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Smart Building Energy Management System Using IoT

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ABSTRACT: In recent decades, energy has been the lifeblood of modern societies. As the world's population has grown and people'sdemands for comfort increased, so has energy consumption. The goal of this project is to create an architecture for a method of manually controlling four sensors-equipped relays in a smart building energy management system using Arduino and the Internet of Things. Robotization of gadget has a wide extension for this age as well as in impending age. In this versatile correspondence innovation is assuming a significant part in the realm of computerization. This article is entirely based on a low-cost and dependable home control monitoring system for remotely accessing and controlling appliances and devices through an Android smartphone app. Using this technology, the system makes the house a smarter place to live, saves time and energy, and reduces the amount of work people have to do. Additionally, it is very helpful in meeting the needs of disabled individuals at home and providing support, allowing them to live a normal life. We are monitoring the device with Wi-Fi technology because of its accuracy, long range, and instant connectivity. This module controls the home machines effortlessly of establishment and it is easy to use.

KEYWORDS: IoT, Smart Building(SB),Sensors, Data Visualization.

I. INTRODUCTION

Energy management systems have been in existence in the energy sector for several decades. The key functions of such systems are to watch, control, and optimize the flow and use of energy. In general, energy management systems have formidable applications in the generation, transmission and distribution systems of the electrical network. Today, the interests in Smart Energy Management systems have been increasing extensively.

Increasing economic growth and consumption patterns are leading to ever growing demand for energy. Since mostof the energy supply is from fossil fuels, the resource is depleting thus increasing cost of energy. Burning fossil fuels has also increased concentration of carbon-di-oxide in the environment leading to extreme weather patterns. Hence it is imperative that Industries and commercial enterprises take steps to reduce energy wastage, become energy efficient and reduce costs. Industry in India consumes 45% of the 900 billion Units of power produced. 35% of electric power produced is lost, and the losses are due to Transmission & Distribution (16%), theft (10%), Inefficiencies among users (10%). The 10% inefficiencies are largely among the industrial and commercial users who have high KVA HT connections. This leads to a drop in power factor and higher utilization of energy leading to higher rate slabs and penalties. Some organizations like Data centres measure Power Usage effectiveness where units consumed per annum is much higher than that required to power their total equipment. All these are applicable to industries like SMEs, cement, steel, auto, heat treatment/cooling, food processing, chemicals, plastics, textiles, commercial spaces using HVAC equipment, hospitals, hotels etc.

II. RELATED WORK

This is IoT project, it's to make a simple smart building energy management system using IoT and Aurdino. We can control home appliances using this and reduce unwanted energy consumption of the building. We are using various sensors which will collect the data and further it will be uploaded to cloud Thingspeak for data visualization and later we can check and compare the difference after implementing the system for total power consumed and total power saved.

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III. METHODOLOGY

We have developed an IoT. Based Energy Management System where environmental sensors like Temperature and light intensity sensor employed and reading sensed are sent to Arduino Microcontroller. Based on sensed reading, the Arduino microcontroller is programmed to control the appliance usage accordingly. In addition to controlling the appliance usage, the amount of current drawn by each appliance is computed using Hall Sensor which are sent wirelessly using Wifi module to esp8266 where total power consumption of each appliance is computer periodically and same plotted as graph. The graphical information on power consumption versus time for all appliances with varying environmental conditions is uploaded.
The BH1750- light intensity sensor will be used to measure the light intensity in the form of lux and send it to the Arduino. The Arduino runs a code that obtains the temperature and humidity from the DHT11 sensor. The Arduino then controls fan and light based on the temperature, Humidity and light intensity. Based on the data captured the in cloud server.

Arduino will also control the voltage required to be sent to the appliance with the help of transistor. The Hall sensor will measure the amount of current sent to the appliance and send it to the Arduino. The Arduino will then send the current consumed to the esp8266. The pi will receive the current consumed and calculate the power consumed and then upload it to a webpage and also will plot a graph base

In this project following component required for smart building energy management system

- Arduino UNO
- 4-channel 5v relay module
- Mobile
- ESP 8266 wi-fi module
- LCD Display

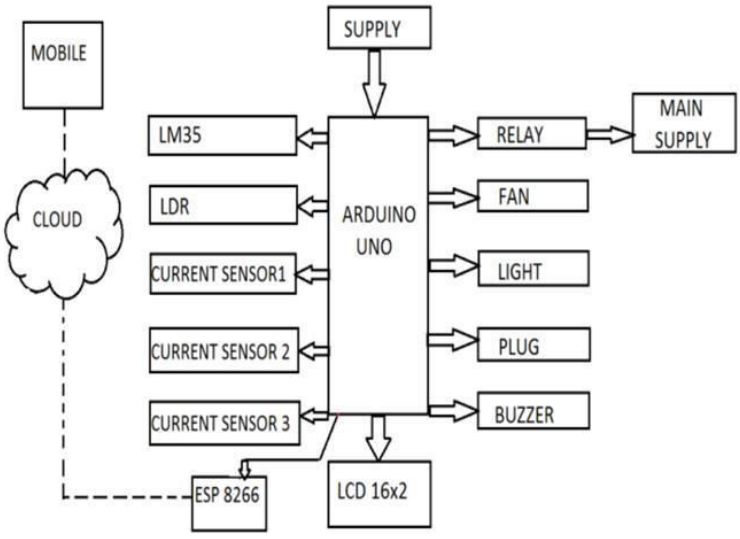

Fig. 1. Block Diagram of proposed system

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Connect Home Appliances with Relay Module:

- Connect the home appliances with the relay module as per the circuit diagram.
- Take proper safety precaution, while working with high voltage.
- Now, turn on the 5V DC supply and 110V/220V AC supply.

ESP8266 CONTROL RELAY WITH ARDUINO UNO

If the ESP8266 is connected with Wi-Fi, then we could control the relay module with Blynk App. We could control, monitor the current status of the relays from anywhere in the world from the Blynk App. When the internet comes back, the ESP32 will fetch the previous state of the switches from the Blynk IoT server and accordingly turn on and off the relays.

LM 35 :

LM 35 is a temperature device having and analog output voltage proportional to the temperature, it provide output in centigrade (Celsius). It does not required any external calibration circuitry.

Wi-Fi MODULE (ESP8266):

Wi-Fi stands for Wireless Fidelity. We are using Wi-Fi which acts as heart for IoT. Through Wi-Fi the consumer can set changes in threshold value, he can ON and OFF the electric use. Time to time the readings of units and cost are displayed on Thingspeak cloud. Consumer can accesses the Arduino board with help of Wi-Fi.

Switching Device:

In our system we are using SSR as switching device even though we can use RELAY because SSR is highly advantageous. We are using switching device to switch the energy meter. For ON and OFF purpose of meter we are using switching block. SSR stands for SOLID STATE RELAY.

Features of Relay :

- Both are used as AC switching device, but if switching speed is high than SSR is suitable, if switching speed is slowthan RELAY is used.
- Relay life decreases as number of usage time increases, but in SSR there is no change.
- For driving relay, current or power required is more comparatively to SSR.
- For switching SSR requires 15amp, whereas RELAY needs (30amp,50amp,90amp) as per requirement.

Arduino uno :

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

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IV. EXPERIMENTAL RESULTS

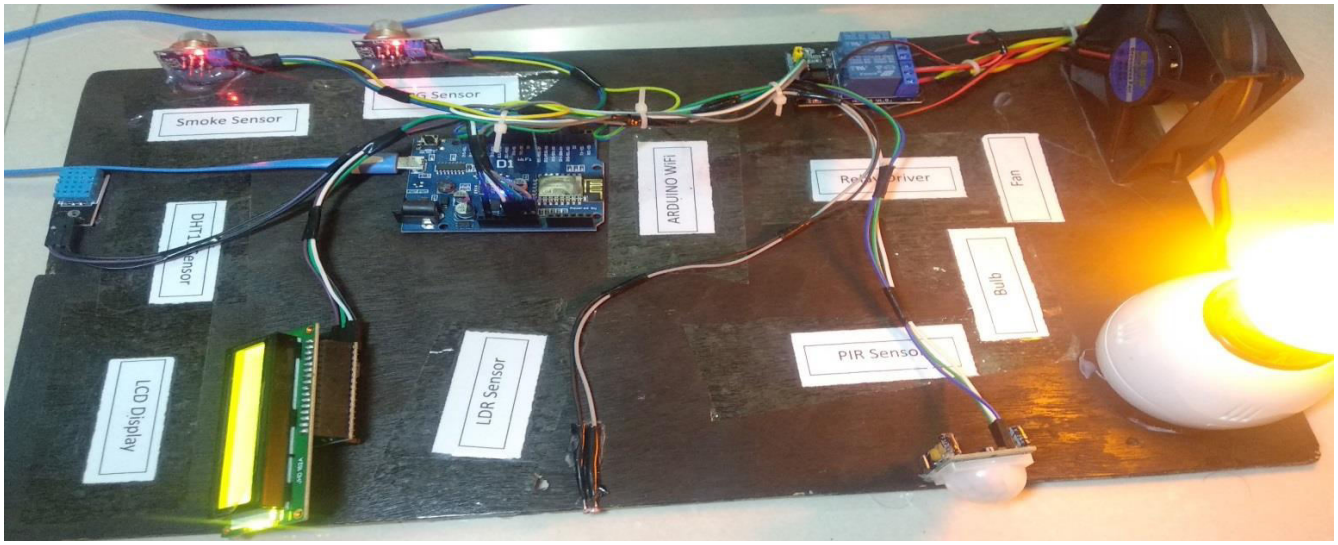

Fig.1.Project Model

The result section will include the result of present system is follows

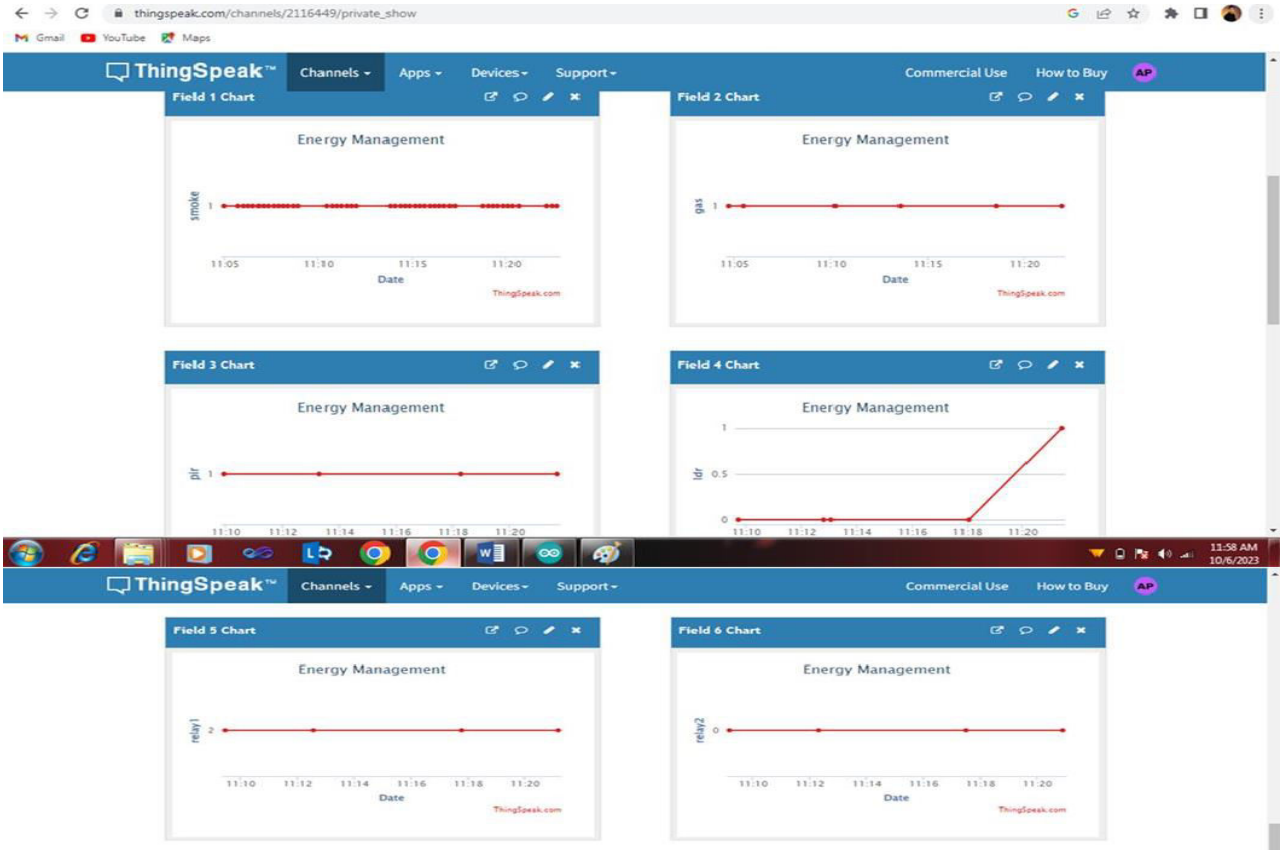

Fig.1. Final Output of Energy Management

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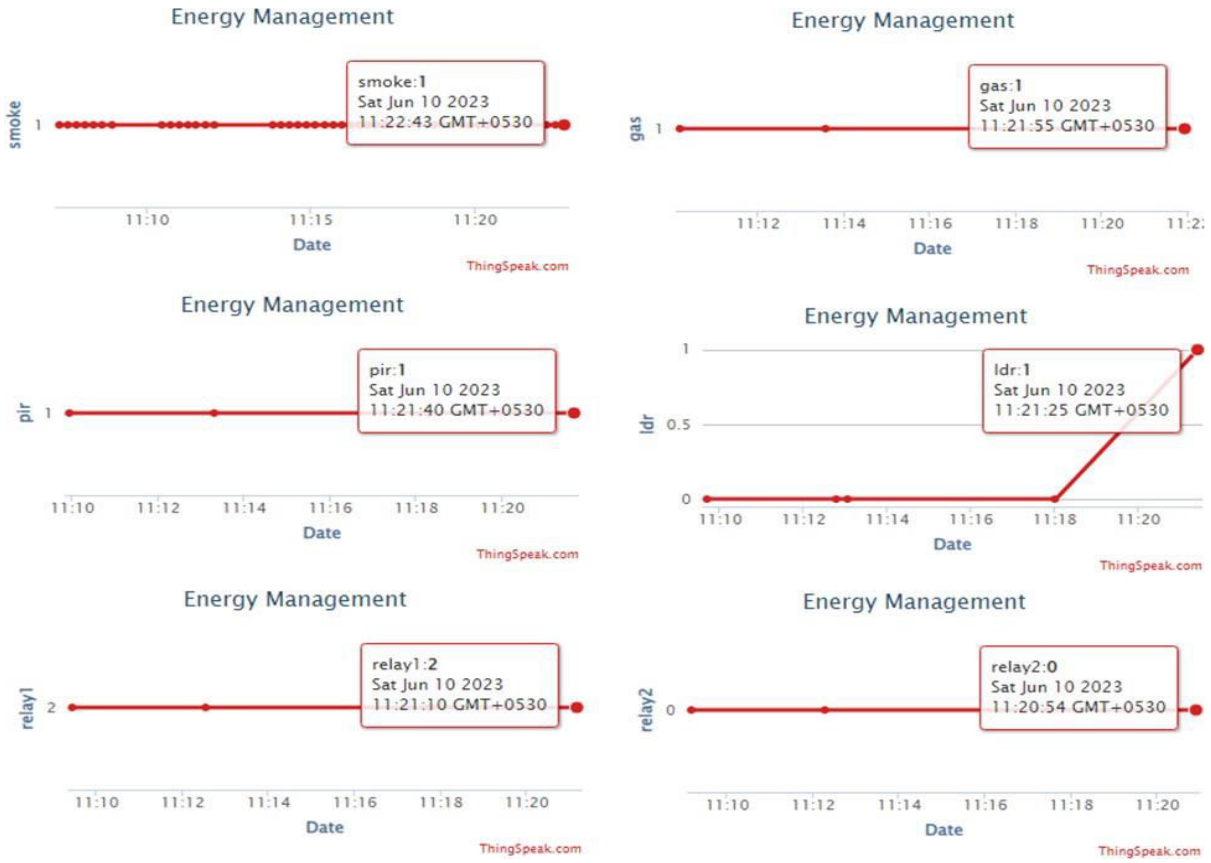

Fig.2. Final Output of Sensors

V. CONCLUSION

Energy efficiency is the wave of the future. The world is quickly moving towards energy sustainability. At an equivalent time, the mankind is trying to re-establish the connection it once had with nature. An energy efficient house is a private step toward the direction of renewable energy, environmental protection, and sustainable living. Having such a home helps homeowners reduce their bills and provides an excellent investment. Furthermore, energy efficiency means healthier and easier living that's in line with nature.

Building or upgrading to an energy efficient home requires an initial investment that is higher than the cost of a traditionally constructed home. However, there are government grants and incentives which will help to urge you started and offset several the value. After you reside in your energy efficient house for a couple of years, your upfront investment can pay for itself.

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