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Iot Based Energy Management System

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Abstract:- The demand for electricity is growing every day, resulting in increased generating and transmission costs. India consumes around 3.4 percent of the world's energy. Over the last 30 years, energy demand has increased by an average of 3.6 percent every year. During peak hours, electricity demand usually spikes dramatically. In order to provide enough energy during peak hours, it is vital to monitor the loads. The government has taken initiatives to limit industrial electricity consumption. Domestic demand reduction is also a possibility. A load management model for domestic dwellings is presented in this paper. If a consumer consumes more electricity than the pre-set limit during peak hours, a notification will be set and load connected to solar will get turned on.

I. INTRODUCTION

India is expected to have the highest increase in energy demand of any country in the world over the next 20 years as its economy develops and its population enjoy greater wealth. Energy use will rise as a result of the combination of a growing and industrialising economy and an expanding and increasingly urban population, raising the question of how best to meet that rising demand without exacerbating issues such as costly energy imports, air pollution, and greenhouse gas emissions. India's power demand is expected to grow at a significantly faster rate than the country's entire energy demand. However, a significant increase in fluctuation is expected, both in electricity generation from solar PV and wind, and in daily demand.Before 2030, demand in various Indian states is expected to regularly surpass supply (usually in the middle of the day). On the demand side, significant expansion in air-conditioning unit ownership is a major driver to fluctuation. Although energy efficiency improvements targeting cooling appliances and buildings avert about a quarter of the possible spike in use in the STEPS, cooling electricity demand still grows six-fold by 2040, resultin a huge early evening peak in electricity use.

II. LITERATURE REVIEW

When discussing load management, it is necessary to emphasise the measurement, or more accurately, the monitoring, of energy usage in the system. When energy consumption is quantified, it becomes possible for consumers to plan for energy savings. Microcontrollers have already been used by several researchers in the field of home energy measurements5,6,8. T. M. Chung [2] used an Arduino microcontroller to create a single-phase power metre. The prototype uses an immediate computation method to calculate the load's voltage, current, and active power. The system is 96.54 percent accurate, however it can only measure active power, voltage, and current up to a maximum of 13 amps. P. Srividya [3] did similar work in which he calculated the power and energy of a single-phase system.

An opto-isolator IC provides isolation between the main circuit and Arduino. Using the prototype, a load power of up to 600MW can be measured. The validation of the project with a load of 50W using commercial measuring device shows an error of 5.13%.

III. PROPOSED MEDTHODOLOGY

A. WORKING(HARDWARE)

A 220V AC is fed into the transformer (4.5 VA), which extracts 18V(AC) and converts it to DC via a bridge rectifier. For filtration, a capacitor is utilised. To convert it to 12V DC, a voltage regulator IC is utilised. Potentiometers and resistors are used to create a potential divider. On the opposite side, the IC7805 produces a 5V output, which is utilised to operate the circuitNode MCU.The voltage and current will be measured by the Node MCU and sent to the server.

If the voltage is less than 180, the low load condition is satisfied, and only one load operates.

If the voltage is greater than 180V but less than 200V, the normal load condition is met, and both the load are operational.

When the voltage exceeds 200V, the high load condition is met, load shifting occurs, and the led connected to the solar panel turns on. In the event of an high load condition a smartphone notification will also be sent.

The occupancy detection technique is also used to alert the user whether there is a human present or absent, allowing the load to be manually turned on or off.

A Google spreadsheet can also be used to track user history.

B. WORKING(SOFTWARE)

a) Arduino IDE

IDE for Arduino the Arduino IDE is a Java-based cross-platform application based on the IDE for the Processing programming language and the Wiring project. It's intended for artists and other newcomers who aren't experienced with software development. It comes with a code editor that includes features like syntax highlighting, brace matching, and automatic indentation, as well as the ability to compile and submit programmes to the board with a single click. There is usually no need to alter create files or use a command-line interface to start programmes. Although, if necessary, several third-party

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programmes such as uno can be used to build on the command line.

The Arduino IDE includes a C/C++ library called "Wiring" (from the same-named project), which simplifies several tasks.Much simpler input/output operations. C is used to write Arduino programmes.

b) IFTTT
The programming conditional expression "if this, then that" inspired IFTTT. The company sells a software platform that connects multiple developers' apps, devices, and services in order to trigger one or more automations involving those apps, devices, and services.

Here are three examples of if this, then those automations that you may use with IFTTT:

When you use your Android phone to make a call, a record of that call is saved in a Google spreadsheet.

If you add a new task to your Amazon Alexa to-do list, it will appear in your iOS Reminders app as well.

If the International Space Station flies over your home, you will receive a notification.

According to IFTTT, there are currently 90 million active applet connections.

IFTTT's workings

Applets, which are similar to macros that connect various apps to conduct automated operations, are used to implement the automations. IFTTT's website or mobile apps (and/or the IFTTT widgets in the mobile apps).

c) Adafruit IO
Adafruit IO is a cloud administration - that simply implies we run it for yourself and you don't need to oversee it. You can associate with it over the Web. It's implied basically for putting away and afterward recovering information yet it can do much something beyond that.

IV. RESULT

The threshold value is chosen at an equilibrium point while considering the highest consumer satisfaction and minimum efficiency of energy market.

For our calculation , we choose upper threshold value of 200V and lower value of 180V.

- CASE 1 : When voltage is less than 180V,
  Low load condition will occur and only a single load will operate.
- CASE 2: When voltage is greater than 180V and less than 200V ,
  Normal load condition will occur and both the load will operate.
- CASE 3:When voltage greater than 200V ,
  High load condition will occur and load shifting takes place , and the led connected to the solar panel operates . Notification on mobile will also be sent in case of high load for manual load shifting.

Occupancy detection is also performed to notify the user in case of presence or absence of human, so that manually load can be turned on/off.User history can also be monitored through google spreadsheet.

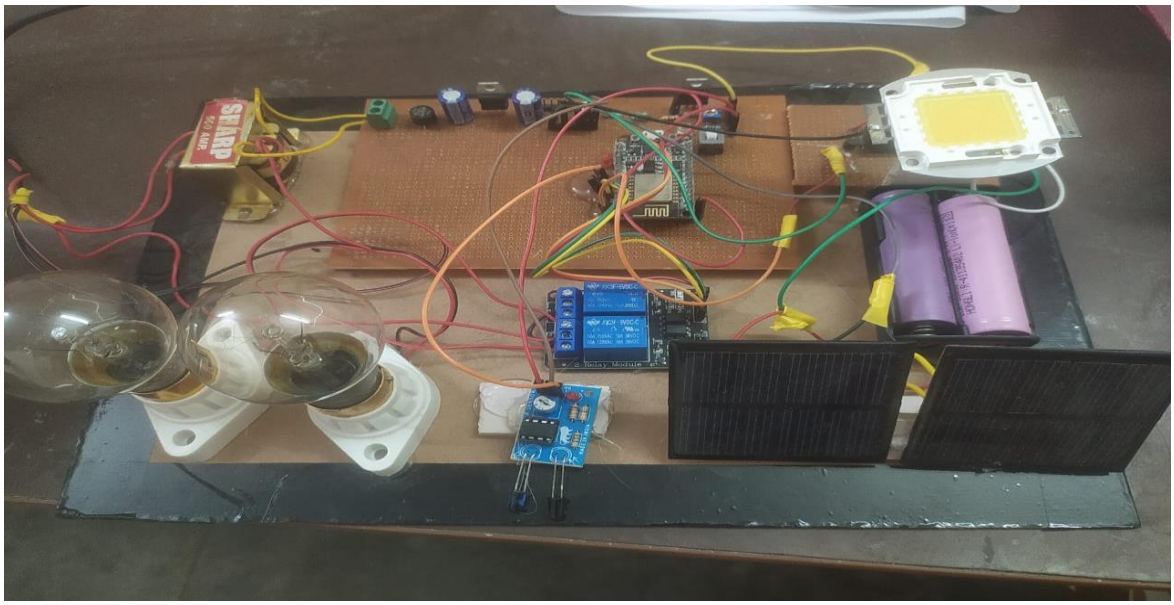

Fig. 1: An IoT based energy management system

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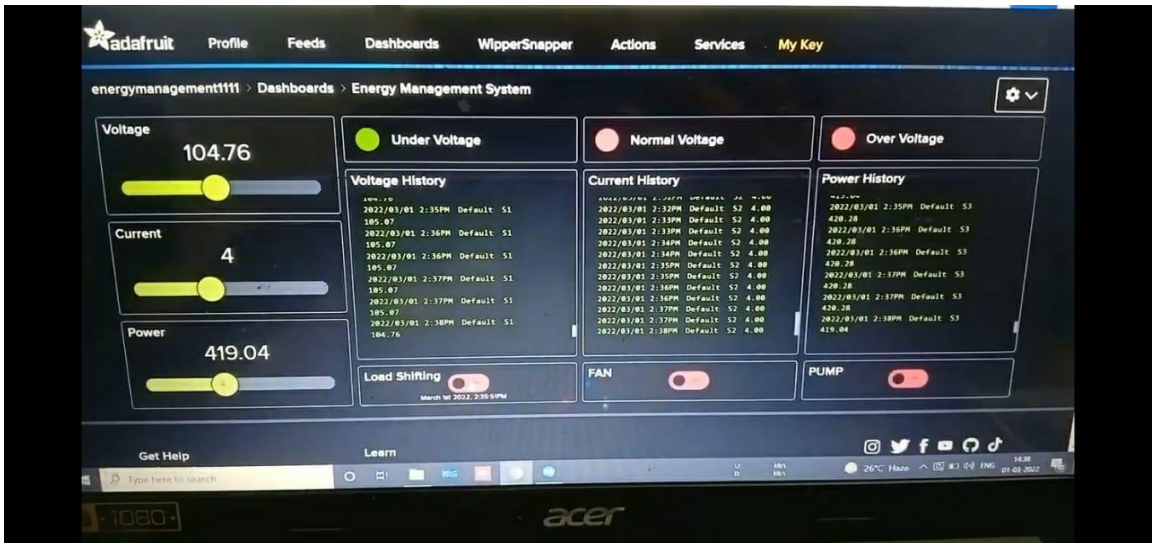

Fig. 2: Webpage

V. DISCUSSION

LOAD	POWER RATING
Fan	50 Watts
Lamp-1	36 Watts
Lamp-2	18 Watts

Table 1

CASES	DESCRIPTION
1	Fan
2	Lamp Type 1
3	Fan+Lamp Type 1+Lamp Type 2
4	3 Fan+2 Lamp Type 1
5	2 Fan+Lamp Type 2
6	Fan+Lamp Type 1+Lamp Type 2

Table 2

Case	Voltage	Current Actual	Display	Absolute	Power Actual	Display	Error
1	230	0.2	0.17	0.03	50	40	-10
2	230	0.15	0.14	0.01	36	33	-31
3	230	0.45	0.56	0.11	104	129	25
4	230	0.96	1.06	0.1	222	244	22
5	230	0.51	0.61	0.1	118	141	23
6	230	0.45	0.56	0.11	104	129	25
6+5	230	0.96	1.03	0.07	222	237	15
5+4	230	1.47	1.56	0.09	340	359	-1
5+4+6	230	1.33	1.96	0.03	444	450	6
5+4+3	230	1.93	2.08	0.15	444	479	33
5+4+3+2	230	2.08	2.11	0.03	480	480	6
5+3+2	230	1.12	1.35	0.23	258	302	-44
5+3+2+1	230	1.55	1.47	0.08	358	338	20
1+2+3+4+5	230	2.75	2.66	0.09	634	612	17

Table 3

From Table 3, considering the following case, based on high, medium, and low load the appliances are turned on. User can also remotely control the appliances through the Adafruit IO server.

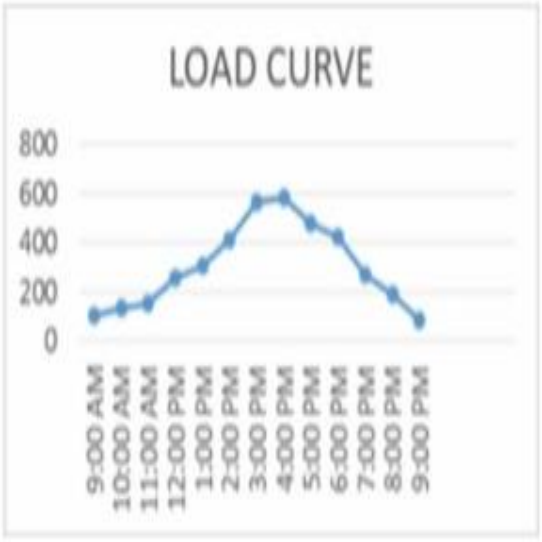

Fig. 3

Fig. 4

The load curve for the test case is shown in figure 3 According to increases or decreases loads with different time interval are plotted in graph as shown in figure 4 According to all loads are increase or decrease plotted a graph for energy pattern.

VI. CONCLUSION

Medium loads, heavy loads, and light loads are all different sorts of loads. Detect high load and switch heavy loads like fans and lights to solar-powered batteries (low rating enough). All data is logged and stored on the server and is monitored. Monitoring of real power, current, voltage, and system conditions graphically. Web page development and load scheduling via IoT platform with remote monitoring Occupancy detection is also used to alert the user when a human is present or absent, allowing the load to be manually turned on or off. Google Spreadsheets can also be used to track user history. In the event of high load for manual control, a smartphone notification will be sent.

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