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IOT Based Energy Meter Reading System

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Abstract: *Efficient use of energy plays an important role in the development of smart grid in power systems. Therefore, proper monitoring and control of energy consumption is a key step. The main priority is with smart grid. The existing energy meter system has many problems. One major problem is the lack of full duplex communication. To solve this problem, we propose a smart energy meter based on Internet of Things (lot). The proposed smart energy meter monitors and calculates power consumption using ESP 8266 12E, a Wi-Fi module and uploads it to the cloud, from where the consumer or manufacturer can view the readings. Hence, the energy analysis of the consumers become much easier and more controlled. This system also helps to detect power theft. So, this smart meter helps with home automation using IoT and enabling wireless connectivity, which is a big step towards the digital transformation of India.*

Keywords: IOT, Wi-Fi.

I. INTRODUCTION

With the present billing system, the companies distributing electricity are not able to keep track of the changing demand of consumers. The consumer is regular faces problems of receiving due payments for bills that have already been paid as well as poor reliability of electricity supply. The solution for all these problems is to keep track of all the consumer's electricity usage on a timely basis, this helps to assure accurate billing, track maximum demand and to detect threshold value.

II. HELPFUL HINTS

2.1 Hardware Components

Component Name	Specification
Arduino Uno	R3 CH340G ATmega328p
ESP12/NodeMCU	Firmware on ESP8266
Male Female wires	-
Bulb	-
ACS712-30Amp Current sensor	-

Table 1: Hardware Components

2.2 Hardware Setup

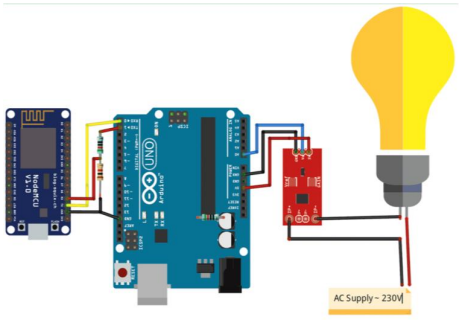

Figure 1: Hardware Setup of connection of Circuit side of Prototype

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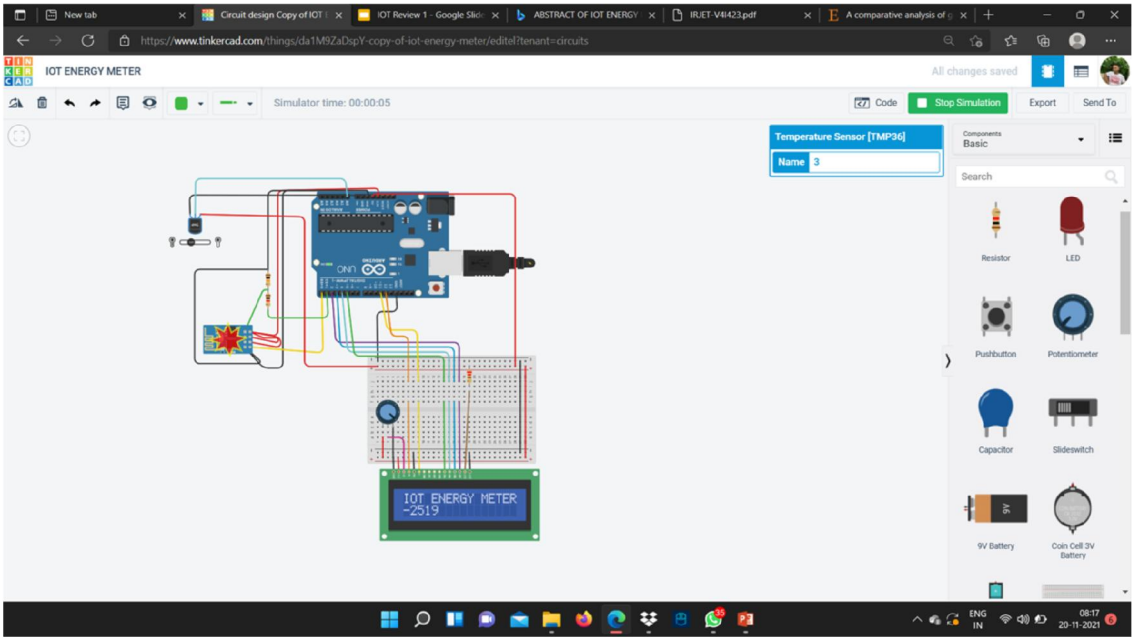

Figure 2: Tinker Cad Simulation

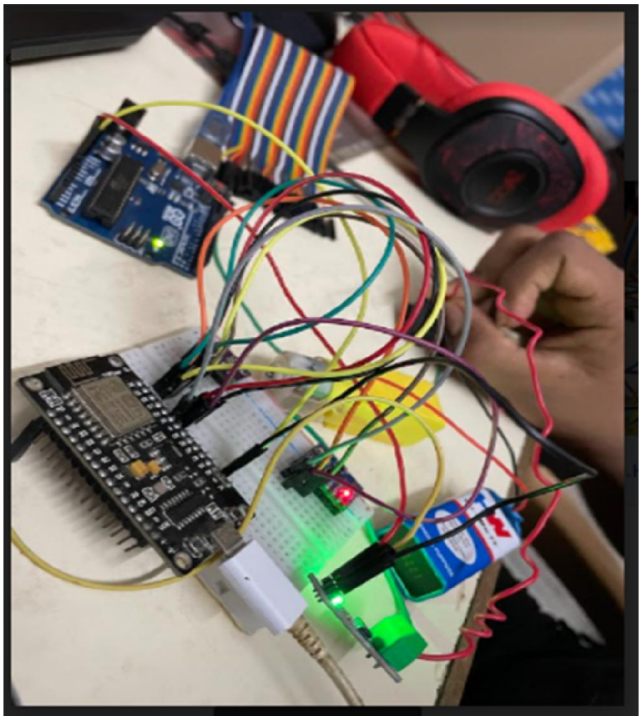

Figure 3: Arduino side of Prototype

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III. Block Diagram

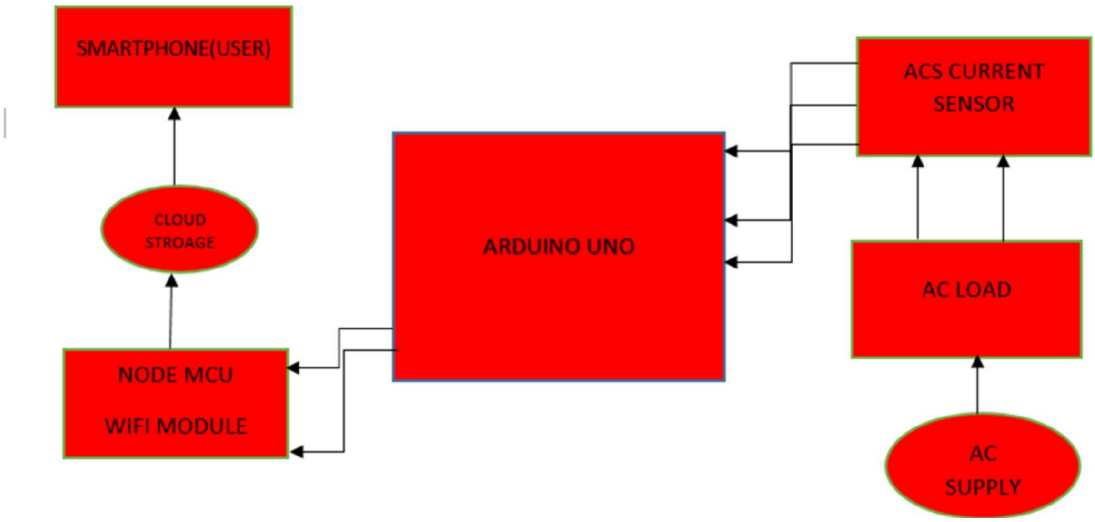

Figure 4: Block diagram

First connect the ESP12 Node MCU as mentioned in Table-1 to Arduino Uno board as shown in the hardware setup. Connect the ACS712-30Amp Current sensor to Arduino Uno. Connect ESP12 as below:

- Connect Rx of ESP12 -> Tx of Arduino.
- Connect Tx of ESP12 -> Rx of Arduino.

The Arduino will read the current sensor value through analog pin and send it to the Wi-Fi module ESP12 using Serial communication. We use a voltage divider circuit at receiver pin of NodeMCU so that receiver pin can get upto 3.3 Voltage level. We provide AC supply of 240 volts to power an AC load, in this case we use an electrical bulb. The AC current is measured using the ACS712 current sensor, which uses the principle of hall effect. The 2-pin terminal block is where the current carrying wire should be passed through. We will be using the Analog pin of Arduino to read the output voltage (Vout) of the module, which will be 512(2500mV) when there is no current flowing through the wire. Once the information is collected by the current sensor the data will be sent securely to be stored on the cloud through the NODE MCU Wi-Fi module. The load consumption for each user will then be displayed on the app.

IV. Results and Outputs

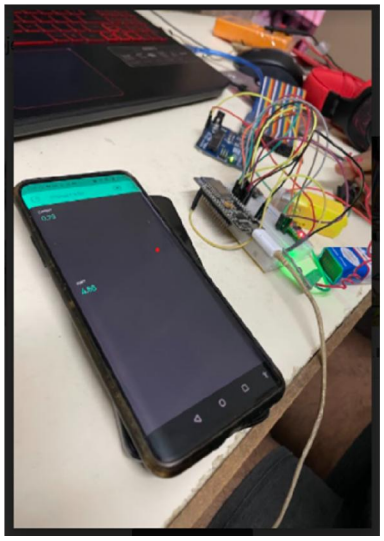

Figure 5: Blink app displaying consumer load and power consumption

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V. Conclusion

The smart IOT energy meter that we have developed reduces energy wastage, brings awareness to energy conservation in an easy and accessible way. It avoids human intervention, reduces the cost, and saves human power. It works both automatically and manually. This computerization diminishes the work costs as well as makes the framework more effective and exact.

VI. Applications

1. Ability to send remote commands based on smart metering data, for example, adjusting the lights, heating, etc.
2. Simple setup, straightforward dashboard configuration, out-of-the-box dashboard for quick start.
3. Adding/managing/removing smart meters within your solution
4. Ability to generate reports or view analytics
5. Ability to set up alerts and notifications

VII. Future Scope

1. A fully integrated single chip can be made to save space.
2. Machine learning can be employed to find the minimum amount of electricity required by a household over a billing cycle to keep costs minimum.

VIII. Appendix

8.1 Arduino Code

```
#include "ACS712.h"
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
BlynkTimer timer;
char auth[] = "Cc0sfGKIfhRtD2MeCLRFAflFNETPV9Kb"; //Auth code sent via
Email
char ssid[] = “Ci"; //Wifi name
char pass[] = "cicero"; //Wifi Password
char watt[5];
ACS712 sensor(ACS712_30A, A0);
unsigned long last_time =0;
unsigned long current_time =0;
float Wh =0 ;
void setup() {
Serial.begin(115200);
sensor.calibrate();
Blynk.begin(auth, ssid, pass);
12
timer.setInterval(100L,ene_meter);
}
void loop() {
if (Blynk.connected())
{
Blynk.run();
}
timer.run();
}
void ene_meter()
```

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```
{ float V = 230;
float I = sensor.getCurrentAC();
Serial.println("CURRENT:");
Serial.println(I);
Blynk.virtualWrite(V0,I);
float P = V * I;
last_time = current_time;
current_time = millis();
Wh = Wh+ P *(( current_time -last_time) /3600000.0) ;
dtostrf(Wh, 4, 2, watt);
Serial.write(watt);
Blynk.virtualWrite(V1,watt);
delay(1000);
}
```

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