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IoT Based Smart Energy Meter Monitoring and Theft Detection

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Abstract:

IoT power meter based on ESP32 Module. In this project we reduce human participation in energy conservation. Electrical theft increases customer costs. This program is therefore used to detect theft. ESP32 tests the reading of the upper and lower meters. If there is a power difference between a large meter connection and a lower meter connection occurs when theft occurs a message will be displayed on blynkapp. Customer can access blynkapp from anywhere. By using the customer's email id can be accessed worldwide at any time.

Keywords-IoT, ESP32, Power Meter Connection, Blynk app, Current Sensor

I.INTRODUCTION:

The energy crisis is one of the biggest problems facing the world today. The energy crisis can be reduced to a degree by properly monitoring the use of our energy and avoiding wastage of energy. Now a days power corporation face many problems such as power theft. Theft of electricity can be a increase the cost of electricity bill. This system will easily detect power theft. This IOT electricity Theft detectection is consisting of ESP32,Which is having with inbuilt WIFI module for IOT connection and Blynk server for uploading sensor values and we will use blynk app for checking the values, on which users will receive information via Notification or mail. This smartelectricity project also consists of a current sensor that sends the current reading to the Esp32 and Voltage sensor for reading the voltage and we can control the load with reference to its power consumption. Voltmeter is used to check the inlet voltage measurements from the mains supply, current sensor is used to check the current consumption of the particular load. With the received voltage and current values we can fetch the power consumption of the load and we can control the load. We can also check the theft detection with the use of current sensor at the mains supply.

These load power details are pushed to cloud so that we can monitor the power consumption continuously.

To monitor the power consumption we need to connect to Blynk server(IOT cloud) with the help of Blynk APP Through Mobile phone

In the case of energy theft, the theft will be caught and displayed on the Mobile. Even the information will be received through Email-id on the configured Email address. After receiving the alert, the operator can switch off the system using IOT platform with the help of WIFI connection to avoid theft. It also shares turn off the message of the system on the cell phone.

II. METHODOLOGY

In this paper, we are explaining a technique of theft detection for electricity energy reading based on IoT concept. This design implements the energy meter using the IoT concept. This whole procedure based on the ESP32. The internet of things is the internet operational of physical devices which permits object to exchange data in the above system energy meter is connected to the internet by using IoT. This method eliminates man power during this connection and disconnection upload. It plays a vital role to inform supplier about any theft that is happing in the sensor.

III.Components:

ESP32 DevKitC Board – 1

ZMPT101B AC Voltage Sensor Module – 1

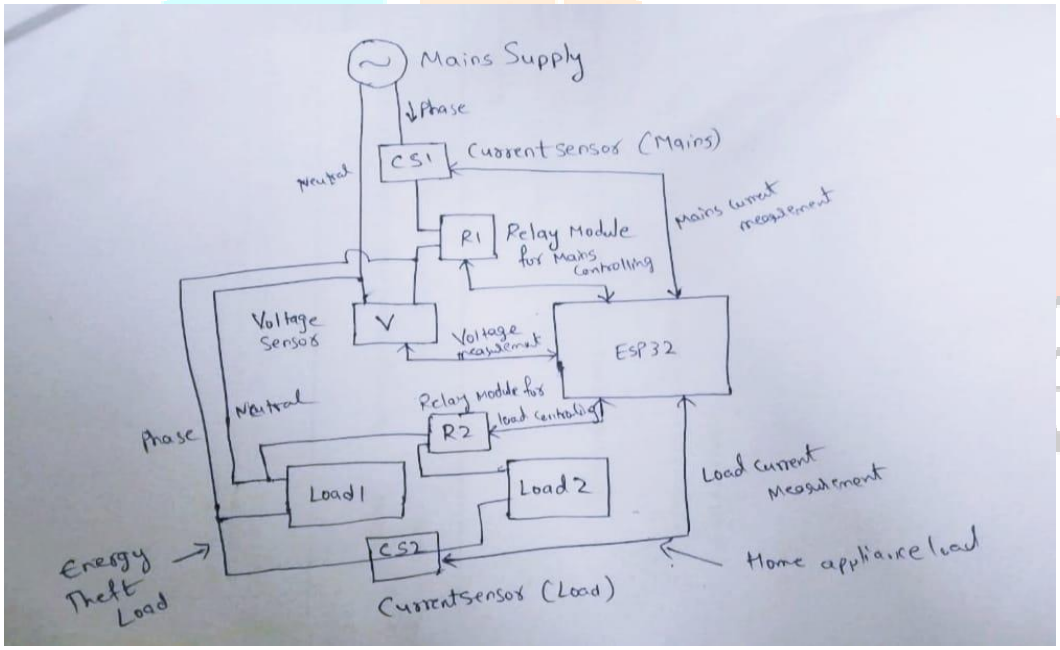
ACS712 Current Sensor Module - 2

Dotboard – 1

AC bulb holders - 2

Relay Module - 2

Circuit Diagram:



ESP32 DevKitC Board:

The ESP32 is a single 2.4 GHz Wi-Fi chip with a Bluetooth combo chip designed for TSMC ultra low power 40 nm technology. It is designed and optimized for power efficiency, RF performance, durability, flexibility, features and reliability, for a variety of applications, and different power profiles.

ESP32 is designed for mobile, wearable, and Internet of Things (IoT) applications. It has many features of state-of-the-low low power chips, including good clock resolution, power modes, and power measurements

ESP32 is the most integrated solution for Wi-Fi + Bluetooth applications in an industry with less than 10 external devices. ESP32 includes antenna switch, RF balun, power amplifier, low noise receiving amplifier, filters, and power management modules. Therefore, the whole solution replaces the Printed Circuit Board (PCB). ESP32 uses CMOS for fully integrated chip and baseband radio, and also incorporates high-level measurement circuits that allow the solution to power itself to eliminate external imperfections or adapt to changes in external conditions.

Relay Module:

Transmission is an electronic device that can be turned on or off, currently allowing it to pass or not, and can be controlled at low rates

This transmission module has two channels (those blue cubes). There are other types with one, four and eight channels. This module should be powered by 5V, suitable for use with Arduino. There are other transmission modules powered by 3.3V, suitable for ESP32, ESP8266, and other microcontroller.

The six pins on the left side of the transmission module connect the mains, and the right-hand pins connect the lower power-intensive part - the Arduino pins.

The high-powered side has two connectors, each with three sockets: standard (COM), normally closed (NC), and always open (NO).

COM: standard pin

NC (Normally Closed): The shut-off mode is usually used when you want the relay to turn off automatically, which means the current flows without sending a signal from Arduino to the transmission module to open the circuit and current suspension.

NO (Normally on): The open suspension usually works the other way: the relay remains open, so the circuit is broken unless you send a signal from Arduino to close the circuit.

ZMPT101B AC Voltage Sensor Module:

The ZMPT101B AC Voltage Sensor is the best for a DIY project purpose, where we need to measure accurate AC power and voltage transformer.

ZMPT 101B is a high-precision voltage Transformer. This module makes it easy to monitor AC mains voltage up to 1000 volts. If you want a smaller version of this module check out ZMPT107

- High galvanic separation
- Wide range
- High accuracy
- Good Harmony

Small Size Voltage transformer applications:

- Meters (electric meters)
- AC Voltage Rate
- Current Overloading Feeling

• Finding fault down

• Household appliances

• Industrial resources

• Electrical testing equipment and transmission protection

ACS712 Current Sensor Module:

The ACS712 Module uses the popular ACS712 IC to measure existing values using the Hall Effect principle. The module derives its name from the IC (ACS712) used in the module.

This ACS712 module can measure current AC or DC current from + 5A to -5A, + 20A to -20A and + 30A to -30A. You have to choose the right distance for your project because you have to sell the accuracy of the higher modules. These modules emit an analog voltage (0-5V) based on the current flow in the phone; which is why it is so easy to connect this module to any microcontroller.

IV.POSSIBLE OUTCOMES:

This project main aim to detect theft while taking power supply through third party. Esp32 plays a key role to upload the data of sensors to the cloud which helps to intimate to customers through blynk app or mail, which can easily operates and takes care through mobile from anywhere.

APPLICATIONS:

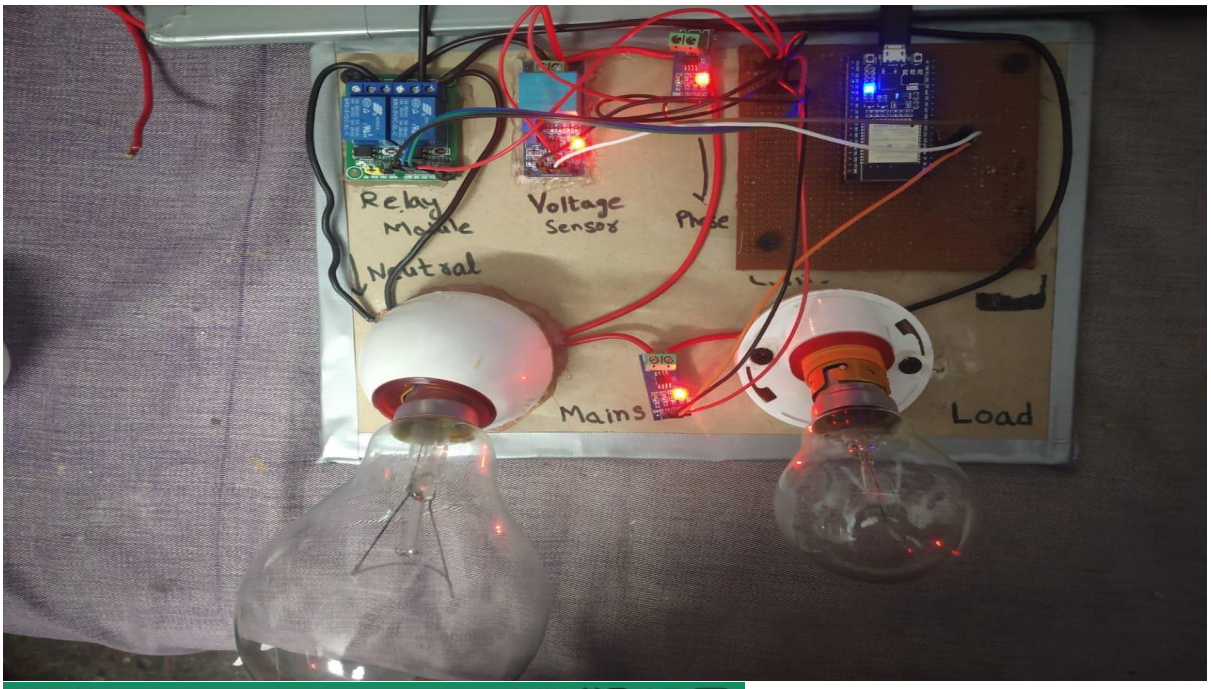
Accessing information is easy for customer from cloud through IoT.

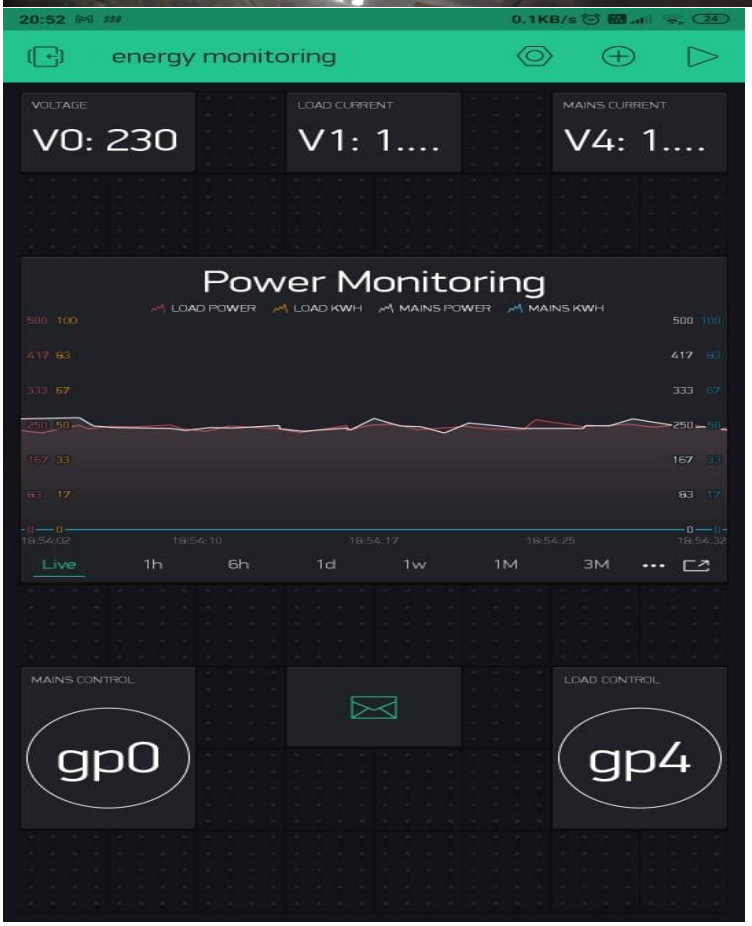
Theft detection at consumer end in existent time.

V.CONCLUSION:

This system helps in control the energy consumption and avoiding energy wastage is very important. This is an ESP32 based design and implementation of energy meter by using IOT concept. In the proposed system, current sensor and voltage from mains and load reading system is designed to monitor continuously the meter reading and transfer the reading to certain server. This data can be access from anywhere on the globe at any time.

VI.FINAL RESULTS OF IoT BASED SMART ENERGY METER MONITORING, THEFT DETECTION AND DISCONNECTION





Thus, we have successfully design smart energy meter monitoring using ESP32. In this project we identify the theft of electricity. This design implements the energy meter theft detection using IoT concept.

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