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INTELLIGENT ENERGY MONITORING SYSTEM USING WEB ACCESS

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Abstract *Energy is a very important aspect for all kinds of activities. So, it is very needful to manage the energy efficiently and to conserve it intelligently. Energy management is a system used for energy consumption surveillance. It optimizes the utility of energy. The main purpose of the Intelligent Energy Management is to find solutions that manage the electricity infrastructure. The energy monitoring system is used to store and analyze all energy consumption data and their consumption pattern information is provided to the users via energy monitoring software. This useful information about energy usage will be delivered directly to the client's device. This proposed method utilizes the THINGSPEAK analytics to analyze the energy usage to give detailed report and visualization of the energy usage, for the purpose of proper home energy management. It digitizes the readings of load energy usage over the internet. The involvement of humans in electricity maintenance can be eliminated by this system.*

***Key Words*: Home energy management, Smart sensor, Energy monitoring software, Thingspeak, No human involvement.**

1. INTRODUCTION

Nowadays the electricity demand is increasing at a constant rate due to the population and it is being utilized for various purposes. So, it is becoming more complicated to maintain electricity and requirements. Also, other issues like power theft which causes economic loss to the nation. Monitoring the Optimized power usage and reduction of power wastage are the major objectives that lie ahead for a better system.

If the consumer is not available, the billing process will be pending and the human operator again needs to revisit. It becomes very difficult, especially in the rainy season. If any consumer did not pay the bill, the operator needs to go to their houses to disconnect the power supply. Moreover, the manual operator cannot find the unauthorized connections or malpractices carried out by the consumer. The inaccuracy and inefficient problem may arise in the billing system.

2. EXISTING SYSTEM

In the existing system for collection of energy consumption data, the representatives of TNEB monthly comes and visit every residential, take the snapshot and corporate and manually reads the consumption data from the meter. This collected data is recorded on a piece of paper along with a snapshot of the meter and finally submitted to the local Tamil Nadu Electricity Board office. Thereafter the officials read the snapshot and meter readings and then gives it to the local software for bill calculations and generation of bill. According to the received bill payment is done by the consumer. The information can be exchanged fast, secured and accurate by the means of wireless system. The data about the energy consumption from residential as well as corporate zones will be collected by the system and sent directly to the central server for the preparation of bills.

3. PROPOSED METHOD

Our Proposed System, makes use of intelligently monitored power consumption data through the monitoring subsystems. It can detect the abnormality in energy consumption and Can also find out power theft. Let us consider we have obtained the fixed rate of units from the transformer and then that will be split into separate units (Houses).In case of any mismatch arises while calculating the unit rate from main supply(Transformer) to separate unit (Home unit) we can able to easily know about the power theft. The rate of usage will be displayed by using LCD. If an area suffered by Power shut down problem then each and every unit get an alert SMS by using GSM. If the user fails to make a payment for usage of the Current rate within a deadline, automatically power supply goes on a particular home will be OFF Mode. Only after making the payment, the power supply will be ON. If we supposed to fix the default unit to separate units, for example, each unit is fixed with 2500Watts and when it reaches 2000Watts it gets an alert SMS. And then, automatically the flow of power will be terminated.

4. OBJECTIVE

To provide automated load energy reading on an immediate basis. To use the electricity in an effective manner. Reduce the power wastage. A more reliable and accurate reading value of energy can be collected. Power theft can be avoided. The problem which arises in the electricity bills can be minimized. It reduces the manual involvement. The energy costs/waste without affecting production and quality can be minimized.

5. BLOCK DIAGRAM

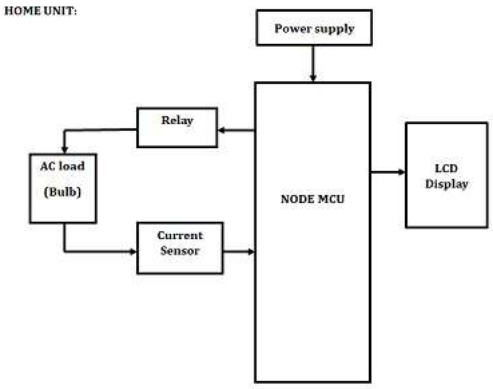

Fig 1-block diagram of home unit

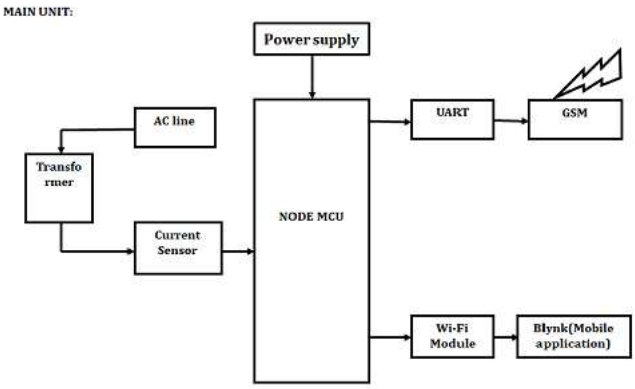

Fig 2-Block diagram of main unit

5.1 NODE MCU

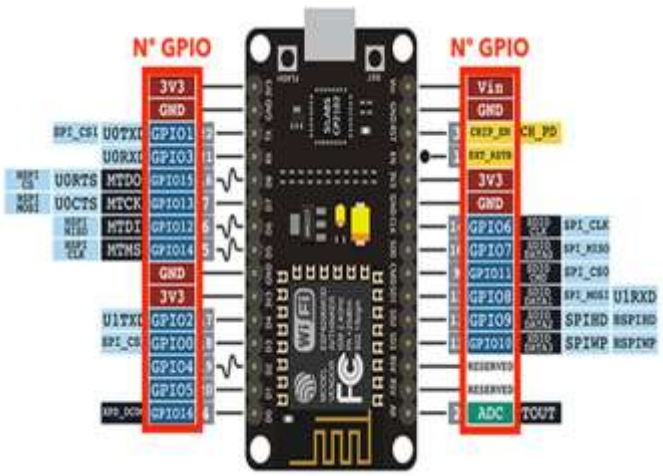

Fig3-Node MCU

Node MCU is an IOT based open-source platform. The main advantage is the low cost. It is a widely used wi-fi module. It will be more simple and powerful. Wi-fi connection can be established even by small coding with the help of node MCU. It even connects wi-fi to the single-chip devices.

- **Memory:** 128kBytes
- **Operating system:** XTOS
- **Storage:** 4MBytes
- **CPU:** ESP8266(LX106)
- **Power:** USB

5.2 CURENT SENSOR

Fig 4-Current Sensor

A current sensor is a device that is used to detect the electric current (AC or DC) in a wire. It generates an electrical signal proportional to it. The form of generated signal could be analog voltage or current or even digital output which can be utilized to display the measured current in an ammeter or further analysis in a data acquisition system the stored signal can be used or can also be utilized for control purposes. In this system, we are using the current sensor to find how much current has been consumed.

The sensed current and the output signal can be:

- Analog output,
- Bipolar output,
- Unipolar output.

5.3 LIQUID CRYSTAL DISPLAY

Fig 5- LCD Display

Liquid crystal cell displays (LCD) are used to display both numeric and alphanumeric characters which are represented in dot matrix and segmental displays. LCD is common because it is more advantages over other display technologies. Less power is consumed by the LCD than LED and gas-display displays because instead of working on the principle of emitting light they work on the principle of blocking light. A passive matrix or an active matrix display grid can be used to make LCD. An active matrix requires less current to control the luminance of a pixel and has a transistor located at each pixel intersection. For this reason, the screen refresh time can be improved by switching on and off the active matrix display more frequently. Passive matrix LCDs have dual scanning, which scans the grid twice the current. In this system, it displays the current consumed and the cost.

5.4 RELAY

Fig 6- Relay

Relays are simple switches that can be operated both electrically and mechanically. Relays are made up of electromagnets and a set of contacts. Relay acts as a switch between load and NodeMCU. The electromagnet is used for switching mechanism. There are other operating principles for working, but they differ based on their applications. Most of the devices possess the application of relays. The Relay is used where only a low-power signal controls the entire circuit and also used in places where only one signal can be used to control a lot of circuits. In our proposed system the relay gets energized by the Arduino UNO. It will play a central role in efficient energy management and consuming no power when not in use.

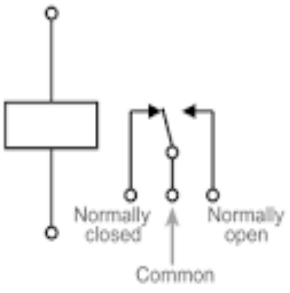

Fig 7-symbol of relay

5.5. GSM MODEM

Fig 8- GSM Modem

This GSM Modem can accept any kind of GSM network operator SIM card and acts similarly to mobile phones with its unique phone number. Communication and development of embedded applications can be carried out using its RS232 port. Applications include SMS Control, data transfer, remote control, and logging can be developed easily. It can be connected to the PC serial port directly or to any microcontroller through MAX232. It can be used to send and receive SMS and also to make/receive voice calls. For applications like data logging and control, it can be used in GPRS mode. In GPRS mode you can also connect to any remote FTP server thereby uploading the files for data logging.

5.6 UART PROTOCOL

The Universal Asynchronous Receiver/Transmitter (UART) controller is the main component of the serial communications of a computer. In most microcontrollers, it is a common integrated feature. The UART converts the bytes of data into individual bits in a sequential fashion. At the destination, a second UART converts the bits into complete bytes. Serial transmission of digital information (bits) is much more cost-effective than parallel transmission. Communication can be either “full-duplex” (both send and receive at the same time) or “half-duplex” (devices take turns transmitting and receiving). One of the best things about UART is that it uses only two wires to transmit data between devices. The advantages of UART includes No clock signal. Has a parity bit for error checking. The structure of the data packet can be changed as long as both sides. It is documented and widely used method.

5.7 ARDUINO IDE

The Arduino Integrated Development Environment or Arduino Software (IDE) is used to inscribe the code and upload it to the microcontroller board. It has a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It intersects with the Arduino and Genuino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These

sketches are written in the text editor and saved with the file extension. ino.

6. METHODOLOGY

When the power supply is on, the relay gets energized by the Arduino UNO. Due to this the relay gets closed and makes the power to flow through the circuit where the bulb glows. The current sensor will sense the amount of power consumed by the AC load (Bulb). The resistor can also be used to resist the flow of high power. The LCD will display the amount of current consumed and its corresponding cost. The GSM module id used to notify the user about the data being collected which is connected to the Arduino UNO through UART protocol.

The WI-FI module is connected to the Arduino which helps to access the Bylnk. Where Bylnk is a mobile application used on the server-side by the operator. Whenever the user fails to pay their respective current bill the operator can turn the power OFF through that mobile application directly without visiting the corresponding home using the customer's id. The power will go off only in that particular house.

When the fixed power mismatches with the total consumed power so that the power theft can be easily detected and notified by this system. Thus, power leakage can be reduced. The manual operator cannot find the unauthorized connections or malpractices carried out by the consumer to reduce or stop the meter reading/power supply that cannot be identified by the manual operator. Where this system can be used to detect the errors and malpractices caused by humans.

7. APPLICATION

- To improve Poor billing and accounting.
- To improve the security issues.
- To achieve the purpose of reducing the cost of social energy.
- Smart energy data analysis.
- Public energy system can be used in residential as well as commercial buildings.
- Municipal corporation
- Public power sources
- Govt. Energy plant

8. ADVANTAGES

- To reduce the wastage of energy.
- Prevent electricity shortage during dry seasons.
- Real-time bill monitoring
- Time reduced in receiving bill

9. CONCLUSION

In case of any mismatch arises while calculating the unit rate from the main supply (Transformer) to separate unit (Home unit) means we can able to easily know about the power theft. The rate of usage will be displayed by using LCD. If an area suffered by Power shut down problem then every unit get an alert SMS by using GSM. If the user fails to make a payment for usage of the Current rate within a deadline means automatically power supply goes on the particular home will be OFF Mode after making a payment only the power supply will be ON. There will be no involvement of manual operators. Sometimes, the readings obtained by the manual operator can be inaccurate which can be minimized by this system. All the malpractices caused by humans can be reduced.

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