand for electricity among younger generations is growing, technological advancement is needed to keep up. The proposed device brings a technological twist to standard energy metres by using The Technology (IoT). There are also a variety of reasons which we must fix, such as power theft, which allows the state to lose revenue. The key goals that lie ahead for a more efficient infrastructure are monitoring, optimised power consumption, and reduced power waste [3].
2. Working Research
Observation, coordination, and research units make up the proposed structure. Client masses are wired to ACS712 current sensors and a voltage sensing circuit in the observance setup. Arduino and a LAN module make up the contact unit. The research unit may be a customer smartphone device with connections to voltage and currents, load curves, energy usage, and so on [4]. A node is built using a consumer's load, voltage and current sensors, an Arduino UNO, and a LAN (ESP-8266) communication board. Sensors are attached to the Arduino, which gathers load data and stores it in internal memory. LAN obtains load information from Arduino via a UART interface and transmits it to the server. The LAN modulates function as a connection between the surveillance facet and the internet server. ThingSpeak is an IoT platform that uses ASCII text files to store, interpret, and recover data from large numbers of people. The data keep helps energy companies and consumers to track load data on mobile devices and computers. The data keep helps energy companies and consumers to track load curves, energy usage, and so on [4]. A node is built using a consumer's load, voltage and current sensors, an Arduino UNO, and a LAN (ESP-8266) communication board. Sensors are attached to the Arduino, which gathers load data and stores it in internal memory. LAN obtains load information from Arduino via a UART interface and transmits it to the server. The LAN modulates function as a connection between the surveillance facet and the internet server. ThingSpeak is an IoT platform that uses ASCII text files to store, interpret, and recover data from large numbers of people. The data keep helps energy companies and consumers to track load data on mobile devices and computers. The data holds load trends, allows for complex asking, and aids in the adjustment of demand and supply of electricity between generation and usage. The successful power tariffs are designed in order to link multiple household equipment and provide wireless networks to monitor and control, but the designs are verified exploitation workplace scenarios. Furthermore, sensible metering schemes, such as, are adapted to particular usages and are closely related to regional usages that are confined to specific areas [5].

Different data and communication technologies community operation of sensible metre sensors was designed and measured at various flats in a vast geographical dominion for optimal power consumption, but the majority of the devices are limited to particular residences. The importance of understanding the efficiency and value considerations associated with the style and production of smart metres, as well as forecasting the application of the capacity usage, is undeniable. However, at the early stages of development, a low-cost, flexible, and strong framework for continuous monitoring and control helped the client needs area unit. The machine is designed to work with an Arduino microcontroller [6]. It's usually divided into three parts: a controller, a felony identification circuit, and a LAN device. The controller is in charge of doing basic measurements and analysing data. The felony monitoring circuit contains information on any additional or felony load energy readings, and the Wi-Fi interface is essential for transmitting data from the controller over the internet. The Arduino controller is programmed using the Arduino computer code IDE.

3. Overview of the System:

The Arduino microcontroller is at the heart of the machine. The controller, the theft detection circuit, and the WiFi device are the three structural components. The controller is in charge of the data processing and basic measurements. Theft monitoring circuit contains information on any additional or stolen load energy readings, and the Wi-Fi device plays the most crucial role in Information from the controller is transmitted via the Internet. The Arduino controller is generated with the Arduino IDE (Integrated Development Environment), which is required to use the board. It uses the C programming language to write its code.

3.1 Measurement of Voltage

The voltage electrical unit used in our study is the voltage phase down electrical device. Two bobbin compartments, self-extinguishing plastics, and an incredibly light weight are among the positioning choices (100gms). The circuit type configuration for voltage measurement is shown in Figure 3. The phase down voltage electrical system is used to transform a 230-240V input supply to a ten VRMSAC signal, which is then corrected and skillfully filtered to produce a DC voltage. This data is then sent to the ZigBee finish device's analogue input tube. The non heritable voltage signal is directly equal to the error provide voltage. To allow a particular voltage output for the ZigBee and the amplifier to work together, a transformer is attached to the corrected output of a voltage electrical unit. The graph shows
the voltage difference between the input and output is used to determine the signal's scaling.

3.2 Current Measurement

The present system will establish isolations inside the current electrical device until the mains are switched on. The amplified signal is then fed into the ZigBee module's analogue input tube. By exploiting burden resistance on the secondary facet, the specified voltage setting is achieved. The observed signal at the output is equal to the current at the origin as shown in Figure 1.

![Figure 1. Current calculation circuit diagram](image)

Following equal weight, power is measured inside the ADP device after obtaining corresponding current and voltage sensors' voltage outputs

\[ m_1 = \text{The signal is scaled from a voltage electrical unit to drive the input.} \]
\[ P = \text{Calculated Power Amount of voltage} \]
\[ m_2 = \text{The signal from the current electrical unit is scaled to urge the input.} \]
\[ m_2 = \text{The signal from the current electrical unit is scaled to urge the input.} \]
\[ v_1 \text{ is the current circuit's output voltage, and } v_2 \text{ is the existing circuit's output voltage. Factor of adjustment (Cf).} \]

3.3 Measurement of Power

The merchandise of volts and amperes could be improved by the capacity problem in order to measure the power of a single segment ac circuit. The circular function A power problem is characterized by changes in the phase of waveform, as seen in Figure 2.

![Figure 2. Power Factor Representation](image)

If the voltage and current are in phase, there is a power issue. If the attached load is just resistive,
electrical phenomena, or inductive, the signal of the current electrical interface is entirely dependent on the character of the connected appliance. Most of the time, the output waveforms aren't sufficiently bent, as seen in the graphs below (a,b,c,d). It can be deduced from the According to the charts, deciding almost no is challenging for some of the facilities, and vibration exclusion is difficult.

![Image](image_url)

**Figure 3.** The fabrication of an intelligent energy monitoring networks

### 4. Experimental Observations and Results

Information is compiled by a wise arranger based on appliance power usage, which preserves all information inside the device for processing as well as potential use of computing systems. Voltage, current, and control are examples of parameters that can be input into the knowledge arranger in a software system from appliances. These parameters are saved in a large database and evaluated. These parameters are represented on a visual user interfaced (GUI) window, allowing the user to take appropriate action from the interface. Figure 4 shows a reactive power strong programming with a Device driver is seen in a diagram.

![Diagram](diagram_url)

**Figure 4.** A reactive power strong programming with a Device driver is seen in a diagram.

The values of pressure, existing, and energy that have been stored are reflected on a computer interface. The voltage readings are processed with the aid of C sharp programming. Figure 5 shows the Voltage signal scaling factor (m1)
For the ability to mensurate for a few hundreds, a correction problem is needed. The solution to this problem can be found by plotting the measured in direct proportion to changes capacity chart. The paradigm has been put to the test, and the findings are undeniably positive for home electrical equipment. A table The proportion error for all calculated parameters is shown below, along with the related references. Figures 6 and 7 shows the output.
5. Conclusion

Victimization of energy observance IOT is a cutting-edge web of things technology that allows you to control your home appliances from any place on the globe through the cloud. A current device is used in the planned project to sense the present and display it on the network using IoT. The computer updates the data every couple of seconds on the internet, using the public cloud THINGSPEAK. Energy load use is accessible via Wi-Fi in the gift scheme, which will assist shoppers in avoiding unnecessary electrical use. An IoT framework will be developed in which users can track their energy usage and pay their bills online. In addition, a device will be implemented in which a customer will receive an SMS until he or she passes the threshold of an electricity consumption block. Once thievery is identified at the shopper finish, we can build a device that sends SMS to the involved metre reading man of that room. We can also forecast potential energy consumptions by using cloud analytics.

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