PREPAID ENERGY METER

A MINI PROJECT REPORT

Submitted

by

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BONAFIDE CERTIFICATE

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ABSTRACT

A prepaid digital energy meter with GSM (Global System for Mobile Communications) capability is a type of electricity meter that allows customers to pay for their electricity in advance and remotely, using their mobile phones or computers. The GSM capability enables the meter to communicate with the power utility company, allowing customers to receive real-time updates on their energy usage, account balances, and recharge options.

The meter is equipped with a SIM card that enables it to communicate with the power utility company's servers through a mobile network. Customers can purchase electricity credits by sending an SMS message or by using an online payment system. Once the payment is processed, the meter is automatically credited with the purchased amount of electricity.

The prepaid digital energy meter with GSM capability provides several benefits, including:

1. Improved accuracy: The meter measures the exact amount of energy consumed by the customer, providing accurate billing information.
2. Better control: Customers can monitor their energy usage in real-time and adjust their consumption to avoid overages or excessive usage.
3. Convenience: The meter allows customers to purchase and top up their electricity credits remotely, using their mobile phones or computers.
4. Cost-saving: Prepaid meters help customers to manage their energy consumption, which can result in reduced energy bills.

Overall, prepaid digital energy meters with GSM capability are becoming increasingly popular as they offer a more convenient and efficient way of managing energy usage and payments.

LIST OF TABLE

LIST OF SYMBOLS

ABBREVIATIONS	FULL FORM
GSM	Global Service for Mobile Communication
LCD	Liquid Crystal Display
LED	Light Emitting Diode
SMS	SHORT MESSAGE SERVICE
USSD	UNSTRUCTURED SUPPLEMENTARY SERVICEDATA
kWh	KILOWATT-HOUR

LIST OF FIGURES

1. INTRODUCTION:-

1.1. GENERAL

Electricity is one of the vital requirements for sustainment of content of life. I agree that electricity is a vital requirement for sustaining life, and it is important to use it judiciously to ensure its proper utilization. It is unfortunate that many areas in our country do not have access to electricity, while some areas have surplus supply. Proper distribution of electricity is essential to ensure that everyone has access to this vital resource.

The issue of power theft is a major problem that needs to be addressed. It is important to accurately estimate the required amount of power and take measures to prevent power theft to ensure that the power supply is not disrupted. In addition, power companies need to improve their services and address consumer complaints to ensure that customers are satisfied.

The use of smart energy meters can help to address some of these issues. Smart meters provide accurate information on energy consumption, reducing the chance of errors in the billing system. They also allow for remote monitoring of energy consumption, which can reduce the need for manual meter reading, saving time and reducing human efforts. This technology can also help to identify areas with high energy consumption and provide insights on how to improve energy efficiency.

Overall, the use of smart energy meters is a step in the right direction towards ensuring the proper distribution and efficient utilization of electricity

1.2. GSM- BASED METER :-

GSM-based prepaid energy meters use a GSM module to enable communication between the meter and the utility company's server. Consumers can use a mobile phone to recharge their prepaid account through SMS. Here are some key features and benefits of GSM-based prepaid meters

1. Real-time monitoring: GSM-based prepaid meters allow for real-time monitoring of electricity consumption. This means that consumers can track their energy usage and adjust their behavior accordingly to conserve energy.
2. Instant recharge: Consumers can recharge their prepaid account instantly through SMS or USSD codes. This eliminates the need to physically visit a recharge station or the utility company's office to recharge the account.
3. Automatic disconnection: Once the prepaid account balance is exhausted, the GSM-based prepaid meter automatically disconnects the power supply. This helps to prevent electricity theft and encourages consumers to use electricity judiciously.
4. Cost savings: The use of GSM technology in prepaid energy metering reduces operational costs for the utility company. This is because manual meter reading and billing processes are eliminated, and the entire process becomes automated.
5. Improved revenue collection: With GSM-based prepaid meters, the utility company can collect revenue in advance, ensuring a steady cash flow. This helps to improve the financial health of the utility company and enables it to invest in infrastructure development and maintenance.

1.2.1. PROBLEM STATEMENT:-

1.2.2. POWER CONSUMPTION:-

Power consumption limitation is Not Available in the ordinary meter .That statement is generally true. Ordinary meters typically do not have the capability to limit power consumption. They are designed to measure the amount of electricity consumed by a household or building and record it for billing purposes.

In contrast, a smart or advanced meter may have the capability to limit power consumption by using demand response technology. This technology allows energy suppliers to remotely control the amount of power being delivered to a building or household during times of high demand.

However, it's important to note that the use of demand response technology must be voluntary and agreed upon by the consumer, as it may affect their comfort and convenience. It's also important to ensure that any power consumption limitations are fair and equitable for all consumers.

1.2.2.1. ACCURACY WOULD BE LESS:-

Prepaid energy meters are designed to provide accurate measurement and billing of electricity usage, just like traditional postpaid meters. In fact, prepaid meters can offer a more accurate measurement of electricity consumption because they record energy usage in real-time, which allows consumers to monitor and control their usage.

However, there have been instances where prepaid meters have provided an inaccurate reading, which has led to billing disputes and loss of trust in the system. This can be due to a variety of factors, including meter malfunction, calibration errors, or

tampering. To ensure accuracy, prepaid energy meters should undergo regular calibration and maintenance to ensure that they are functioning properly. Additionally, there should be a dispute resolution process in place to address any billing discrepancies and to ensure that consumers are not unfairly charged for electricity usage.

Overall, prepaid energy meters can provide accurate measurement and billing of electricity usage when properly maintained and calibrated, and when proper dispute resolution processes are in place.

1.2.3.1. IMPROVED CUSTOMER SERVICE :-

Prepaid energy meters have the potential to improve customer service for energy consumers in several ways.

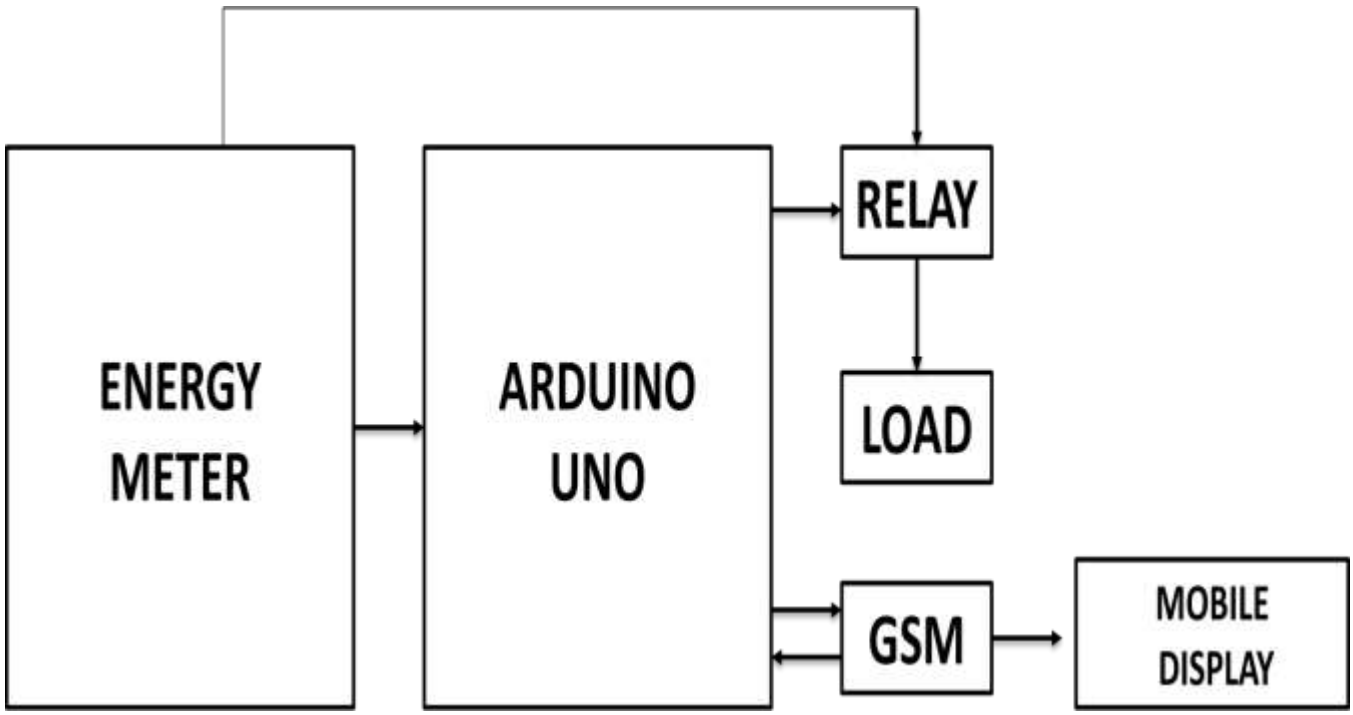
Firstly, prepaid meters offer consumers greater control over their energy usage and spending. By allowing consumers to monitor their real-time energy consumption, prepaid meters can help consumers identify areas where they can reduce their energy usage and save money on their energy bills.

Secondly, prepaid meters can help to reduce disputes between consumers and energy suppliers by providing more transparent and accurate billing. Prepaid meters can provide consumers with real-time information on their energy consumption, which can help to prevent billing errors and disputes.

Thirdly, prepaid meters can provide greater flexibility in payment options for consumers. Prepaid meters allow consumers to pay for their energy usage in advance, which can help consumers to better manage their energy expenses and avoid unexpected bills.

Overall, prepaid energy meters can help to improve customer service for energy consumers by providing greater control over energy usage and spending, more transparent and accurate billing, and more flexible payment options.

1.3. BLOCK DIAGRAM:-



1.3. BLOCK DIAGRAM

1.4. CHAPTER CONCLUSION:-

Prepaid energy meters have emerged as a viable alternative to traditional postpaid meters for managing electricity consumption and billing. These meters allow consumers to pay for their energy usage in advance, monitor their real-time energy consumption, and avoid unexpected bills.

Prepaid energy meters have the potential to improve customer service by providing greater control over energy usage and spending, more transparent and accurate billing, and more flexible payment options. However, there have been concerns about the accuracy and affordability of prepaid meters, which need to be addressed to ensure that they are accessible to all consumers.

The system is designed to provide real-time information about energy usage, including voltage levels, current usage, and energy consumption patterns. It also allows users to monitor their electricity usage remotely using a mobile phone or computer, making it an incredibly convenient and accessible system for consumers.

One of the key advantages of this system is that it eliminates the need for manual meter reading and billing, making it more cost-effective for both the consumer and the utility company. Additionally, the system helps reduce energy wastage and encourages consumers to use electricity more responsibly.

Overall, prepaid energy meters have the potential to revolutionize the way we consume and pay for electricity, but it is important to ensure that they are properly maintained, calibrated, and regulated to provide accurate measurement and fair billing practices. With proper oversight, prepaid energy meters can help to promote energy efficiency, reduce billing disputes, and improve customer service for energy consumers.

2. LITERATURE REVIEW:-

2.1. CHAPTER INTRODUCTION:-

2.1.1. Energy usage in advance:-

Prepaid energy meters have gained popularity as a solution for managing electricity consumption and billing).(1) A review on prepaid energy meter based on GSM technology, (2) Monitor their real- time energy consumption, and avoid unexpected bills. Prepaid energy meter using GSM technology.

This chapter aims to Design and development of a prepaid energy meter using GSM technology (3) their benefits and challenges, and the need for Design and implementation of a prepaid energy meter (4) (5) and Prepaid Energy Meter Using Arduino to ensure their accuracy and fairness. We will examine the impact of prepaid meters on energy consumption and (6) Prepaid Energy Meter Using Arduino , as well as the accuracy and fairness of billing practices. Additionally, we will explore the affordability and accessibility of prepaid meters, particularly for low-income households.

Moreover, we will review the existing literature on prepaid energy meters to provide insights into the potential benefits and challenges associated with their use. Prospects and challenges (7)(8) of relevant studies on prepaid energy meters, including their impact on energy consumption, accuracy and fairness of billing practices, and A review of prepaid energy meter (9).

The insights provided in this chapter will be useful for policymakers, energy suppliers, and consumers who are interested in using prepaid energy meters for managing electricity consumption and billing.

2.1.2. MANAGING ELECTRICITY CONSUMPTION:-

Prepaid energy meters have emerged as an innovative solution Practical Approach for Sustainable Energy Supply (10) and billing. These meters enable consumers to pay for their energy usage in advance, monitor their real-time energy consumption, and avoid unexpected bills.

A ZigBee-Bound Home Automation System WEE Tra C422-430 (15) .We will examine the impact of prepaid meters on energy consumption and . This paper provides an overview of the working principle and implementation of a prepaid energy meter with GSM technology (11), as well as the accuracy and fairness of billing practices.Additionally; we will explore the affordability and accessibility of prepaid meters, especially for low-income households. This paper presents a detailed description of the design and implementation of a prepaid energy meter with GSM network (12).

Furthermore, we will review the existing literature on prepaid energy meters to provide insights into the potential benefits and challenges associated with their use. The literature review will examine the findings of relevant studies on prepaid energy meters, including their impact on energy consumption, accuracy and fairness of billing practices, and affordability and accessibility.

This chapter aims to provide policymakers, This paper presents a detailed description of the design and development of a prepaid energy meter using GSM technology (13), (14). of prepaid energy meters, their potential benefits and challenges, and the need for proper maintenance and regulation. The insights provided in this chapter can assist stakeholders in making informed decisions about the use of prepaid energy meters for managing electricity consumption and billing.

2.2. CHAPTER CONCLUSION:-

The literature on prepaid energy meters provides a comprehensive overview of the potential benefits and challenges associated with their use. Prepaid energy meters have been found to promote energy efficiency and conservation by providing consumers with real-time information on their energy consumption and allowing them to control their energy usage more effectively.

However, there are concerns about the accuracy and fairness of prepaid meters, as well as their affordability and accessibility for low-income households. It is essential to address these concerns to ensure that prepaid energy meters are a viable and equitable option for managing electricity consumption and billing.

Overall, the literature highlights the need for proper maintenance and regulation of prepaid energy meters to ensure their accuracy and fairness. Additionally, efforts should be made to address the affordability and accessibility of prepaid meters for low-income households to avoid exacerbating energy poverty.

Prepaid energy meters have the potential to revolutionize the way we consume and pay for electricity, but it is crucial to ensure that they are properly managed and regulated to provide accurate measurement and fair billing practices. With proper oversight, prepaid energy meters can help to promote energy efficiency, reduce billing disputes, and improve customer service for energy consumers.

2. PROPOSED SYSTEM:-

This mechanism requires the consumers to pay for the electricity before its consumption. On that way, users hold credit and then use the electricity until the credit is ended. If the available credit is ended then the electricity supply is cutoff by a relay. Readings made by operators are prone to errors. This project shows the above mentioned problems. These systems will first register the user. For making recharge the consumer must have to login to the system. The username and password must create to login then it will check for the user is valid or not through server. It can able to recharge through user phone app only if the user is authorized user. As recharge ends it will cut off the electricity.

2.1. CHAPTER INTRODUCTION:-

The proposed system for prepaid energy meter is a cutting-edge solution that offers numerous benefits to both energy providers and consumers. By combining advanced hardware and software components, the system enables efficient and cost-effective energy management, providing greater convenience, flexibility, and control for consumers.

One of the key features of the proposed system is real-time monitoring of energy consumption. The prepaid energy meter is equipped with sensors that measure energy usage in real-time and transmit this data to the utility company. This enables the energy provider to monitor consumption patterns and identify areas where energy savings can be achieved.

Another important feature of the proposed system is the ability to remotely manage prepaid accounts. Customers can top up their prepaid balance via a mobile app or website, providing greater convenience and flexibility. The energy provider can also remotely manage and monitor prepaid accounts, reducing the need for manual intervention and increasing efficiency.

The proposed system also incorporates advanced security measures to prevent fraud and meter tampering. The prepaid energy meter is equipped with encryption and authentication protocols to ensure that all data transmission is secure. Additionally, the meter is designed to detect any attempts at tampering and notify the utility company immediately.

Automated disconnection and reconnection of the energy supply is another key feature of the proposed system. If the prepaid balance runs out, the energy supply is automatically disconnected. Once the balance is topped up, the supply is automatically reconnected, eliminating the need for manual intervention.

Energy usage alerts and notifications are also included in the proposed system. Customers can receive alerts and notifications when their prepaid balance is low or when they are consuming energy at a higher than usual rate. This enables them to manage their energy consumption more effectively and avoid unnecessary waste.

Overall, the proposed system for prepaid energy meter is designed to provide a comprehensive and efficient solution for energy management. With its advanced features and functionalities, the system has the potential to transform the way energy is consumed and managed, offering benefits for both energy providers and consumers alike.

2.2. PROMOTING ENERGY CONSERVATION:-

A prepaid energy meter system is a type of utility meter that allows consumers to pay in advance for their energy usage, and then use the energy until the prepaid amount is depleted. This system can be useful for managing energy costs and promoting energy conservation.

There are several types of prepaid energy meters available, including:

2.2.1. SMART PREPAID ENERGY METER : –

These meters are equipped with advanced technology such as smart sensors and communication modules. They can monitor energy usage in real-time and send data to the utility company for billing and analysis. They can also be programmed to automatically turn off appliances when the prepaid amount runs out. Smart prepaid energy meters are equipped with sensors and communication modules that enable them to collect and transmit data about energy usage in real-time. This data can be used by utility companies to accurately bill consumers based on their actual energy usage. It can also be used by consumers to monitor their energy usage and make adjustments to reduce energy consumption.

One of the benefits of smart prepaid energy meters is that they can be programmed to automatically turn off appliances when the prepaid amount runs out. This can help consumers avoid unexpected outages and also promote energy conservation.

2.2.2. KEYPAD PREPAID ENERGY METER :–

Keypad prepaid energy meters are a type of utility meter that allows consumers to prepay for their energy usage using a keypad. These meters are similar to traditional energy meters but have a built-in keypad that enables consumers to enter a code to add prepaid energy credits to the meter. The meter will then deduct the energy used from the prepaid amount.

One of the benefits of keypad prepaid energy meters is that they provide consumers with greater control over their energy usage and expenses. Consumers can easily add prepaid energy credits at any time, and the meter will display the remaining balance and usage history, allowing them to monitor their energy usage and adjust accordingly to avoid running out of prepaid energy credits.

Another advantage of keypad prepaid energy meters is that they can help consumers to manage their energy costs more effectively. With a prepaid energy system, consumers can pay for their energy usage in advance, which can help them to avoid unexpected bills and keep their energy costs under control.

Keypad prepaid energy meters are also easy to install and use, making them a convenient option for both consumers and utility companies. They can be used in a variety of settings, including residential and commercial properties, and can be integrated with other energy management systems to provide consumers with even greater control over their energy usage.

Overall, keypad prepaid energy meters are a cost-effective and efficient way for consumers to manage their energy usage and expenses, while also promoting energy conservation. By providing consumers with greater control over their energy usage, these meters can help to reduce energy waste and promote sustainable energy consumption

2.3. SOFTWARE PROGRAM:-

```
#include<EEPROM.h>
#include<LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27,16,2);
int led=13;
#define pulsein 8
#define relay 10
unsigned int pusle_count=0;
float units=0;
unsigned int rupees=0;
 float watt_factor=0.3125;
unsigned int temp=0,i=0,x=0,k=0;
char str[70],flag1=0,flag2=0;
String bal="";
void setup()
{
  lcd.init();
  lcd.backlight();
  Serial.begin(9600);
  pinMode(led, OUTPUT);
  pinMode(pulsein, INPUT);
  pinMode(relay, OUTPUT);
  digitalWrite(pulsein, HIGH);
```

```
  lcd.setCursor(0,0);
  lcd.print("Automatic Energy");
  lcd.setCursor(0,1);
  lcd.print("      Meter    ");
  delay(2000);
  lcd.clear();
  lcd.print("GSM Initilizing...");
  gsm_init();
  lcd.clear();
  lcd.print("System Ready");
  Serial.println("AT+CNMI=2,2,0,0,0");
  init_sms();
  send_data("System Ready");
  send_sms();
  delay(1000);
  digitalWrite(led, LOW);
  lcd.clear();
//  EEPROM.write(1,0);
 // rupees=EEPROM.read(1);
}
void loop()
{
    serialEvent();
    rupees=EEPROM.read(1);
```

```
    units=rupees/5.0;
    lcd.setCursor(0,0);
    lcd.print("Units:");
    lcd.print(units);
    lcd.print("      ");
    lcd.setCursor(0,1);
    if(rupees<15)
    lcd.print("LOW Balance:");
    else
    lcd.print("Balance:");
    lcd.print(rupees);
    lcd.print("      ");
    read_pulse();
    check_status();
    if(temp==1)
    {
     decode_message();
     send_confirmation_sms();
    }
}
void serialEvent()
{
  while(Serial.available())
  {
```

```
    char ch=(char)Serial.read();
    str[i++]=ch;
    if(ch == '*')
    {
      temp=1;
      lcd.clear();
      lcd.print("Message Received");
      delay(500);
      break;
    }
  }
}
void init_sms()
{
   Serial.println("AT+CMGF=1");
   delay(200);
   Serial.println("AT+CMGS=\"+916385479706\"");
   delay(200);
}
void send_data(String message)
{
  Serial.println(message);
  delay(200);
}
```

```
void send_sms()
{
  Serial.write(26);
}
void read_pulse()
{
   if(!digitalRead(pulsein))
   {
     digitalWrite(led, HIGH);
     //count++;
     //units=watt_factor*count/1000;
     if(units<1){}
     else
     units--;
     rupees=units*5;
     EEPROM.write(1,rupees);
     while(!digitalRead(pulsein));
     digitalWrite(led,LOW);
    // delay(2000);
   }
}
void check_status()
{
     if(rupees>15)
```

```
{
 digitalWrite(relay, HIGH);
 flag1=0;
 flag2=0;
}
if(rupees<15 && flag1==0)
{
 lcd.setCursor(0,1);
 lcd.print("LOW Balance       ");
 init_sms();
 send_data("Energy Meter Balance Alert:");
 send_data("Low Balance\n");
 Serial.println(rupees);
 delay(200);
 send_data("Please recharge your energy meter soon.\n Thank you");
 send_sms();
 message_sent();
 flag1=1;
}
if(rupees<5 && flag2==0)
{
digitalWrite(relay, LOW);
lcd.clear();
```

```
        lcd.print("Light Cut Due to");
        lcd.setCursor(0,1);
        lcd.print("Low Balance");
        delay(2000);
        lcd.clear();
        lcd.print("Please Recharge ");
        lcd.setCursor(0,1);
        lcd.print("UR Energy Meter ");
        init_sms();
        send_data("Energy Meter Balance Alert:\nLight cut due to low
Balance\nPlease recharge your energy meter soon.\n Thank you");
        send_sms();
        message_sent();
        flag2=1;
      }
    }
    void decode_message()
    {
     x=0,k=0,temp=0;
       while(x<i)
       {
        while(str[x]=='#')
        {
          x++;
```

```
        bal="";
        while(str[x]!='*')
        {
          bal+=str[x++];
        }
       }
      x++;
    }
    bal+='\0';
}
void send_confirmation_sms()
{
    int recharge_amount=bal.toInt();
    rupees+=recharge_amount;
    EEPROM.write(1, rupees);
    lcd.clear();
    lcd.print("Energy Meter ");
    lcd.setCursor(0,1);
    lcd.print("Recharged:");
    lcd.print(recharge_amount);
    init_sms();
    send_data("Energy Meter Balance Alert:\nYour energy meter has been recharged Rs:");
    send_data(bal);
```

```
    send_data("Total Balance:");
    Serial.println(rupees);
    delay(200);
    send_data("Eelctricity Has Been Connected\nThank you");
    send_sms();
    temp=0;
    i=0;
    x=0;
    k=0;
    delay(1000);
    message_sent();
}
void message_sent()
{
  lcd.clear();
  lcd.print("Message Sent.");
  delay(1000);
}
void gsm_init()
{
  lcd.clear();
  lcd.print("Finding Module..");
  boolean at_flag=1;
  while(at_flag)
```

```
{
 Serial.println("AT");
 while(Serial.available()>0)
 {
  if(Serial.find("OK"))
  at_flag=0;
 }
 delay(1000);
}
lcd.clear();
lcd.print("Module Connected..");
delay(1000);
lcd.clear();
lcd.print("Disabling ECHO");
boolean echo_flag=1;
while(echo_flag)
{
 Serial.println("ATE0");
 while(Serial.available()>0)
 {
  if(Serial.find("OK"))
  echo_flag=0;
 }
 delay(1000);
```

```
  }
  lcd.clear();
  lcd.print("Echo OFF");
  delay(1000);
  lcd.clear();
  lcd.print("Finding Network..");
  boolean net_flag=1;
  while(net_flag)
  {
    Serial.println("AT+CPIN?");
    while(Serial.available()>0)
    {
      if(Serial.find("+CPIN: READY"))
      net_flag=0;
    }
    delay(1000);
  }
  lcd.clear();
  lcd.print("Network Found..");
  delay(1000);
  lcd.clear();
}
```

3.3. CHAPTER CONCLUSION:-

The proposed system for prepaid energy meter is an innovative solution that combines advanced hardware and software components to enable efficient and cost-effective energy management. The system incorporates the following key features:

1. Real-time monitoring of energy consumption: The prepaid energy meter is equipped with sensors that measure the amount of energy used by the consumer in real-time
2. Mobile app for prepaid balance top-up: Customers can top up their prepaid balance via a mobile app or website, eliminating the need to physically visit a payment center..
3. Remote management of prepaid accounts: The utility company can remotely manage and monitor prepaid accounts, reducing the need for manual intervention. This enables greater efficiency and cost savings forthe energy provider.
4. Advanced security measures: The prepaid energy meter is equipped with encryption and authentication protocols to ensure that all data transmission is secure.
5. Energy usage alerts and notifications: Customers can receive alerts and notifications when their prepaid balance is low or when they are consuming energy at a higher than usual rate. This enables them to manage their energy consumption more effectively and avoid unnecessary waste.

Overall, the proposed system for prepaid energy meter offers a comprehensive and efficient solution for energy management. With its advanced features and functionalities, the system has the potential to transform the way energy is consumed and managed, providing benefits for both energy providers and consumers

4. SIMULATION /HARDWARE IMPLEMENTATION

4.1. CHAPTER INTRODUCTION:-

Simulation and hardware implementation are two important aspects of any technical project. Simulation involves the use of software tools to model and test the behavior of a system or component under various conditions, while hardware implementation involves the actual construction and testing of a physical prototype.

In the context of prepaid energy meter systems, simulation can be used to test and optimize the performance of the system under various scenarios, such as different energy usage patterns, payment options, and system configurations. This can help to identify and address any potential issues before the system is deployed in the real world.

Hardware implementation, on the other hand, involves the actual construction and testing of a physical prepaid energy meter system. This can involve the selection and integration of various hardware components, such as sensors, communication modules, and payment processing systems, as well as the design and construction of the physical housing for the meter.

Both simulation and hardware implementation are critical components of any technical project, and each has its own advantages and limitations However, simulation may not always accurately reflect the behavior of a system in the real world.

Hardware implementation, on the other hand, provides a more realistic testing environment and can be used to verify the performance of a system under real-world conditions. However, hardware implementation can be more expensive and time-consuming than simulation, as it requires the construction and testing of physical prototypes.

In the following chapters, we will discuss the simulation and hardware mplementation of a prepaid energy meter system, including the selection and integration of hardware components, the design and construction of the physical meter, and the testing and optimization of the system under various conditions

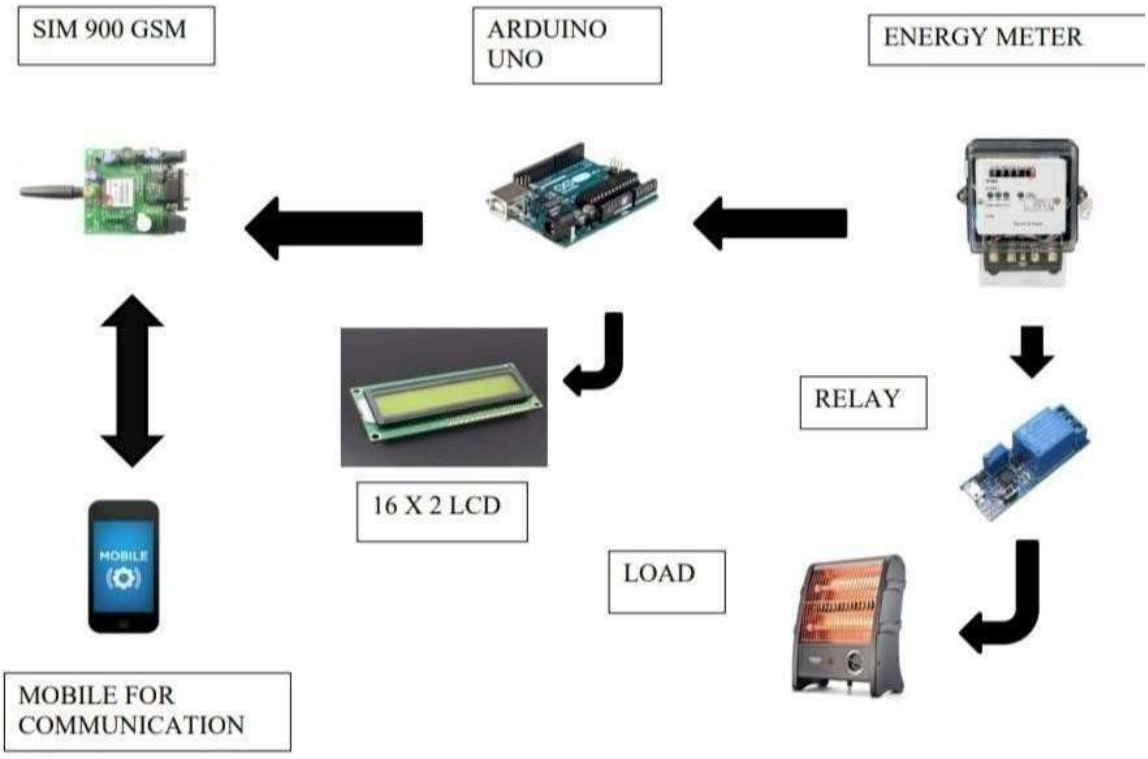
4.2. MAIN FEATURES OF THE PROTOTYPE :-

The features of the developed prototype are:

1. LCD display (showing the unit and balance)
2. Communication between user and provider
3. Prepaid recharge of energy meter
4. Intimation for low balance.
5. Power cut occur if there is insufficient balance
6. Cost effective (Rs 1110/- approx.)
7. 5 Volt operation (both control board and ON & OFF relay)

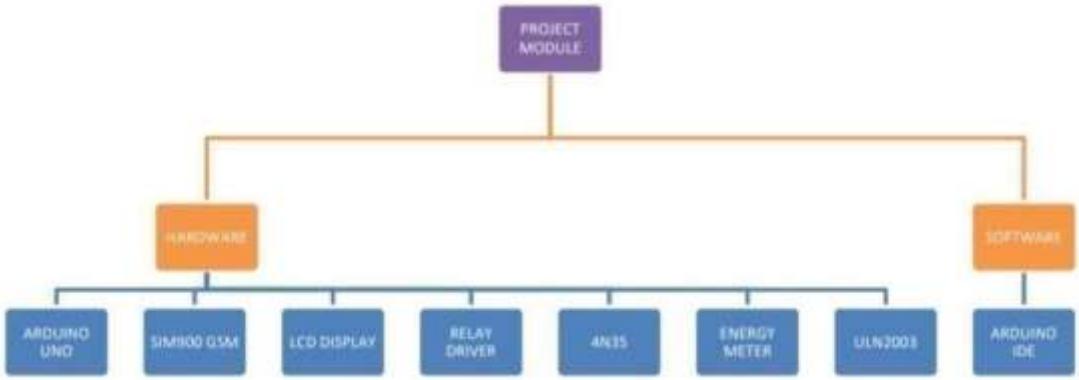
4.2.1. OVERVIEW OF THE PROJECT :-

The working of the project is described in the fig. . At first the GSM module is initialized and it establishes a network for communicating with the user. After initialization the controller checks the balance if it is above optimum balance then the load is turned on. If the balance is below a certain value then the controller will send a SMS for recharging the energy account.



4.2. OVERVIEW OF PROJECT

PROJECT LAYOUT:



4.2.1. PROJECT LAYOUT

4.2.2. WORKING PRINCIPLE:-

This model has the Arduino UNO as CPU. The entire system is interfaced with Arduino UNO. The GSM modem is serially connected with the controller which is used as communication module between User and provider. The GSM uses its own network for the transfer of data. Special coding in Arduino is used for programming AT89S51 microcontroller. The relay is used as switching device to cut off and restore power supply. The LCD is interfaced to microcontroller using parallel connection. In this project the Microcontroller based system continuously measures the readings and the current meter reading can be sent to the Electricity department on request. This system also can be used to cut off the power supply to the house in case of non-payment of electricity bills. This GSM modem with SIM card is essential for each energy meter.

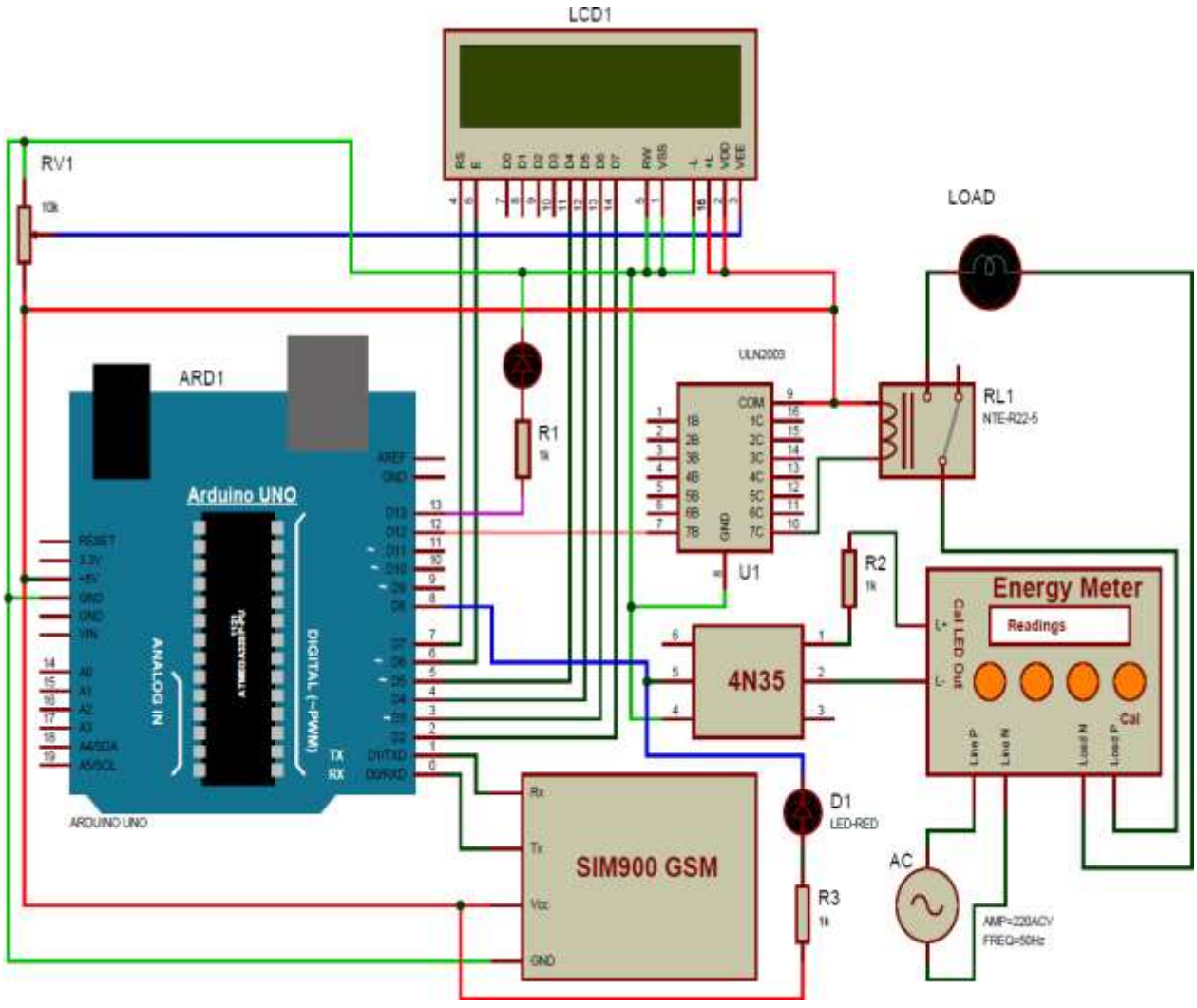
A prepaid energy meter with GSM (Global System for Mobile Communications) operates on the principle of allowing users to prepay for their electricity usage before they consume it. The meter uses a GSM module to communicate with a remote server, which manages the prepayment process and sends instructions to the meter to allow or deny access to electricity.

Here is a brief overview of the working principle of a prepaid energy meter with GSM:

The user purchases a prepaid electricity token from a vending point, which could be a physical outlet or an online portal.

The token contains a unique code that represents a specific amount of electricity units (kWh). The user enters the code into the prepaid meter's keypad to load the units onto the meter.

The prepaid meter communicates with a remote server through a GSM module that is embedded within the meter. The server validates the token code and updates the meter's internal memory with the amount of prepaid units purchased

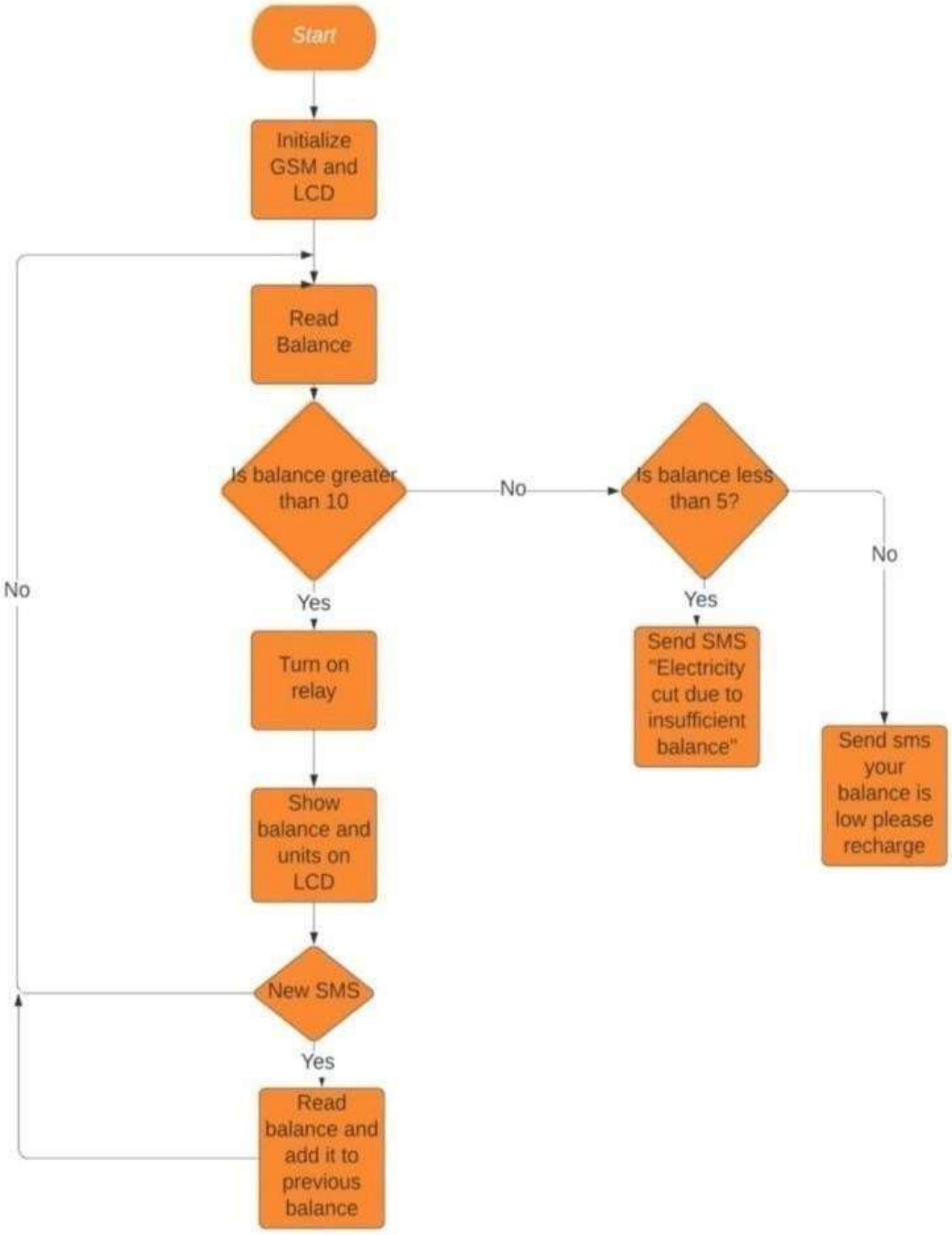


4.2.2. WORKING OPERATION

If the prepaid balance is exhausted, the meter disconnects the user's electricity supply until they recharge their prepaid balance.

Overall, a prepaid energy meter with GSM provides a convenient and cost-effective way for electricity users to manage their consumption and pay for their energy usage in advance.

4.2.3FLOW CHART:-



4.2.3. FLOW CHART

4.3. CHAPTER CONCLUSION:-

In conclusion, prepaid energy meter is a smart solution to manage energy consumption in households and industries. By implementing a prepaid system, users become more aware of their energy usage, and it can also help in reducing energy wastage.

Simulation is an essential tool in the development and testing of prepaid energy meter systems. It enables the designers to test the system in a virtual environment, thus saving time and costs. Furthermore, simulation also allows the designers to identify and fix any issues before the implementation phase.

Hardware implementation of prepaid energy meters involves the use of physical components and sensors to monitor and control energy consumption. It is a more challenging and expensive process compared to simulation, but it provides more accurate and reliable results.

In summary, a combination of simulation and hardware implementation is crucial in the development and deployment of prepaid energy meter systems. Simulation helps in testing and refining the system design, while hardware implementation ensures its reliability and effectiveness in the real world.

5. RESULT AND DISCUSSION:-

5.1. CHAPTER INTRODUCTION:-

The increasing demand for energy, coupled with the need for efficient management of resources, has led to the development of prepaid energy meter systems. These systems enable users to pay for the energy they consume in advance, thus promoting energy conservation and reducing wastage. This paper presents the results and discussion of a study on prepaid energy meter systems.

5.1.1. LCD STATEMENTS:-

STEP 1 :-

5.1.1(1).STEP.I

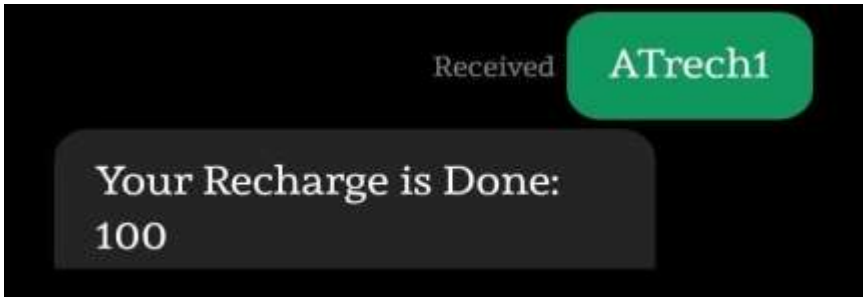
GIVE TO SUPPLY AND LCD (LIQUID CRYSTAL DISPLAY) WITH COMMENT TO DISPLAY ON LCD DISPLAY

STEP 2:-

5.1.1(2).STEP.II

SAME TIME MOBILE GET TO MESSAGE

STEP 3:-



5.1.1(3).STEP.III

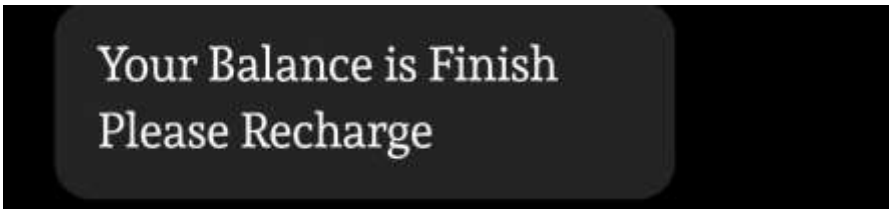
RECHARGE FOR POWER SOURCE IS RECOVERED IN (ATrech1) RECHARGE TO 10 UNIT RECEIVED

STEP 4:-

5.1.1(4).STEP.IV

60 % RECHARGE IS COMPLETED TO POWER SOURCE. GIVE TO MESSAGE IN MOBILE PHONE SO PLEASE RECHARGE

STEP 5:-



5.1.1(5).STEP.V

LOW POWER WILL BE RECOVERED MESSAGE TO MOBILE . IN RECHARGE CONTINUES POWER SOURCE

5.1.2. RECHARGE MEASURED FOR LCD DISPLAY :-

5.1.1(6)MEASURE BALANCE

CALCULATION TABLE :-

Recharge	Price	Unit	Pulse
ATrech1	100	10	1000
ATrech2	200	20	2000
ATrech3	300	30	3000

5.1.2. Calculation table

5.2. STATEMENT:-

5.2.1 RESULTS:-

The results of the study show that prepaid energy meter systems are effective in reducing energy wastage and promoting energy conservation. The implementation of the system led to a significant reduction in energy consumption in households and industries. The system also enabled users to monitor their energy usage, thus making them more aware of their consumption patterns.

A prepaid energy meter with GSM technology allows users to pay for their energy usage in advance and monitor their consumption in real-time using their mobile phones. The GSM technology enables the meter to

communicate with the user's mobile phone network, allowing them to receive updates on their energy usage and balance.

With this type of meter, users can purchase credits for their energy usage, and the meter deducts the credit as energy is consumed. When the credit balance becomes low, the user receives an alert on their mobile phone, prompting them to top up their account.

The advantages of a prepaid energy meter with GSM technology include proved energy efficiency, reduced energy wastage, and increased control over energy costs. It also enables electricity providers to accurately track energy usage and billing, which can help to reduce the number of disputes over billing and payments.

Overall, prepaid energy meters with GSM technology offer a convenient, secure, and efficient way for users to manage their energy consumption and cost.

The study also revealed that simulation is an essential tool in the development and testing of prepaid energy meter systems. The use of simulation software enabled the designers to test the system in a virtual environment, thus saving time and costs. Furthermore, simulation also allowed the designers to identify and fix any issues before the implementation phase.
It providers to accurately track energy usage and billing, which can help to reduce the number of disputes over billing and payments

DIAGRAM FOR OPERATION VIEW:-

With this type of meter, users can purchase credits for their energy usage, and the meter deducts the credit as energy is consumed.

5.2. OPERATION VIEW

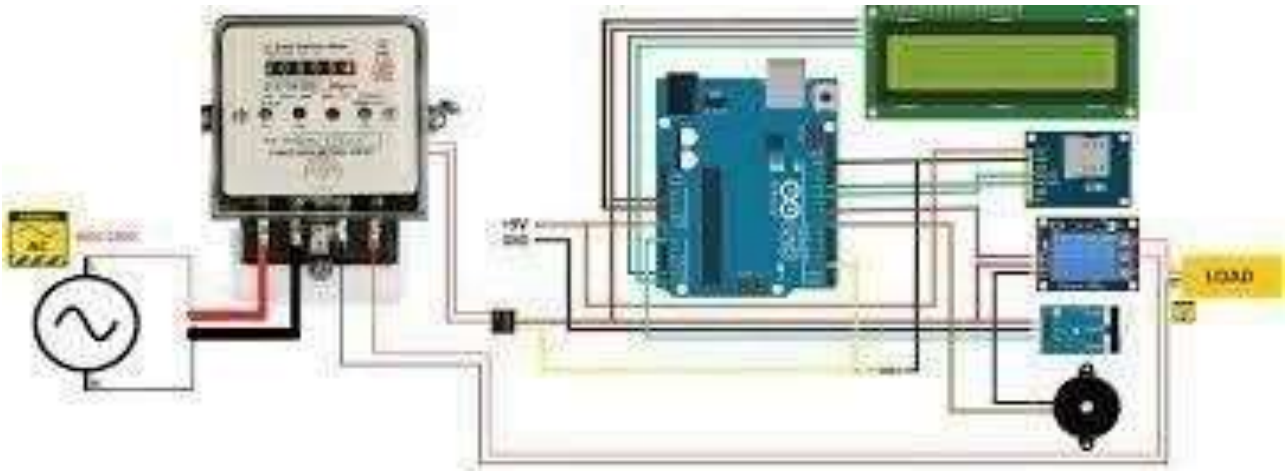
The hardware implementation of prepaid energy meters was found to be a more challenging and expensive process comparedto simulation. However, it provided more accurate and reliable results. The use of physical components and sensors enabled the system to monitor and control energy consumption effectively.

Overall, prepaid energy meters with GSM technology offer a convenient, secure, and efficient way for users to manage their energy consumption and cost.

5.2.2. DISCUSSION:-

The study demonstrates the effectiveness of prepaid energy meter systems in promoting energy conservation and reducing wastage. The implementation of the system led to a significant reduction in energy consumption, which is essential for sustainable development. The system also enabled users to monitor their energy usage, which can lead to behavioral changes that promote energy conservation.

The use of simulation software is an essential tool in the development and testing of prepaid energy meter systems. Simulation allows the designers to test and refine the system design, identify and fix any issues, and save time and costs. Simulation is particularly useful in the early stages of the system development process.



5.2.1.DISCUSSION VIEW

Hardware implementation of prepaid energy meters is a more challenging and expensive process, Hardware implementation is particularly useful in the later stages of the system development process when the system design has been finalized.

5.3. CHAPTER CONCLUSION:-

In conclusion, prepaid energy meter systems are effective in promoting energy conservation and reducing wastage. The implementation of the system led to a significant reduction in energy consumption in households and industries. The system also enabled users to monitor their energy usage, thus making them more aware of their consumption patterns.

Simulation is an essential tool in the development and testing of prepaid energy meter systems. Simulation enables the designers to test and refine the system design, identify and fix any issues, and save time and costs.

Hardware implementation of prepaid energy meters is a more challenging and expensive process, but it provides more accurate and reliable results. The use of physical components and sensors enables the system to monitor and control energy consumption effectively.

Overall, a combination of simulation and hardware implementation is crucial in the development and deployment of prepaid energy meter systems. Simulation helps in testing and refining the system design, while hardware implementation ensures its reliability and effectiveness in the real world.

CONCLUSION:-

To summarize the key points, the implementation of a prepaid energy meter system with GSM technology:

i. Offers real-time communication and remote monitoring of energy consumption, leading to improved energy efficiency and cost savings.

ii. Enables users to receive real-time updates on their energy usage and balance, promoting energy conservation and reducing wastage.

iii. Provides alerts to users when their balance is low, ensuring they always have access to energy.

iv. Offers utilities a cost-effective and efficient way to manage their operations, including monitoring energy consumption and implementing measures to reduce wastage.

v. Contributes to global efforts to reduce greenhouse gas emissions and achieve sustainable energy management.

Overall, the prepaid energy meter system with GSM technology is an effective solution for managing energy consumption, promoting energy conservation, and reducing wastage. Its benefits extend to users, utilities, and other stakeholders, making it a valuable tool for achieving sustainable energy management and contributing to a greener future.

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These references provide insights into the design, development, and implementation of prepaid energy meter systems with GSM technology. They also discuss the benefits and challenges of such systems and offer recommendations for future research in this area.