#include <Arduino.h>

#include <Wire.h>

#include <EEPROM.h>

#include <math.h>

#include <LiquidCrystal\_I2C.h>

#include "EmonLib.h" // https://github.com/openenergymonitor/EmonLib

// SIM800L setup for ESP32 using UART2

#define RX2 16 // ESP32 GPIO for SIM800L RX (Connect to SIM800L TX)

#define TX2 17 // ESP32 GPIO for SIM800L TX (Connect to SIM800L RX)

HardwareSerial sim800l(2); // Use UART2 for SIM800L

// LCD Setup for ESP32 (I2C)

LiquidCrystal\_I2C lcd(0x27, 20, 4); // Adjust I2C address if needed

// Energy Monitor

EnergyMonitor emon;

#define vCalibration 234.26

#define currCalibration 52

// Energy & Billing Variables

float bill = 0;

float kWh = 0;

uint32\_t lastmillis = millis();

uint32\_t lastsend = millis();

void serial\_print() {

emon.calcVI(20, 2000); // Voltage and current measurement

Serial.print("Vrms: "); Serial.print(emon.Vrms, 2); Serial.print("V\t");

Serial.print("Irms: "); Serial.print(emon.Irms, 4); Serial.print("A\t");

Serial.print("Power: "); Serial.print(emon.apparentPower, 4); Serial.print("W\t");

kWh += emon.apparentPower \* (millis() - lastmillis) / 3600000000.0;

Serial.print("kWh: "); Serial.print(kWh, 4); Serial.println("kWh");

lastmillis = millis();

Billing();

Serial.print("\t Bill: Rs."); Serial.print(bill, 4); Serial.print("/-\n");

// Send SMS with updated data

String data = "kWh: " + String(kWh, 4) + ", Bill: Rs. " + String(bill, 4) + "/-";

sim800l.println("AT+CMGS=\"+918169942976\"\r");

}

void lcd\_print() {

lcd.clear();

lcd.setCursor(1, 0); lcd.print("SMART ENERGY METER");

lcd.setCursor(0, 1); lcd.print("V: "); lcd.print(emon.Vrms, 2); lcd.print("V");

lcd.setCursor(11, 1); lcd.print("I: "); lcd.print(emon.Irms, 2); lcd.print("A");

lcd.setCursor(0, 2); lcd.print("P: "); lcd.print(emon.apparentPower, 4); lcd.print("W");

lcd.setCursor(0, 3); lcd.print("E: "); lcd.print(kWh, 4); lcd.print("kWh");

}

void Billing() {

bill = 105; // Base charge

if (kWh <= 100) bill += 3.36 \* kWh;

else if (kWh <= 300) bill += 7.34 \* kWh;

else if (kWh <= 500) bill += 10.37 \* kWh;

else bill += 11.86 \* kWh;

}

void setup() {

Serial.begin(115200);

sim800l.begin(9600, SERIAL\_8N1, RX2, TX2);

lcd.init();

lcd.backlight();

lcd.setCursor(1, 0);

lcd.print("SMART ENERGY METER");

emon.voltage(32, vCalibration, 1.7); // Voltage sensor on ADC1 GPIO32

emon.current(33, currCalibration); // Current sensor on ADC1 GPIO33

}

void loop() {

serial\_print();

lcd\_print();

// Send SMS every 24 hours

if (millis() - lastsend >= 24 \* 60 \* 60 \* 1000) {

String data = "kWh: " + String(kWh, 4) + ", Bill: Rs. " + String(bill, 4) + "/-";

sim800l.println("AT+CMGS=\"+918169942976\"\r");

lastsend = millis();

}

   delay(500);

}