

“SMART ENERGY METER”

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Abstract—The effort of collecting electricity utility meter reading. Internet of Things (IoT) present an efficient and coeffectve to transfer the information of energy consumer wirelessly as well as it provides to detect the usage of the electricity the main intention of this project is measure electricity consumption in home appliances and generate its bill automatically using IoT. The energy grids need to be implemented in a distributed topology that can dynamically absorb different energy sources.

IoT can be utilized for various applications of the smart grid with distributed energy plant meter, energy generation and energy consumption meter smart meter, energy demand side management and various area of energy production.

Keywords— Smart Grid, Energy Meter, Internet of Things.

Keywords- Voltage Sensor, Current Sensor, Relay, Connecting wires, ESP wi-fi controller

I. INTRODUCTION

1. Existing System

Energy meters are a mystery to many people but spending just ten minutes to find out a bit more about how yours works could save you lots of cash. That's because regular meter readings can help you pin down how much energy you are using – and identify where you might be overpaying. In addition, meters break and do go wrong. If your meter is playing up then you need to tackle the problem now so you don't get overcharged in error.

Here are some of the most common meter problems – and how to deal with them. First things first: many meter reading errors come from the energy firm misinterpreting the information you give them. I've seen a number of examples recently of people moving in to new properties, giving readings and being hit with totally unrealistic bills.

There are lots of reasons for this, but usually it's the energy firm's own system refusing to accept that its previous estimates were miles off and applying the wrong rates.

Remember the firm should be working off the readings you give when you move in, not estimates – so check that bill

2 Proposed System

The proposed system replaces traditional meter reading methods and enables remote access of existing energy meter by the energy provider. also, they can monitor the meter readings regularly without the person visiting each house represents the module at User's House consisting of several hardware components.[5]

II. REVIEW OF LITERATURE

Anitha et al., [1] proposed “Smart energy meter surveillance using IoT” about IoT, internet of things as an emerging field and IoT based devices have created a revolution in electronics and IT.

The foremost objective of this project is to create awareness about energy consumption and efficient use home appliances for energy savings. Due to manual work, existing electricity billing system has major drawbacks. This system will give the information on meter reading, power cut when power consumption exceeds beyond the specified limit using IoT. The Arduino esp8266 micro controller is programmed to perform the objectives with the help of GSM module. It is proposed to overcome all the disadvantages in the already existing energy meter. All the details are sent to the consumer's mobile through the IoT and the GSM module and it is also displayed in the LCD. It is a time saving and it helps to eliminate the human interference using IoT. Devadhanishini et al., [2] “Smart Power Monitoring Using IoT” that energy Consumption is the very important and challenging issue.

Automatic Electrical Energy meter is used in large electric energy distribution system. The integration of the Arduino WIFI and SMS provides the system as Smart Power Monitoring system. Smart energy meter provides data for

optimization and less the power consumption. This system also includes amotion sensor such that if there is no human in house or house it will automatically turn off the power supply.[5]

III. OBJECTIVES

The project aims to provide low cost IoT based solutions for energy meter which includes:

- o A smart meter provides detailed information on consumption in order to reduce electricity bills and also increase knowledge about the status of the electricity grid, which improves its performance and the quality of service for customers.
- o Allows customers to make informed decisions by providing highly detailed information about electricity usage and costs. Armed with a better understanding of their energy use, consumers, can make informed decisions on how to optimize their electricity consumption and reduce their bills.

1 Internet of Things

Internet of Things (IoT) links anything from anywhere in the universe. It communicates with almost everything around the world. The communication can be a control signal or identified data from this world. It is a common internet data communication and is communicated in different ways.

The Internet of Things (IoT) collects the data of automated objects and helps the machine learn where it needs. The data is stored in cloud and sends to the energy meter to switch on/off objects.

2 Importance of Topic Selected

Electricity plays an important role in day-to-day life. Internet of Things (IoT) is an emerging field and IoT based devices have created a revolution in electronics. The main objective of this project is to create an awareness about energy consumption and efficient use of home appliances for energy savings.

This system gives the information on meter reading, power cut and the alert systems for producing an alarm when energy consumption exceeds beyond the specified limit using IoT.

This idea is being implemented to reduce the human dependency to collect the monthly reading and minimize the technical problems regarding billing process. This project extends the design and implementation of an energy monitoring system with the pre-intimation of power agenda using Arduino micro controller. The advantage of this system is that a user can understand the power consumed by the electrical appliances on the daily basis and can take further steps to control themand thus help in energy conservation. From the electricity board section, the information regarding the bill amount, payment and the pre-planned power shut down details are communicated to the consumer. If the

customer does not pay the bill in time, the user is informed through a message.

If still the customer does not pay the bill, then as per designated consideration, one alert message will be sent then automatically power connection is disconnected from the remote server.[5]

IV. BLOCK DIAGRAM

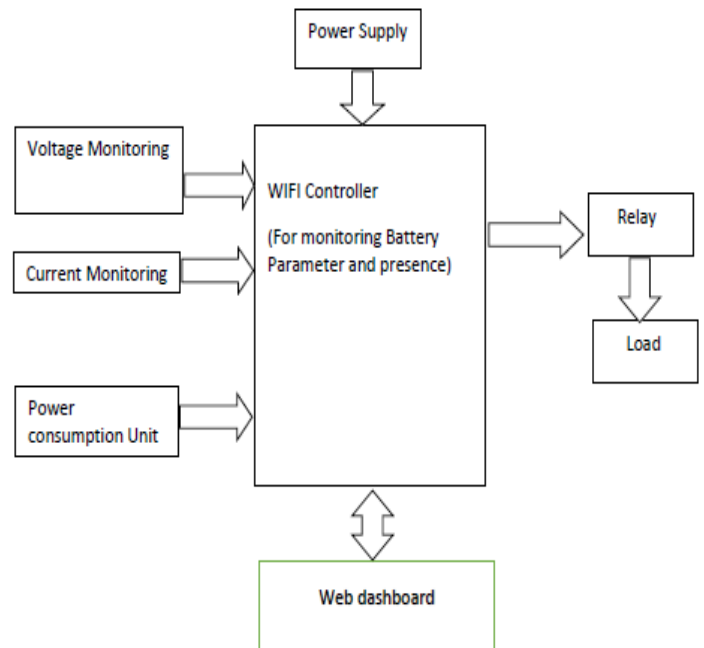


Fig. 1 Block Diagram of Project

VI. COMPONENTS USED

1. Voltage Sensor

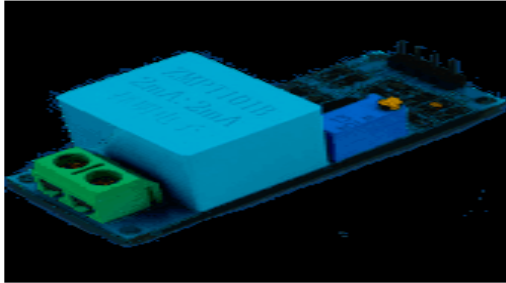


Fig. 2 Diagram of Voltage sensor

The Voltage Sensor is a simple module that can be used with Arduino (or any other microcontroller with input tolerance of 5V) to measure external voltages that are greater than its maximum acceptable value i.e., 5V in case of Arduino. Following is the image of the Voltage Sensor Module used in this project.

In our Project, the Voltage Sensor constantly monitors the Line Voltage of the Battery and sends the Data to the Mobile App. So that User can check the Availability of the Battery and its voltage from Remote Location. Specifications of the voltage sensor

- Voltage up to 250 volts can be measured
- Light weight with on-board micro-precision voltage transformer.
- High precision on-board op-amp circuit
- Operating temperature: 40°C ~ + 70°C
- Supply voltage 5 volts to 30 volts

2. Current Sensor

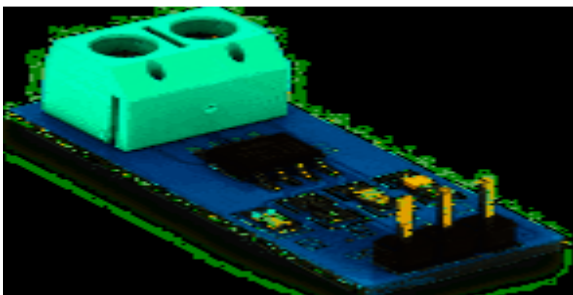


Fig. 3 Diagram of Current sensor

This sensor operates at 5V and produces an Analog voltage output proportional to the measured current. ... The output of this current sensor is analog, so to read it, we can directly measure the output voltage using a voltmeter or measure it by using a microcontroller like Arduino through Analog Read pin or ADC pin. In our Project, the Current sensor will constantly monitor the Current of the Battery and Send the command to the Mobile App. Which indicates the Charge Available in the Battery.

Features:

Current sensor chip: ACS710 Operating voltage (V): 4.5-5.5vdc

Measure current range: -30 to +30A

Sensitivity: 100mV/A

3. Relay



Fig. 4 Diagram of Relay

This is 1 Channel 5V Relay Board Module for Arduino PIC AVR DSP ARM. A wide range of microcontrollers such as Arduino, AVR, PIC, ARM and so on can control it.

Each one needs 15mA - 20mA driver current and equipped with high current relay: DC 5V / 10A,

AC 250V / 10A

Standard interface that can be compatible with microcontroller.

Specifications:

- 1 channel relay board
- Operating Voltage 5V
- Max current: 20mA
- Relay Contact Current Capacity at AC250V: 10A
- Relay Contact Current Capacity at DC5V: 10A
- One normally closed contact and one normally open contact
- Triode drive, increasing relay coil
- High impedance controller pin
- Pull-down circuit for avoidance of malfunction
- Power supply indicator lamp
- Control indicator lamp
- Indicator for Relay output status
- Can Be controlled various appliances & other Equipment with Large current.
- Standard TTL Level logic controlled (AVR, Arduino, 8051, PIC, ARM)
- The module is compliant with international safety standards, control and load areas isolation trenches

4. Connecting Wires

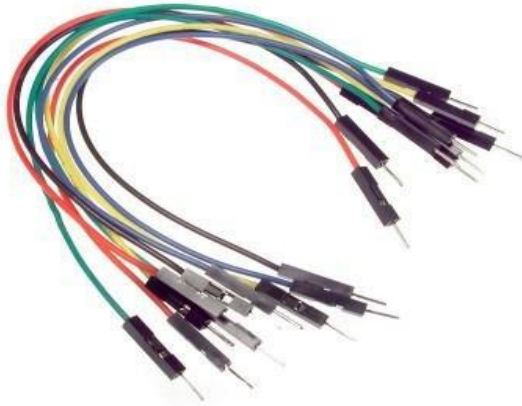


Fig. 5 Diagram of Connection wires

Jumper wires are used for making connections between items on your breadboard and your Arduinos header pins. Use them to wire up all your circuits.

5. ESP wi-fi controller



Fig. 6 Diagram of ESP wi-fi controller

There are a lot of apps on both store Apple and Android for controlling ESP8266, but none of them will give you all what you need. So, we decided to build a mobile application from scratch alongside with the code that can give you the following:

Specifications:

- Read & write digital pins.
- Read & write PWM pins.
- Read analog pins.
- Remember last status of the pins.
- Change the mode of the pin (Output, PWM, SERVO or Input).
- Automatic connect to Arduino.
- Rename the label of each pin.
- Terminal to send any data to Arduino.
- LCD to receive any data from Arduino.
- Assign actions when receiving data from Inputs, LCD and Analog.

Hardware components.

ESP Wi-Fi Controller.

Voltage sensor. Current sensor.

CONCLUSION

Smart energy monitoring system includes ESP 8266, WI-FI, energy meter. The system automatically reads the energy meter and provides home automation through an app developed and power management done through this application. The proposed system consumes less energy and it will reduce manual work. We can receive monthly energy consumption from a remote location directly to centralize office. In this way we reduce human effort needed to record the meter reading which are till now recorded by visiting the home individually.[5]

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