UNIVERSITI KUALA LUMPUR
ASSESSMENT BRIEF

COURSE DETAILS	
INSTITUTE	UniKL BRITISH MALAYSIAN INSTITUTE
COURSE NAME	ELECTRICAL ENERGY UTILISATION
COURSE CODE	BKB40303
COURSE LEADER	MOHD HELMY HAKIMIE MOHD ROZLAN
LECTURER	MOHD HELMY HAKIMIE MOHD ROZLAN
SEMESTER & YEAR	JULY 2021

ASSESSMENT DETAILS	
TITLE/NAME	ASSIGNMENT 1
WEIGHTING	10%
DATE/DEADLINE	5/11/2021, 5.00 PM
COURSE LEARNING OUTCOME(S)	CLO 2: Investigate solution to problems related to demand side management and economic aspect of efficient energy equipment **(PLO4, C5)**
INSTRUCTIONS	Perform the following tasks: 1. All answers must be in English language only.

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Assessor's Comment:		**Marks:**

Verified by: Course Leader [MHHMR] Prepared by: [MHHMR]	QSC format verification	PC/HOS content validation
I hereby declare that all my team members have agreed with this assessment. All team members are certain that this assessment complies with the Course Syllabus. Signature: Date: 3/8/2021	QUALITY ASSURANCE ACADEMIC 09 SEP 2021 VERIFIED	HEAD OF SECTION ELECTRICAL ENGINEERING SECTION UNIVERSITI KUALA LUMPUR BRITISH MALAYSIAN INSTITUTE 10/09/2021.

TASK NO	CLO	MARKING SCHEME	MARKS
1	2	Investigate solution to problems related to demand side management and economic aspect of efficient energy equipment	***100***
		TOTAL	**100**

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CHAPTER 1: PROJECT BACKGROUND

1.0 INTRODUCTION

Technology nowadays grows and advances at a quick pace. Since contemporary technology is continuously growing, some aspects of the system must also evolve in order to avoid becoming outdated. Many years ago, a home monitoring system could not be maintained without human involvement, but recent technological advancements, particularly in the area of the Internet of Things (IoT), have given a new face to home monitoring and system management. The Internet of Things (IoT) is a massive infrastructure that connects a large number of devices and sensors to share information on their applications and the conditions under which they might be employed. The Internet of Things (IoT) is a network of smart gadgets that can securely send and receive data or information.

A SMART Masjid is a concept of mosque that connects the primary electrical equipment, such as fans, lamps, lighting, and others to the communication network. The user will be able to access, monitor, and control this system remotely. The word "remotely" refers to the ability to operate and monitor all devices' equipment via a communication system from within or outside the premises. The Internet of Things may be defined as the intelligent connection of common objects to the Internet to enable communication between things, people, and machines (IoT). As can be seen in Figure 1, it illustrates that IoT allows nearly all environmental devices to connect to the Internet and share data in order to create new services and applications that improve our quality of life.

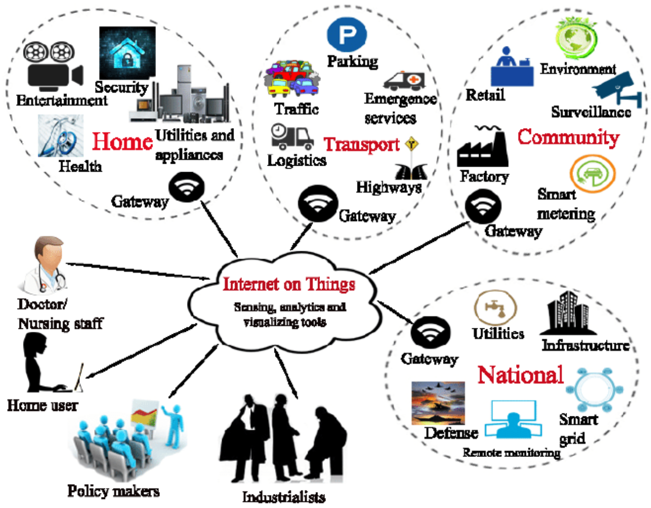

Figure 1 Applications of IoT

A continuation of our previous assignment, in which we were entrusted with conducting an electrical energy audit at Masjid Nurul Ihsan Rasah Kemayan in Seremban as the premise or auditee, this project is a continuation of that assignment. After going through the audit procedure, we discovered that the premise has a significant amount of potential to save energy by limiting consumption at an optimal level to avoid electricity wastage. One method of accomplishing this is through the use of an automatic switching control for all electrical equipment in the building, which is referred to as SMART Masjid.

1.1 OBJECTIVE

There are three objectives that must be achieved in order for the project to be completed effectively in this instance. We intend to concentrate our attention on the electrical equipment that had a significant impact on the auditee's electricity bill, including the air conditioning system.

i. To develop SMART Mosque with a suitable prototype by using Raspberry Pi and webserver.

ii. To design a low-cost SMART Mosque system to control general electrical appliances inside the mosque.

iii. To monitor the SMART control panel of “ON” and “OFF” switch of all the electrical appliances via application.

CHAPTER 2: LITERATURE REVIEW

2.0 INTERNET OF THINGS (IOT)

The internet of things, or IoT, is a network of interconnected computing devices, mechanical and digital machine with its own identifier and the ability to transfer data without needing human-to-human or human-to-computer interactions. IoT devices or systems are connected to internet and were able to detect any changes happened in environment using sensors thus sending signals toward the microprocessor. The microprocessor then will analyse the data from the sensor and produce output such as turning on and off a switch without human interaction. According to (In Lee, 2015), IoT system should be able to monitor, control, optimize, and automate its surrounding. This can be achieved using sensors as input, devices like ARDUINO as microcontroller, and smartphone as output display. In energy audit activities, IoT device can help the Registered Electrical Energy Manager (REEM) to monitor and record the energy consumed by the equipment in the buildings.

2.1 ENERGY MONITORING DEVICE

Energy monitoring device is a device that helps to identify the equipment usage efficiency and record the equipment energy consumption. By integrating this device with internet of things, IoT, it enables the device to display the recorded value via internet. This will ease the task of REEM in measuring and display the building's energy consumption as REEM can monitor the real-time data using mobile phone anytime and anywhere. Based on (Hao Luan, 2016), IoT energy monitoring device also can help to improve the energy management system as it will collect and save the real-time data of energy consumption automatically.

2.2 HARDWARE ELEMENTS

2.2.1 ARDUINO UNO

Figure 2: Arduino UNO

Arduino UNO is an open-source programmable microcontroller board which is low-cost, versatile, and easy-to-use in any electrical applications. It is based on the ATmega328P and has 14 digital input/output pins, (Arduino/Genuino UNO, 2021). For this IoT based energy monitoring device, Arduino UNO will act as microcontroller to process and store all the data obtained by the sensor then transfer the data to be displayed at dashboard on mobile phone. One of the advantages using Arduino UNO as microcontroller is that it can be simulated using PROTEUS software.

2.2.2 NODEMCU

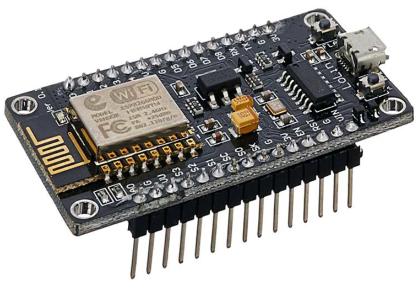

Figure 3: Node-MCU

Node-MCU is an open source IoT platform with a low cost. It features a modular design with Wi-Fi capability built in. Its programmable ability allows for low-cost implementation of internet applications for any devices. It also has the total capacity of 128 KB RAM and 4MB of Flash memory to store data and programs, (Components101, 2020). This component allows Arduino UNO to be connected to internet and its high processing power with in-built Wi-Fi or Bluetooth makes it ideal for IoT based project.

2.2.3 TEMPERATURE AND HUMIDITY SENSOR – DHT11

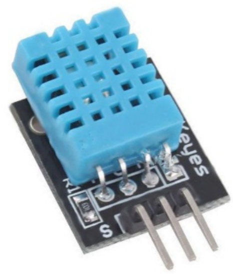

Figure 4: DHT11 Sensor

The DHT11 is a temperature and humidity sensor with a dedicated NTC for temperature measurement and 8-bit microprocessor that outputs temperature and humidity measurements as serial data. With an accuracy of around 1°C and 1%, the sensor can detect temperature from 0°C to 50°C and humidity from 20% to 90%. This sensor will read the surrounding temperature and humidity and act as input for the microcontroller.

2.3 SOFTWARE ELEMENTS

2.3.1 PROTEUS

Figure 5: Proteus Logo

Proteus is a free software program that allows you to simulate, design, and sketch electrical circuits. In Proteus, the microcontroller simulation is accomplished by adding a hex or debug file to the microcontroller portion on the schematic. This software will be used to simulate the device operation and connection. It initially does not come with Arduino UNO library. However, it can be externally installed to simulate the system that using Arduino UNO as its microcontroller. One of the main advantages by using Proteus for Arduino simulation is that it has a high-speed visualisation and analysis tool that may be used to check for errors, (Jenipher, 2017).

2.3.2 BLYNK

Blynk is an application platform for iOS and Android that lets you operate controllers such as Arduino, Raspberry-Pi, ESP32, and Node-MCU through the internet. Without having to write any code, a graphical interface for projects may be created in a relatively short period simply using widgets on this platform.

CHAPTER 3: METHODOLOGY

3.1 BLOCK DIAGRAM

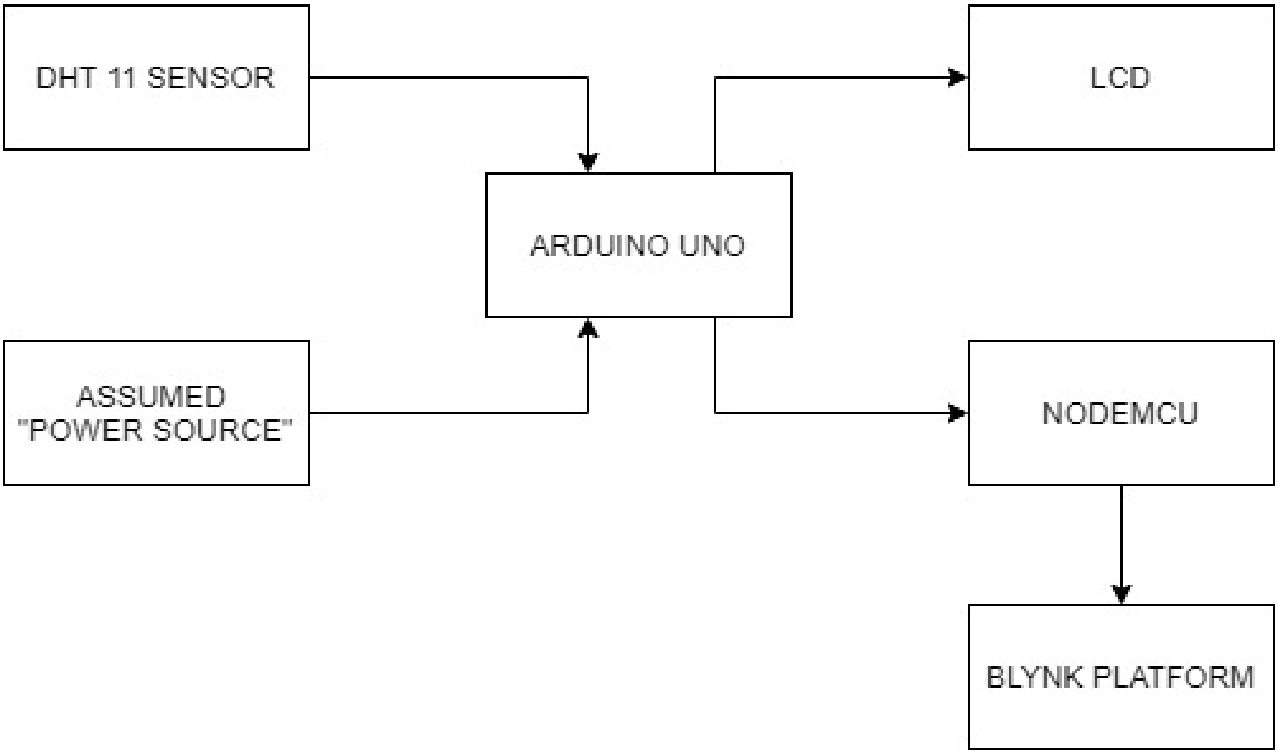

Figure 6 Block Diagram of The System

Figure above shows the block diagram of the whole system which the overall interactions between sensors, microcontroller, and software. The main device for the system is the Arduino Uno which is working to receive and process the data from the sensors. Then, it will display the output on LCD display. The data processed are then stored in cloud of NodeMCU and been displayed on the blynk platform.

3.2 FLOWCHART

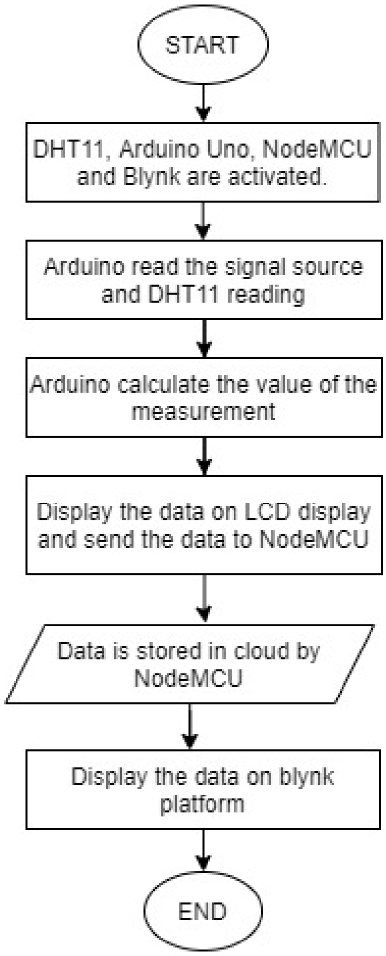

Figure 7 The flow chart of the IoT energy monitoring system

The figure 7 shows the flow chart of the smart energy monitoring system. The flowchart can give better understanding on how the smart energy monitoring system operates. The system is only provided simple data monitoring using IoT which uses the NodeMCU to connect with internet and Blynk to display the data from the cloud. This flowchart will serve as our main structure for the coding system. At first, Arduino will get the value of each parameter by help of the DHT11 sensor and a circuit that assumed as power source. At this stage, all data are observed and calculated by Arduino and these data will be stored in cloud via NodeMCU. Other than that, these data will be displayed on LCD and blynk platform.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 SIMULATION

4.2 CIRCUIT DIAGRAM

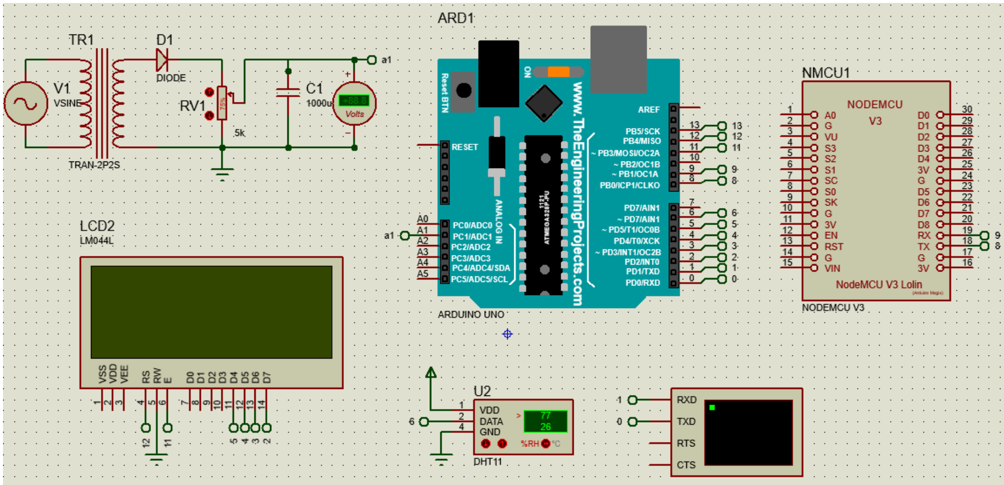

Figure 8 circuit diagram of the smart energy monitoring system

Figure above shows the circuit diagram of the smart energy monitoring system that is constructed in Proteus 8 simulation. The circuit consists of Arduino Uno, NodeMCU, 20x4 LCD, DHT11 sensor, virtual terminal, and a circuit that is assumed as power source. The coding of the system is done using Arduino IDE and is uploaded to the Arduino Uno in the Proteus simulation.

4.3 RESULT

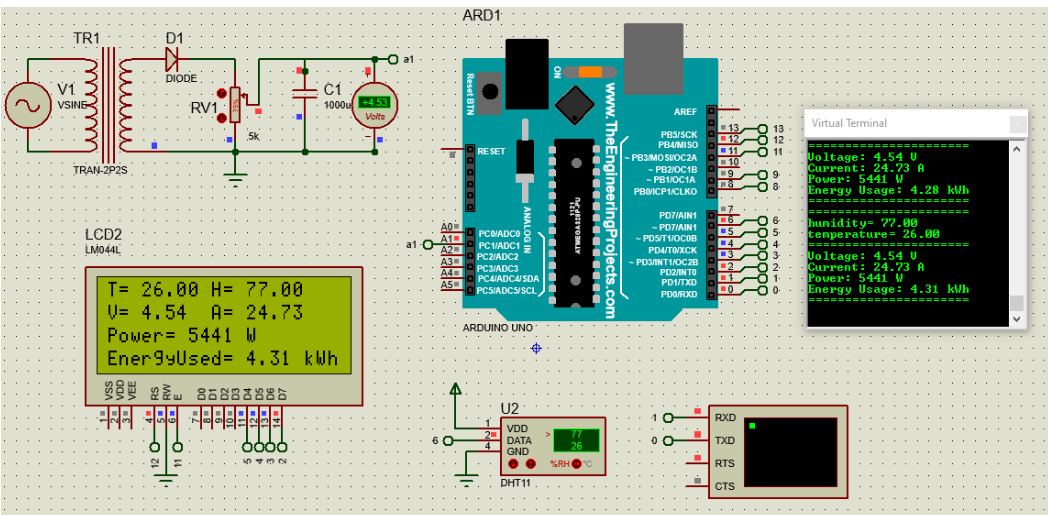

Figure 9 The simulation of the system

The figure 2 shows the simulation of the smart energy monitoring system is running. The Arduino Uno manages to measure the temperature and humidity value from DHT11 and the energy measurement like voltage (V), current (A), Power (Power) and energy usage (Energy Used). The measurements are displayed on the LCD display and the virtual terminal. The measurements value will be sent to NodeMCU through serial connection using pin 8 and pin 9 on Arduino to pin RX and TX on NodeMCU. During this simulation, the NodeMCU is not used as it cannot be used for simulation due to its incomplete model for simulation. The Arduino coding of the system can be found in the appendices.

4.4 ANALYSIS

Based on figure 1 that shows the circuit diagram of the smart energy monitoring system, the circuit at the top left of the diagram is assumed as power source from a plug which the voltage source of 220V AC, VSINE is step down by the transformer. The source is rectified by the diode, D1 and is filtered by the potentiometer, RV1 and capacitor, C1. The circuit will provide signal source that can be converted into digital input. The digital input can be used to calculate the energy measurements like voltage, current, power and energy usage. The DHT11 sensor can be adjusted its value in the Proteus to simulate the temperature and humidity value. The measurement data is sent to NodeMCU through serial connection. The NodeMCU will store the data and send the data to Blynk to display the measurements on the blynk platform. This system can help the user to monitor the energy usage of electrical appliances like fan, TV, air conditioner or any electrical appliances that use plug. In the simulation, the system manages to measure the data of energy usage from 220V AC source by using potential transformer and rectifier circuit.

5.0 CONCLUSION

As more services are supplied via Internet technology, the number of applications that use this technology is constantly growing. People's increasing desire for comfort is driving an increase in demand for smart and autonomous devices that can conduct their own work. However, the device cluster produced by these devices connecting with one another across the internet network gradually alters our perception of the internet. Now, the internet is continually shifting our expectations for the future by providing a wide range of options and functionalities such as social media tools, e-commerce platforms, and news sources. The Internet of Things

(IoT), which has made a quick entry into our lives, is rapidly expanding to incorporate a variety of sectors and applications. A prototype home automation application was developed using IoT technologies and the Node MCU embedded system microcontroller in this project. This system delivers a comfortable and smart climate-lighting system that can be controlled via the Blynk interface from any location with Internet access. Our accomplishments in this outstanding application, which is a low-cost, efficient, and dependable solution, will enable us to develop new applications in a variety of fields, including industry, health, agriculture, the environment, education, and energy.

6.0 REFERENCE

1. *Arduino/Genuino UNO*. (2021, October 23). Retrieved from ARDUINO: https://www.arduino.cc/en/pmwiki.php?n=Main/arduinoBoardUno
2. *Components101*. (2020, April 22). Retrieved from NodeMCU ESP8266: https://components101.com/development-boards/nodemcu-esp8266-pinout-features-and-datasheet
3. Hao Luan, J. L. (2016). Design of Energy Monitoring System based on IOT. *Chinese Control and Decision Conference (CCDC)*.
4. In Lee, K. L. (2015). The Internet of Things (IoT): Applications, investments, and challenges for enterprises. *Business Horizons*.
5. Jenipher, R. (2017). SOFTWARE AND HARDWARE IMPLEMENTATION OF SMART METER WITH DEMAND RESPONSE USING PROTEUS . *International Journal of Pure and Applied Mathematics*.

APPENDIX

Arduino coding

```
#include<LiquidCrystal.h> //lcd library
LiquidCrystal lcd(12, 11, 5, 4, 3, 2); //assigning lcd pins
(RS,En,D4,D5,D6,D7)

#include <SoftwareSerial.h>//ESP library
#include <ArduinoJson.h> //arduino to NodeMCU library
SoftwareSerial nodemcu(8, 9);//8=TX & 9=RX on nodeMCU


#include "DHT.h" //library DHT11
#define dht_1 6      //pin 6 to dht11
#define DHTTYPE DHT11
DHT dht(dht_1, DHTTYPE);

double kilos = 0; //Declare energy usage
int peakPower = 0; //Declare RMS power


void setup() {
  Serial.begin(9600);
  //  nodemcu.begin(9600);
  dht.begin();
  lcd.begin(20, 4); //set lcl (row,column)
  delay(500);
}


void loop() {

  delay(2000);
  StaticJsonBuffer<1000> jsonBuffer;
  JsonObject& data = jsonBuffer.createObject();

  //Read DHT11
  float humid = dht.readHumidity();
  float temp = dht.readTemperature();

  int InputVoltage  = analogRead(A1); // Read the analog  value
  double voltage = InputVoltage * (5.0 / 1024.0) ; //convert the value to
volts

  int current = 0;
  int maxCurrent = 0;
  int minCurrent = 1000;
  for (int i = 0 ; i <= 200 ; i++) //Monitors and logs the current input
for 200 cycles to determine max and min current
  {
    current = analogRead(A1);    //Reads current input
    if (current >= maxCurrent)
      maxCurrent = current;
    else if (current <= minCurrent)
      minCurrent = current;
  }
  if (maxCurrent <= 517)
  {
```

```
    maxCurrent = 516;
  }
  double RMSCurrent = ((maxCurrent - 516) * 0.707) / 11.8337; //Calculates
RMS current based on maximum value
  int RMSPower = 220 * RMSCurrent;  //Calculates RMS Power Voltage 220VAC
  if (RMSPower > peakPower)
  {
    peakPower = RMSPower;
  }
  kilos = kilos + (RMSPower * (2.05 / 60 / 60 / 100)); //Calculate kilowatt
hours used


  //Serial monitor display
  Serial.println("====================== ");
  Serial.print("humidity= ");
  Serial.println(humid);
  Serial.print("temperature= ");
  Serial.println(temp);
  Serial.println("====================== ");


  Serial.print("Voltage: ");
  Serial.print(voltage);
  Serial.println(" V");


  Serial.print("Current: ");
  Serial.print(RMSCurrent);
  Serial.println(" A");

  Serial.print("Power: ");
  Serial.print(RMSPower);
  Serial.println(" W");

  Serial.print("Energy Usage: ");
  Serial.print(kilos);
  Serial.println(" kWh");
  Serial.println("====================== ");


  //LCD display
  lcd.setCursor(0, 0); //display on lcd at x=0, y-=0
  lcd.print("T= "); //display on lcd
  lcd.print(temp);

  lcd.setCursor(9, 0); //display on lcd at x=9, y-=0
  lcd.print("H= "); //display on lcd
  lcd.print(humid);

  lcd.setCursor(0, 1); //display on lcd at x=0, y-=0
  lcd.print("V= "); //display on lcd
  lcd.print(voltage);

  lcd.setCursor(9, 1); //display on lcd at x=0, y-=0
  lcd.print("A= "); //display on lcd
  lcd.print(RMSCurrent);

  lcd.setCursor(0, 2); //display on lcd at x=0, y-=3
  lcd.print("Power= "); //display on lcd
```

```
  lcd.print(RMSPower);
  lcd.print(" W");

  lcd.setCursor(0, 3); //display on lcd at x=0, y-=4
  lcd.print("EnergyUsed= "); //display on lcd
  lcd.print(kilos);
  lcd.print(" kWh");

  //Assign collected data to JSON Object
  data["Humidity"] = humid;
  data["Temperature"] = temp;
  data["Voltage"] = voltage;
  data["Current"] = RMSCurrent;
  data["Power"] = RMSPower;
  data["Energy_Usage"] = kilos;

  //Send data to NodeMCU
  data.printTo(nodemcu);
  jsonBuffer.clear();

}
```