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IOT BASED ELECTRICITY ENERGY METER

SMART GRID

EEE-4013

Project Report

Submitted by

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A project report submitted to

PREMALATHA L

School of Electrical and Electronics Engineering

April 2022

DECLARATION BY THE CANDIDATE

I hereby declare that the report titled "IOT Based electricity energy meter " submitted by me to VIT Chennai is a record of bona-fide work undertaken by me under the supervision of PREMALATHA L, Associate Professor, SELECT, Vellore Institute of Technology, Chennai.

Signature of the Candidate

ACKNOWLEDGEMENT

We wish to express our sincere thanks and deep sense of gratitude to our project guide, PREMALATHA L, School of Electric and Electronic Engineering for her consistent encouragement and valuable guidance offered to us throughout the course of the project work.

We are extremely grateful to Dr.Peer Fathima, Dean, School of Electric and Electronic Engineering (SELECT), Vellore Institute of Technology, Chennai, for extending the facilities of the school towards our project and for his unstinting support.

We express our thanks to our **Head of the Department** for his support throughout the course of this project.

We also take this opportunity to thank all the faculty of the school for their support and their wisdom imparted to us throughout the courses.

We thank our parents, family, and friends for bearing with us throughout the course of our project and for the opportunity they provided us in undergoing this course in such a prestigious institution.

BONAFIDE CERTIFICATE

Certified that this project report entitled "IOT BASED ELECTRICITY ENERGY METER “is a bona-fide work of BOREDDY CHAITANYA KUMAR REDDY(19BEE1001),R HRITHIK (19BEE1044),ABISHEK S (19BEE1094) ,D ADITHYA(19BEE1212)carried out the “J”-Project work under my supervision and guidance for Subject

EEE4013 SMART GRID

PREMALATHA L

SELECT

Abstract

The effort of collecting electricity utility meter reading. Internet of Things (IoT) presents an efficient and effective way to transfer the information of energy consumers wirelessly as well as to detect the usage of electricity. The main intention of this project is to measure electricity consumption in home appliances and generate its bill automatically using IoT. The energy grid needs 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 meters, energy generation and energy consumption meters, smart meters, energy demand side management and various areas of energy production.

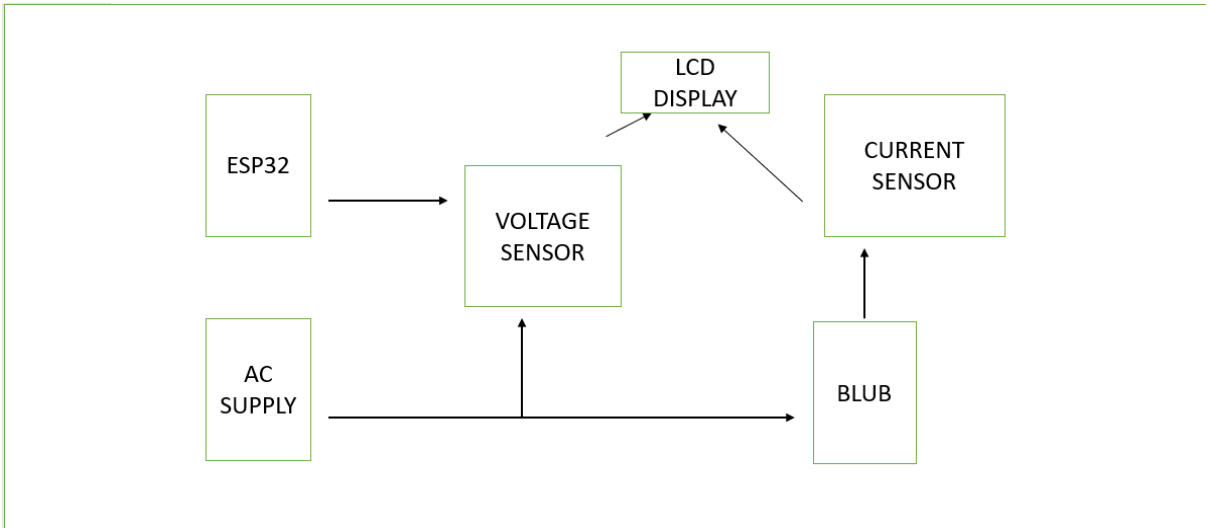
Objectives:

- To build a circuit required for the system to monitor energy consumption with the components such as ESP32 board, Voltage sensor, Current sensor, LCD Display, Resistor(100,10kohms), Capacitor(10uf), Jumper wires and Breadboard.
- To setup the built hardware circuit using blynk application.
- To monitor the energy consumption of the user.

Introduction:

Usually, people are required to check their energy consumption by looking at the current meter present in their households. It is not possible to check their energy consumption anytime or from anywhere with this type of system. Also, people won't have any awareness about their energy consumption till they check the current meter. So, we came up with the idea of this device to try to tackle the drawbacks present in the current system as much as possible. In this IoT based electricity energy meter we can access the information related to energy consumption from anywhere through a Blynk mobile application. It also helps people to consume energy in a smarter and cost-efficient way.

Block Diagram



Components used:

- ESP32 board
- Voltage sensor
- Current sensor
- LCD Display
- Resistor(100,10kohms)
- Capacitor(10uf)
- Jumper wires
- Breadboard
-

SCT-013 Current Sensor:

The SCT-013 is a Non-invasive AC Current Sensor Split Core Type Clamp Meter Sensor that can be used to measure AC current up to 100 amperes. Current transformers (CTs) are sensors for measuring alternating current. They are particularly useful for measuring whole building electricity consumption. The SCT-013 current sensors can be clipped straight either to the live or neutral wire without having to do any high voltage electrical work.

Specifications

1.Input Current: 0-30A AC
2. Output Signal: DC 0-1 V
3. Non-linearity: 2-3 %
4. Build-in sampling resistance (RL): 62 Ω
5. Turn Ratio: 1800:1
6. Resistance Grade: Grade B
7. Work Temperature: -25 °C~+70 °C
8. Dielectric Strength (between shell and output): 1000 V AC / 1 min 5 mA

ZMPT101B AC Single phase voltage sensor:

The ZMPT101B AC Single Phase voltage sensor module is based on a high precision ZMPT101B voltage Transformer used to measure the accurate AC voltage with a voltage transformer. This is an ideal choice to measure the AC voltage using Arduino or ESP32.The Modules can measure voltage within 250V AC voltage & the corresponding analog output can be adjusted. The module is simple to use and comes with a multi-turn trim potentiometer for adjusting and calibrating the ADC output.

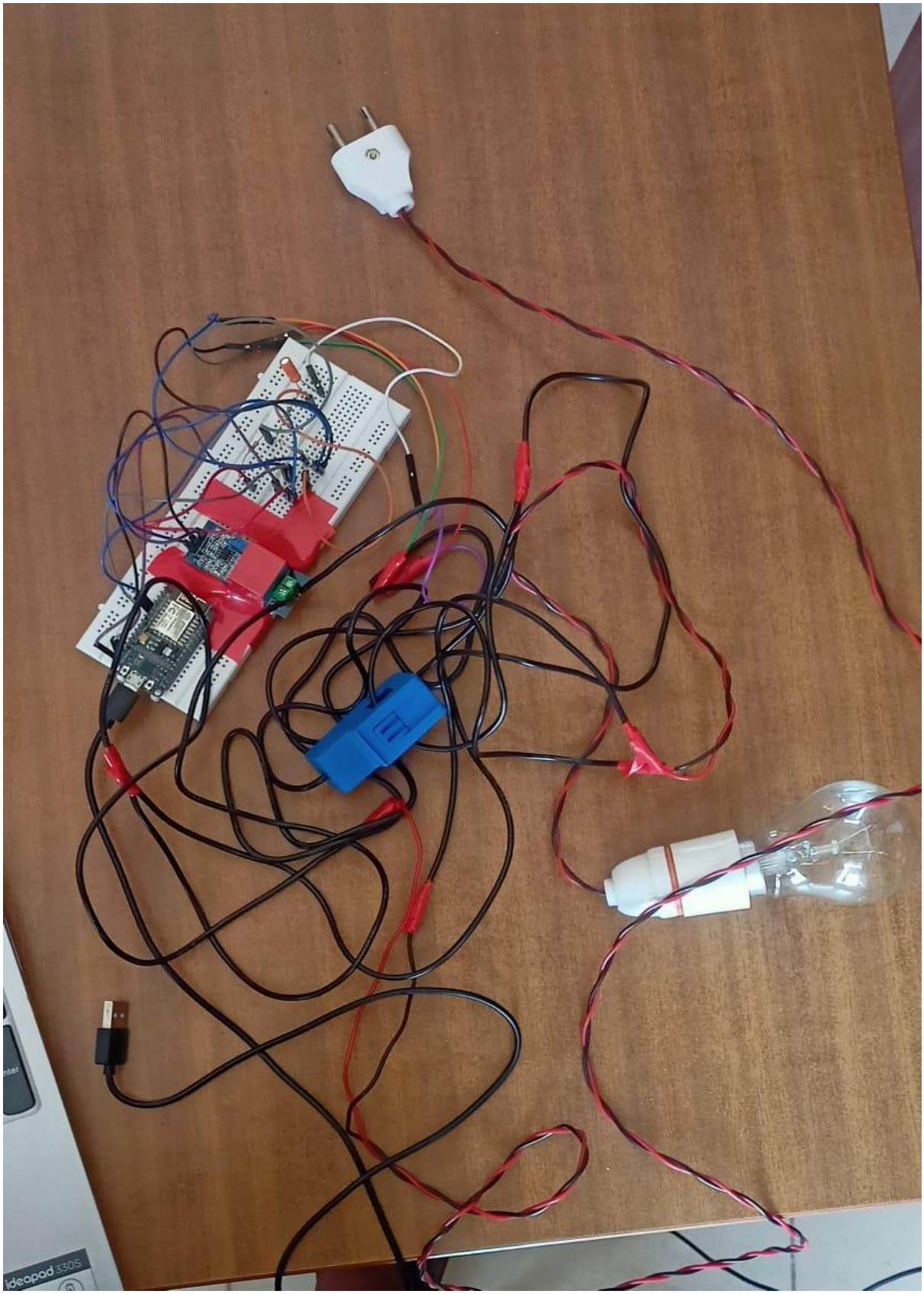
Specifications

1.Voltage up to 250 volts can be measured
2. Lightweight with on-board micro-precision voltage transformer
1. High precision on-board op-amp circuit
2.Operating temperature : 40ºC ~ + 70ºC5. Supply voltage 5 volts to 30 volts

BLYNK:

Blynk App - allows to you create amazing interfaces for your projects using various widgets we provide. Blynk Server - responsible for all the communications between the smartphone

HARDWARE SETUP:



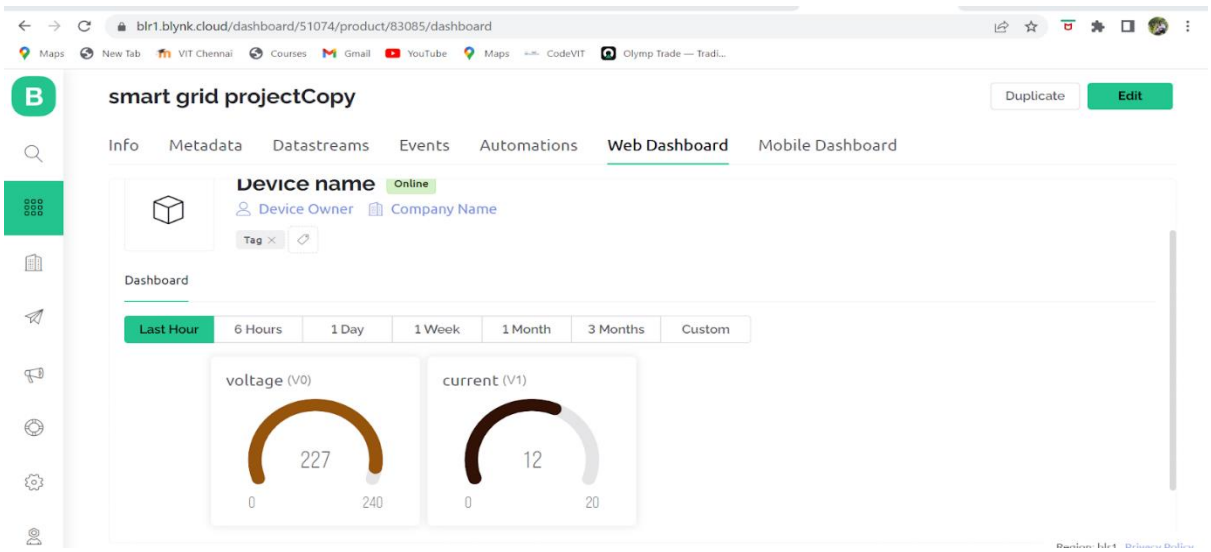
Code:

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(13, 12, 14, 27, 26, 25);
#define BLYNK_PRINT Serial
#include "EmonLib.h"
#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>
EnergyMonitor emon;
#define vCalibration 83.3
#define currCalibration 0.50`
BlynkTimer timer;
char auth[] = "hsYG_5da4gdP9jZkL18O5RNcJSrBT-Ou";
char ssid[] = "Alexahome";
char pass[] = "loranthus";
float kWh = 0;
unsigned long lastmillis = millis();
void myTimerEvent()
{
  emon.calcVI(20, 2000);
  kWh = kWh + emon.apparentPower * (millis() - lastmillis) / 3600000000.0;
  yield();
  Serial.print("Vrms: ");
  Serial.print(emon.Vrms, 2);
  Serial.print("V");
  Serial.print("\tIrms: ");
  Serial.print(emon.Irms, 4);
  Serial.print("A");
  Serial.print("\tPower: ");
  Serial.print(emon.apparentPower, 4);
```

```
  Serial.print("W");
  Serial.print("\tkWh: ");
  Serial.print(kWh, 5);
  Serial.println("kWh");
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Vrms:");
  lcd.print(emon.Vrms, 2);
  lcd.print("V");
  lcd.setCursor(0, 1);
  lcd.print("Irms:");
  lcd.print(emon.Irms, 4);
  lcd.print("A");
  delay(2500);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Power:");
  lcd.print(emon.apparentPower, 4);
  lcd.print("W");
  lcd.setCursor(0, 1);
  lcd.print("kWh:");
  lcd.print(kWh, 4);
  lcd.print("W");
  delay(2500);
  lastmillis = millis();
  Blynk.virtualWrite(V0, emon.Vrms);
  Blynk.virtualWrite(V1, emon.Irms);
  Blynk.virtualWrite(V2, emon.apparentPower);
  Blynk.virtualWrite(V3, kWh);
}
```

```
void setup()
{
  Serial.begin(9600);
  Blynk.begin(auth, ssid, pass);
  lcd.begin(16, 2);
  emon.voltage(35, vCalibration, 1.7); // Voltage: input pin, calibration, phase_shift
  emon.current(34, currCalibration); // Current: input pin, calibration.
  timer.setInterval(5000L, myTimerEvent);
  lcd.setCursor(3, 0);
  lcd.print("IoT Energy");
  lcd.setCursor(5, 1);
  lcd.print("Meter");
  delay(3000);
  lcd.clear();
}
void loop()
{
  Blynk.run();
  timer.run();
}
```

RESULTS:



INFERENCE

First the main power supply is switched on. Current sensor and voltage sensor senses the current and voltage utilized by the load and gives output in analog form. ESP32 board has inbuilt analog to digital converter which converts analog input to digital output. This digital output is displayed on an LCD display. The ESP32 is also used to connect to the internet and access the values of voltage, current and power using blynk application.

Initially ESP32 Board will try connecting to the wifi Network using the given SSID & Password. When no load is connected or when the load is powered off the Current and Voltage parameters should be almost 0. Now when the load is connected, the LCD Display will display the Voltage and Current value on the LCD Screen along with Power Consumption and total kWh units.

The energy meter data is uploaded to Blynk Application after the interval of every 5 seconds. The data can be observed on Serial Monitor as well as Blynk Application.

CONCLUSION

Energy Monitoring using IOT is a very innovative application of the internet of things which plays a vital role in upcoming years. It is used to monitor power consumption remotely over the cloud from anywhere in the house. An attempt has been made to make a practical model of IoT Based Electricity Energy Meter using ESP32 & Blynk. In the proposed project current sensor and voltage sensor is used to sense the current, voltage and display it on the blynk application using IoT. The system updates the information every 5 seconds. In this new system, load consumption of the appliances is accessed using Wi-Fi technology and it will help consumers to avoid unwanted use of electricity. An IoT system where a consumer can monitor energy consumption. The propagated model is used to calculate the energy consumption of the household. Hence it reduces the wastage of energy and brings awareness among all.

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