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Power Theft Detection System

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ABSTRACT:Power theft is a critical issue faced by utility companies worldwide, leading to significant revenue losses and operational challenges. To address this problem, we propose a power theft monitoring and alert system using GSM technology. This system aims to detect unauthorized consumption of electricity and alert authorities in real-time, enabling prompt action to be taken. By leveraging GSM modules, the system can monitor power consumption patterns and detect anomalies that may indicate theft. When suspicious activity is detected, the system sends an alert via SMS to designated personnel, allowing them to investigate the issue promptly. This system offers several advantages over traditional methods of power theft detection, including cost-effectiveness, remote monitoring capabilities, and real-time alerts. Additionally, by deterring theft, the system can help utility companies improve revenue collection and ensure fair distribution of electricity resources. In this project, we will discuss the design and implementation of the power theft monitoring and alert system using GSM technology and explore its potential impact on reducing power theft and improving the efficiency of utility operations.

KEYWORDS: Arduino Uno (At Mega 328), ACS712, GPS, GSM SIM 800l, LCD 16*2 Display.

I. INTRODUCTION

Power theft is a significant issue faced by utility companies, leading to revenue loss and operational challenges. To address this problem, we propose a power theft monitoring and alert system using GSM technology. This system aims to detect unauthorized consumption of electricity and alert authorities in real-time, enabling prompt action to be taken. By leveraging GSM modules, the system can monitor power consumption patterns and detect anomalies that may indicate theft. When suspicious activity is detected, the system sends an alert via SMS to designated personnel, allowing them to investigate the issue promptly. This system offers several advantages over traditional methods of power theft detection, including cost-effectiveness, remote monitoring capabilities, and real-time alerts. Additionally, by deterring theft, the system can help utility companies improve revenue collection and ensure fair distribution of electricity resources. In this project, we will discuss the design and implementation of the power theft monitoring and alert system using GSM technology. We will also explore its potential impact on reducing power theft and improving the efficiency of utility operations. Smart Electric Bill is a complicated platform to the manner we The acquire power nowadays. In earlier times the demand for electricity was substantial compared there to presently. Since the demand for electricity has tremendously increased, a redesign of the present grid system is far needed. With the technology available in these times , the smart grid might be designed in such a fashion , that it uses digital technology to detect and react to local changes in usage. The system will feature a two-way dialog where electricity and knowledge are often exchanged between the buyer and utility. This can increase or decrease the quantity of energy a consumer needs by analyzing the feedback of the two-way dialog. In this system a practical energy meter is installed in every consumer unit and a server is maintained on the service provider side.

II. RELATED WORK

Theft of electricity is the criminal practice of stealing electrical power. According to a study the world loses US$89.3 billion annually to electricity theft. The highest losses were in India ($16.2 billion), followed by Brazil ($10.5 billion) and Russia ($5.1 billion) [1]. Nationally, totaltransmission and distribution losses approach 23% and somestates' losses exceed 50% [2]. A huge amount of power is required for the Integrated steel plants To meet this requirement it is calculated that approximately a capacity of 25,000 MW power plant needs to be installed apart from thecaptive power & blowing stations [3]. By the help of our prototype we can detect the theft and possibly save the maximum electricity which can be effectively used in the steel plants.

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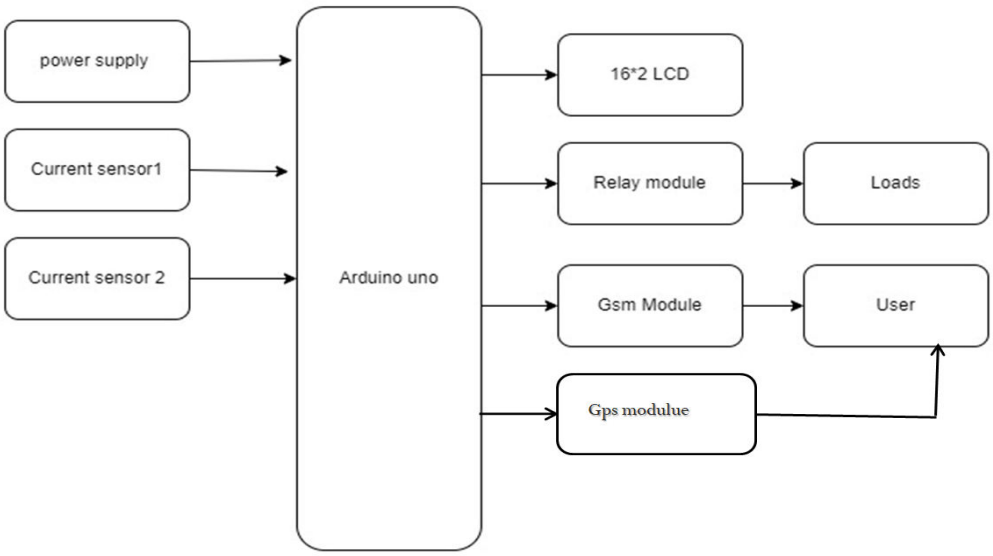

Fig. 1. Block diagram of power theft detection system

III. DETAILED SYSTEM EQUIPMENT

The hardware and software required for our solution is:

- Arduino Uno
- Current Sensing Module (ACS 712)
- GSM (SIM 800)
- GPS Module

A. Arduino UNO

Arduino [4] is an open-source electronics prototyping platform based on flexible, easy-to use hardware and software. As Arduino is open source, the CAD and PCB design are freely available. There are several different arduino boards are available on the market (both original andcloned) such as Arduino UNO, Arduino Nano, Arduino Miniand Arduino Mega.

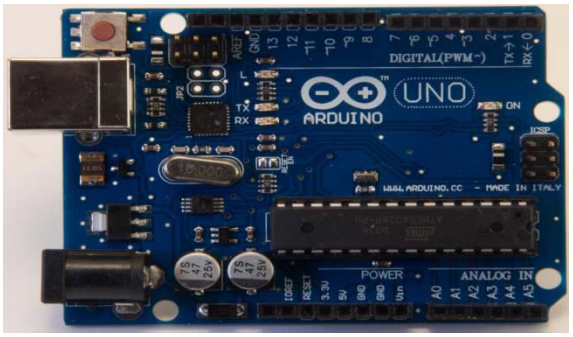

Fig. 2. Arduino UNO R3

For our work specifically we used this board (Fig. 2) dueto the below specifications.

- 6 analog input ports
- Power Input connector.
- 14 digital I/O ports (of which 6 PWM)
- Standard USB for data and power and programming.
- Female headers.
- 1 hardware serial port (UART)

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- Most popular board. Ideal for starters.

B. Current sensing Module (ACS 712)

The ACS712 Current Sensor as shown in Fig. 3 offeredon the internet are designed to be easily used with micro controllers like the Arduino. These sensors are based on the Allegro ACS712ELC chip. These current sensors are offeredwith full scale values of 5A, 20A and 30A.

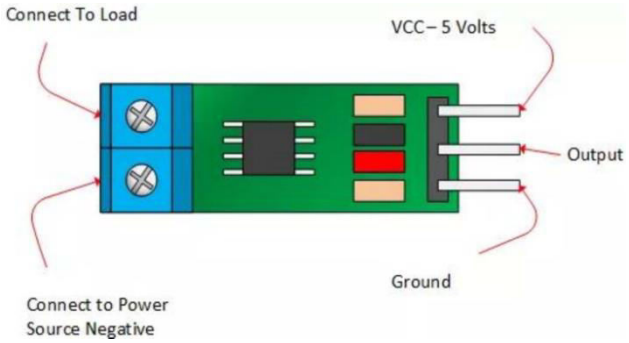

Fig. 3. Pin configuration of ACS 712

C. GSM Module

Fig. 4 GSM Module (SIM 800)

SIM800 is a quad-band GSM/GPRS module that works on frequencies GSM/GPRS module that works on frequencies GSM 850MHz, EGSM 900MHz, DCS1800MHz and PCS 1900MHz. SIM800 features GPRS multi-slot class12/class 10(optional) and supports the GPRS coding schemes CS-1,CS-2, CS-3 and CS-4; With a tiny configuration of 24*24*3mm, sim800 can meet almost all thespace requirements in users' applications, such as M2M, smart phone, PDA and other devices.

D. GPS Module

To get the information of the device's geographical position, a GPS navigation device is needed that is capable of receiving information from satellites. Using suitable software, the device may display the position on a map, and it may offer directions. SIM800 has 68 SMT pads, and provides all hardware interfaces between the module and customers' boards.So to detect this we have to make the following arrangements: Firstly we will use a GPS module to store the latitude and longitude of that place.

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Fig. 5 GPS Module

IV. PROJECT MODEL

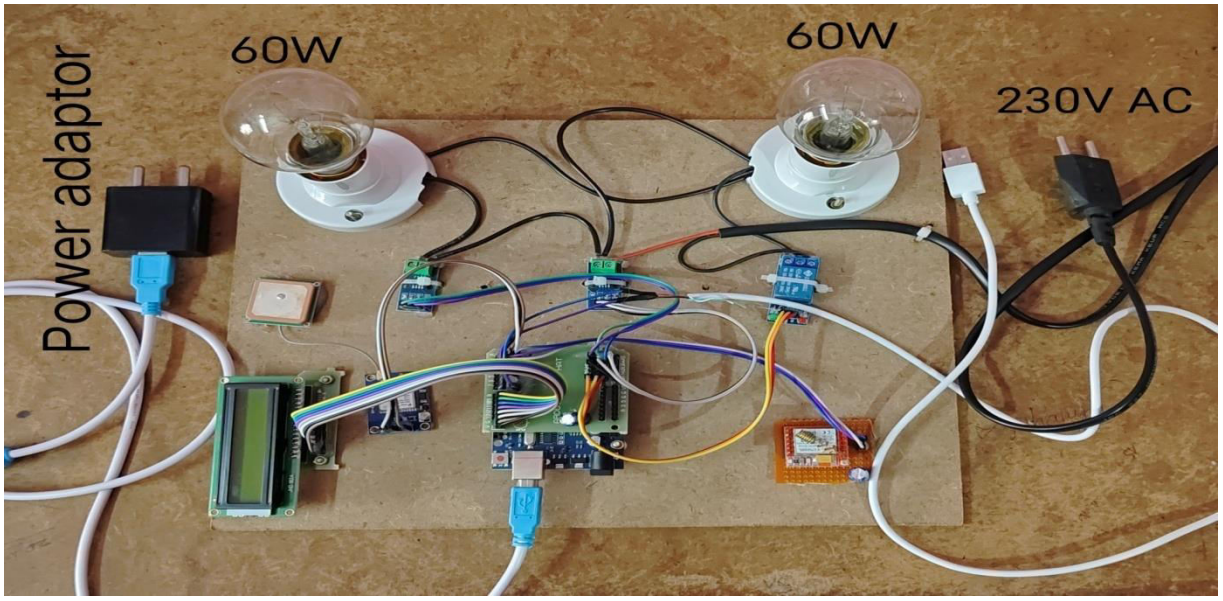

Fig. 6 Project model

This is power theft detection system by using this we reduce the revenue loss of government. We can identify theft by comparing the load.

V. CODE

```
#include <LiquidCrystal.h>
#include <SoftwareSerial.h>
const int sensor1In=A4;
const int sensor2In=A5;
unsigned long lastTime = 0;
unsigned long timerDelay = 16000;
LiquidCrystal lcd(8,9,10,11,12,13);
int kk=0,sts=0,thft;
#define relay A0
#define buz A3
double cval;
double cval1;
double pval;
double pval1;
```

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```
double vval=230,pf=1;
#include <TinyGPS.h>
TinyGPS gps;
float flat=0, flon=0;
void read_gps()
{
   bool newData = false;
  unsigned long chars;
  unsigned short sentences, failed;
  for (unsigned long start = millis(); millis() - start < 1000;)
  {
    while (Serial.available())
    {
      char c = Serial.read();
      if (gps.encode(c))
        newData = true;
    }
  }

  if (newData)
  {

    unsigned long age;
    gps.f_get_position(&flat, &flon, &age);

  }
}

void setup() {
   Serial.begin(9600);
//    mySerial.begin(115200);
   pinMode(relay,OUTPUT);
   pinMode(buz,OUTPUT);
   digitalWrite(relay,0);
   digitalWrite(buz,0);
   lcd.begin(16, 2);
   lcd.setCursor(0,0);
   lcd.print("  WElCOME");   // wifi_init();

}

void loop() {

  cval=read_current(A4);
  cval1=read_current(A5);
  pval=cval*vval*pf;
  pval1=cval1*vval*pf;

  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("S:" + String(pval) + " D:"+ String(pval1));
  if(pval1>170)
  {
    thft=thft+1;
    lcd.setCursor(0,1);
    lcd.print("Theft Warning..");
```

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```
 }
 if(thft>2 && kk==0 )
 {
  read_gps();
  kk=1;
  sts=1;
  //digitalWrite(relay,1);
  digitalWrite(buz,1);
  lcd.clear();
  lcd.print("THEFT - LOAD OFF");
  lcd.setCursor(0,1);
  lcd.print("Sending Info..");
  send_sms();
 }

 if ((millis() - lastTime) > timerDelay)
   {
    // upload(pval,pval1,sts);
     lastTime = millis();
   }


 delay(100);
}

double read_current(int pin)
{

int mVperAmp = 200; // use 100 for 20A Module and 66 for 30A Module
double Voltage = 0;
double VRMS = 0;
double AmpsRMS1 = 0;
double c;
 float result;
 int readValue;             //value read from the sensor
 int maxValue = 0;          // store max value here
 int minValue = 1024;          // store min value here

  uint32_t start_time = millis();
  while((millis()-start_time) < 1000) //sample for 1 Sec
  {
     readValue = analogRead(pin);
     // see if you have a new maxValue
     if (readValue > maxValue)
     {
        /record the maximum sensor value/
        maxValue = readValue;
     }
     if (readValue < minValue)
     {
        /record the minimum sensor value/
        minValue = readValue;
     }
  }

  // Subtract min from max
  result = ((maxValue - minValue) * 5.0)/1024.0;
```

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```
   VRMS = (result/2.0) *0.707;  //root 2 is 0.707
    c = ((VRMS * 1000)/mVperAmp)*2;
    if(c<0.30 || c>3)
    c=0;

  return c;
 }
// void wifi_init()
// {
//  mySerial.println("AT+RST");
//  delay(4000);
//  mySerial.println("AT+CWMODE=3");
//  delay(4000);
//  mySerial.print("AT+CWJAP=");
//  mySerial.write("");
//  mySerial.print("SRC 24G"); // ssid/user name
//  mySerial.write("");
//  mySerial.write(',');
//  mySerial.write("");
//  mySerial.print("src@internet"); //password
//  mySerial.write("");
//  mySerial.println();
//  delay(1000);
// }
//
//
//void upload(double x,double y,int sts1)
//{
//  read_gps();
//  String cmd = "AT+CIPSTART=\"TCP\",\"";
//  cmd += "184.106.153.149"; // api.thingspeak.com
//  cmd += "\",80";
//  mySerial.println(cmd);
//  delay(1000);
// String getStr ="GET /update?api_key=5C0ZAZ2NPDU9DFX0&field1=";
//  getStr += String(x);
//  getStr +="&field2=";
//  getStr += String(y);
//  getStr +="&field3=";
//  getStr += String(sts1);
//  getStr +="&field4=";
//  getStr += String(flat,6);
//  getStr +="&field5=";
//  getStr += String(flon,6);
//
//  getStr += "\r\n\r\n";
//  cmd = "AT+CIPSEND=";
//  cmd += String(getStr.length());
//  mySerial.println(cmd);
//  delay(1000);
//  mySerial.println(getStr);
//}
void send_sms()
{
 read_gps();
Serial.println("Sending SMS...");
```

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```
Serial.println("AT");
delay(1000);
Serial.println("ATE0");
delay(1000);
Serial.println("AT+CMGF=1");
delay(1000);
Serial.print("AT+CMGS=\"8328231147\"\r\n");// Replace x with mobile number
delay(1000);
Serial.println("Alert:Theft warning  found (Load Shutdown) ");
Serial.println("https://www.google.com/maps/search/?api=1&query="  +  String("16.577932")+  ","  +
String("80.874326"));
delay(100);
Serial.println((char)26);// ASCII code of CTRL+Z
delay(1000);
}
```

VI. RESULTS

The model studies involve the how much amount of power loss can be done by power thefting system. By using this method can easy to identify the wherever the power theft can be occurred in the sytem.This method we can comparing the current of the source position and the destination position. And this method we can identify the theft simply by the graphical position of particular location. In (Fig 8) with load is normal condition the alert will not activated,SMS will not send to authorized person or user. (Fig 9) when un balancing of load can be identify in source and destination SMS will send to the user.(Fig 10)In that SMS send the particular area location ,a nd we can identify the theft.

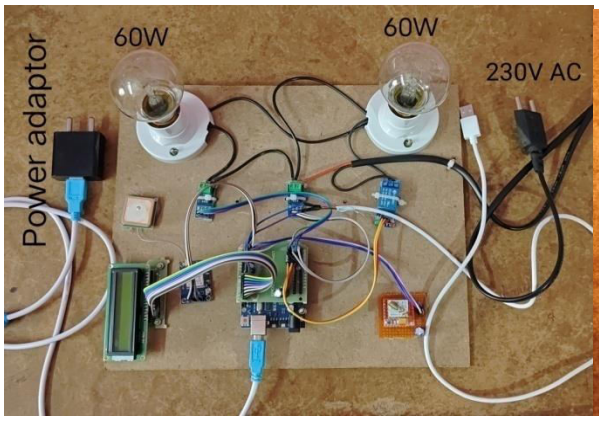

Fig.7 Without load Position

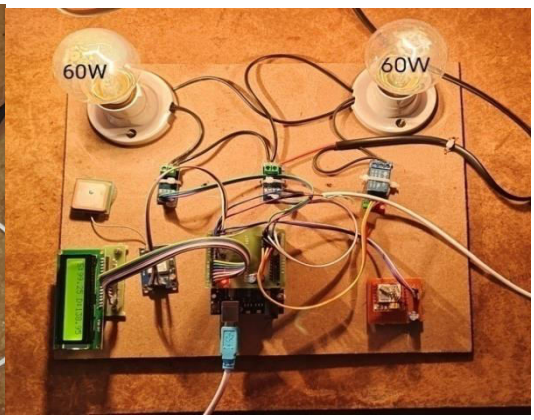

Fig. 8. Load position

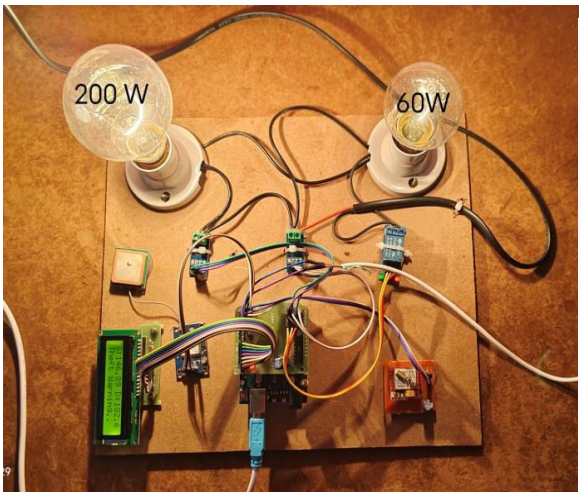

Fig. 9.When thefting position

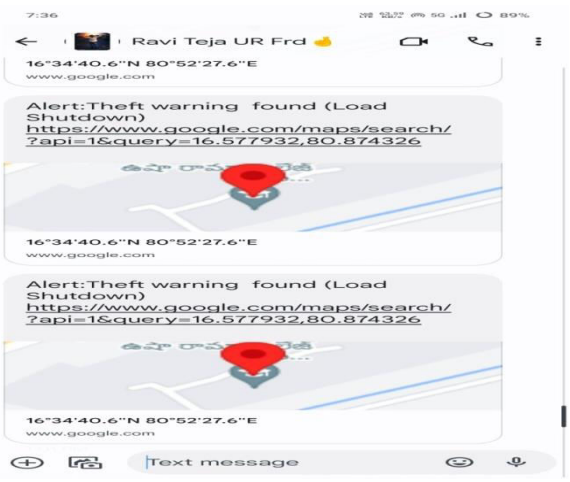

Fig 10. Message to user

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VII. CONCLUSION

This method reduces the heavy power and revenue losses that occur due to power theft by customers. By this design it can be concluded that power theft can be effectively curbed by detecting where the power theft occurs and informing the authorities. The proposed system will be hidden in electric meters in such a way that as soon as the difference between current crosses the threshold value, an automatic message and email will be sent to the concerned authority along with its location and image of that particular area.

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