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IOT BASED SMART ENERGY METER USING ARDUINO UNO

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Abstract - *The main aim of this paper is to monitor the amount of electricity consumed by a consumer. Generally, the energy consumption can be monitored by an electric device called Energy Meter. Every month one person comes from electricity board to our home and generates the electricity bill. So, by this manual work there are some errors like we don't know the bill generated by him belongs to us or not, we cannot see our usage. By using this system over IoT the cost and regular usage of power consumption can be informed to the user to overcome the high bill usage. The user can also track and control the loads in our home with the help of Transmission Control Protocol (TCP) application and Arduino board through a Wi-Fi module and LDR Sensor.*

Key Words: Energy meter, IoT, TCP Application, Wi-Fi Module, LDR Sensor.

1. INTRODUCTION

Now a days many consumers doesn't able to know whether the bill generated by the person who came from electricity board belongs to them or not. And at the same time the consumers were confused about the high bill usage so for this we came with a project in that the consumer can able to closely track their usage and spend. In this project consumption of energy i.e., units consumed by that meter will be displayed on the 16X2 LCD provided and at the same time any internet enabled devices through Transmission Control Protocol (TCP) application. So, whenever there is vary in count that is units in the energy meter get change, these values are displayed on LCD. Due to manual electricity billing, there exists some errors to overcome those errors we came with a proposed system that working of energy meter over IoT. This system mainly consists of Energy meter, Arduino UNO, Wi-Fi module, LDR Sensor, a display unit and two loads provided.

2. WORKING

First, we should turn on the supply next we need to connect the Wi-Fi in our mobile or laptop, with the username and password provided for Wi-Fi module.

Open the TCP Application and establish the connection with the Wi-Fi module through IP address of the Wi-Fi module so by this we are successfully connected with Wi-Fi module.

When the connection is established the two loads which is Bulb-1 and Bulb-2 will be switched ON. So, when the loads are ON the system starts its work.

According to the energy meter specification 3200 blinks is equal to 1 unit. For easy understanding we converted the 3200 blinks to 1 blink it means if the calibration LED blinks one time, we should come to conclusion that the system consumed 1 unit.

When the calibration LED is blinked it will be sensed by the LDR Sensor and sends the information to the Arduino UNO and through Arduino UNO it will be displayed on the LCD provided. At the same time the readings will be displayed in the TCP application.

Additional to this we can turn ON and OFF the loads. Here we took the ASCII code to control the loads.

To turn OFF the Bulb-1 we need to give *22#, To turn OFF the Bulb-2 we need to give *44#, similarly if we want to turn ON the loads we should give *11# to turn ON the Bulb-1 and *33# to turn ON the Bulb-2.

3. BLOCK DIAGRAM

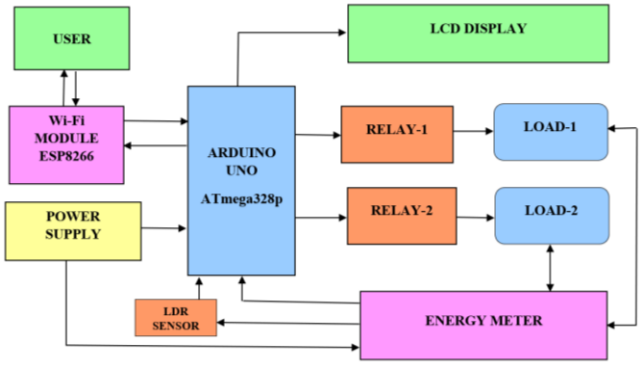


Fig -1: Block Diagram

3.1 Arduino UNO

The Arduino UNO board mainly consists of a microcontroller which is ATmega328P, USB jack, mini power jack, a reset button. UNO has 14 digital input/output pins (from which 6 can be used as PWM pins), 6 analog input pins, a 16MHz crystal oscillator, and ICSP pins. This Arduino board gets

power supply from USB cable when it is connected to the PC, or directly from the power supply jack. When the calibration LED is blinked on the energy meter, the LDR sensor gets activated and sends info to the Arduino board and from this Arduino board the reading will be displayed on the LCD provided and at the same time it will be visible on TCP application.

Fig -2: Arduino UNO

3.2 Energy Meter

Energy meters are used for the measurement of energy. As we know that energy is measured by measuring the power over the period of time. The unit for power is Watt and over the time we are measuring watt hour meter. This meter is also called as watt hour meter. Here the energy meter reads the loads and that is sensed by the LDR sensor and it reaches the Arduino board.

Fig -3: Energy Meter

3.3 Wi-Fi module

The Wi-Fi module (ESP8266) is a circuit which is generally used to establish the connection for any internet enabled devices. In our system we should connect Wi-Fi module in our mobile using username and password. Through this Wi-Fi module the reading will reaches the users mobile. Generally, the Wi-Fi module has the range of 2.4GHz.

Fig -4: Wi-Fi Module

3.4 Relay

Relays are the link between low power digital electronics and high-power devices. Relays allow digital circuits and digital microcontrollers to switch high power devices ON and OFF. The relay here we are used is 2 channel relay it is based on the no of loads we are connecting.

Fig -5: Relay Circuit

3.5 LDR sensor

LDR is a light dependent resistor that changes its resistance depending on the amount of light that hits it. They are made from a semiconductor material so that when light hits the semiconductor material it becomes more conductive and therefore has less resistance. Here in the system the LDR sensor senses the calibration LED and sends that info to the Arduino.

Fig -6: LDR Sensor

3.6 Liquid Crystal Display

A liquid crystal display also known as an LCD is one of the display units which displays the reading that has been read by the energy meter.

Fig -7: LCD Display

3.7 Heat sink

Heat sink is the component which reduces the excess heat. which is attached to the voltage regulator to control the excess heat dissipated from the voltage regulator.

Fig -8: Heat Sink

4. FLOW CHART

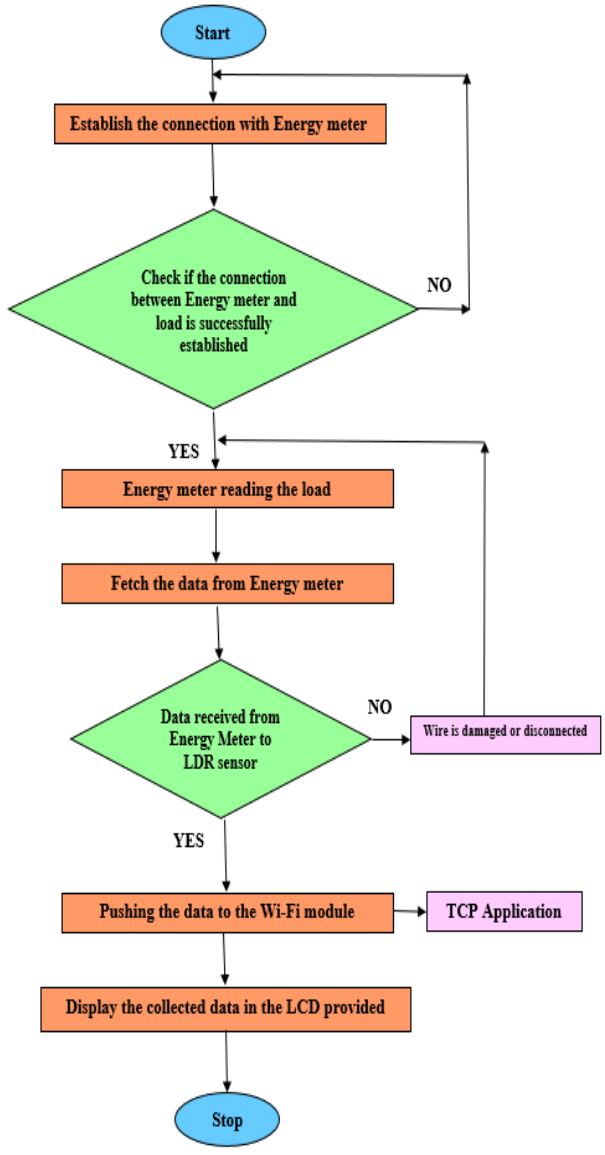


Fig -9: Flow Chart

5. PROTOTYPE

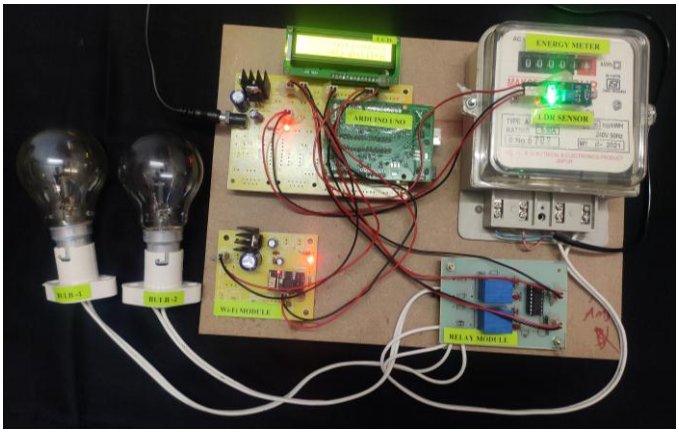


Fig -10: Prototype

6. RESULT AND DISCUSSION

From this project we came to conclusion that this system works on IoT, here we took 1unit = 5Rs.

If the system consumed 1 unit it will be displayed as 1 unit and 5 rupees

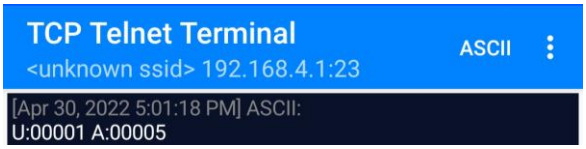
U: Units Consumed

A: Amount

If the system consumed 2 unit it will be displayed as 2 units and 10 rupees

At the same time the reading will be displayed on the Transmission Control Protocol (TCP) application in the user's mobile.

If the system consumed 1 unit it will be displayed as 1 unit and 5 rupees



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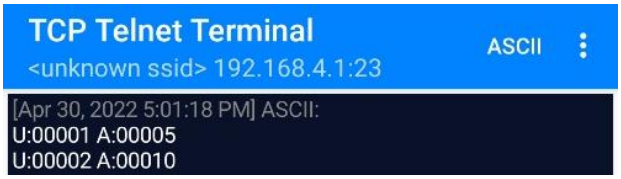

CONCLUSION

This project gives the customer the number of units they have consumed and the amount it costs. This helps the customer who can really save their electricity bill amount by just reducing their little consumption. And we can closely track our usage and spend. This allows the customer to also control the loads through the TCP application. The main advantages of this system are efficient and low-cost design, low power consumption, fast and accurate result, supports controlling of loads. And we can use this system in domestic commercial and industrial purposes.

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