Table of Contents

LIST OF FIGURES

ABBREVIATIONS

DSL	Digital Service Line
DSM	Demand Side Management
GSM	Global System for Mobile communications
Hz	Hertz
LCD	Liquid Crystal Display
PCB	Printed Circuit Board
UFLS	Underfrequency Load Shedding
UVLS	Undervoltage Load Shedding

ABSTRACT

With the increased consumption of electrical energy in our country, there is a need to develop a system that will help in load shedding during peak hours to avoid losing the entire power system. Load shedding is the process through which Power transmission and distribution companies reduce electrical energy consumption by customers due to power shortage or overloading of the transmission and distribution lines, causing the entire system to be at risk. The peak hours of electricity consumption may vary for different places such as manufacturing industries, households and learning institutions. The current system available is the Power System Load shedding system at the National Control Centre managed by the Kenya Power & Lighting Company. Therefore, there is a need to design a load shedding system customised for a given place. In this project, a load shedding system will be designed for Kenyatta University that will help in monitoring the electrical load at different times of the day. In a scenario where the demand is greater than the supply, there would be a need to shed off some of the load not to lose the entire power supply system. This process ensures that the heavy loads are shed off during peak hours, and the necessary loads are retained. The project simulation will be done using proteus software using the current sensors and a microcontroller. This project will help in reducing power outages by proper regulation of the load and ensure proper utilisation of electrical energy.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Electricity is an essential commodity in our day to day lives. We use it for different purposes such as pumping water using motors, lighting our homes, charging our electronic appliances and many other uses. With the increased demand for electricity, there is a need for proper management of the loads. Load shedding is necessary to ensure the smooth operation of the power system. Load shedding can be defined as the quantity of load that must almost immediately be removed from a power system to keep the remaining section of the system operational. The process of load removal is a result of the interruption that may occur to a power system as a result of a deficiency condition which, if not properly managed, can cause a total power system failure. Some of the disturbances that may lead to load shedding include major generation outages, power transmission line outages, switching errors, lighting strikes and faults. Load shedding occurs when the power being supplied cannot meet the load demand. The imbalance caused by the increased demand may lead to the power system's failure, which will negatively affect the nation's economy. Most of the manufacturing industries depend on power for running their processes. Therefore, it is necessary to have proper load management systems, which will help to ensure there is an uninterruptible power supply in our country during both off-peak and peak hours. Since building new power generation plants is very expensive, designing load shedding systems is adopted as the alternative way of managing the increased demand for power during peak hours.

1.2 Problem statement

This project aims to design a load shedding system that will monitor the loads at any given time to ensure a healthy operation of the power system at Kenyatta University. It will ensure that heavy loads are shed off during peak hours and that only critical loads are being supplied with power to avoid loss of the whole power system. The load shedding system will be designed at the generator points.

1.3 Main objective

- To design a load shedding system for Kenyatta University

1.4 Specific objectives

- To design a circuit for the load shedding systems that will prioritize necessary loads during peak hours.
- To design a prototype for the load shedding system.
- To ensure efficient load management of electrical energy at Kenyatta University.

1.5 Scope and Limitation of the study

This project mainly aims to design a circuit and prototype of the load shedding system that will be used to remove heavy loads during peak hours. It will entail current sensors that will be connected to the loads and the microcontroller. Three loads will be used: a servo-motor, a light bulb, and an inductive load (electric coil). It will also have an LCD module, SIM800L and Real-Time Clock D51307.

1.6 Justification of the project

This project will help in implementing a load shedding system that monitors the loads at any given time. It will help to ensure efficient utilisation of electrical energy & proper operation of the power system. The system will be cost-effective. The system will be simple to implement due to its automation.

CHAPTER TWO

2.0 LITERATURE REVIEW

Load shedding is the intentional shutdown of certain loads in a power system to prevent the total failure of the system due to the demand exceeding the capacity of the system. Load shedding is mainly done during peak hours to ensure a proper balance between the supply and demand of power in a given region. It encourages firms and other electricity users to manage their loads properly to ensure that they use power in peak and off-peak hours. Most areas have adopted load shedding since it helps to ensure there is proper energy management. The cost of building new generating power stations is high; hence there is a need to utilize efficiently the available electrical energy. In other times load shedding is adopted by power companies when there is scheduled maintenance of major power stations or sub-stations, while in other cases, it could be due to a fault affecting one of the major transmission lines. In these cases, the load shedding mechanism is adopted to ensure that the whole power system is not lost, but the available power can be used to supply the major and critical loads (Faranda & Tironi, 2007). During maintenance in a major substation the customers with major and critical loads will be supplied through the spare bus bar to ensure safety of the personnel working and continuity of supply to the customers.

Load management may also be adopted in an event where a generator is being used to supply power to a given institution such as a school or a hospital. The generator has a load shedding module that can be used to shut down certain loads that might not be needed in a given time. There are different types of load shedding systems for example;

1) Undervoltage Load Shedding (UVLS)
2) Underfrequency Load Shedding (UFLS)

2.1 Undervoltage Load shedding

Undervoltage load shedding occurs when the voltage at particular locations in the power system network is lower than the predetermined value for the proper functioning of power flow and load requirements. When the voltage drops below the predetermined value, the load shedding system is activated to stabilise the voltage. The allowed voltage range of operation in Kenya is 240+/-6%. This ranges ensures that the voltage reaching consumers is constant and ensures proper operation of the equipment and minimizes damages. When there is undervoltage some equipment such as motors may shut down and in other cases the windings may be damaged leading to economical loss to the consumers. Due to this it is necessary to have an Undervoltage load shedding scheme which enables proper operation of the consumers' equipment. In other cases, undervoltage may occur due to symmetrical and asymmetrical power system faults. The Power companies try their best to ensure that these faults rarely occur. In the event they do occur it's important to eliminate the faulty part of the power system. This operation is majorly carried out by the protection system which entails of the protective relays and the circuit breakers.

2.2 Underfrequency Load Shedding (UFLS)

Underfrequency load shedding occurs when the available generators cannot supply adequate power to meet the load's demand. It is characterised by a drop in the average system frequency. It is caused by a shortage in the active power being supplied. Whenever the frequency drops below the predetermined value, the load shedding system is activated. Electrical energy is supposed to be supplied at a constant frequency of 50Hz to ensure the proper functioning of the equipment. Any alteration in the frequency may lead to the destruction of electrical equipment or poor performance of equipment such as motors. The frequency of the power being transmitted needs to maintained at a given value (which is 50 Hz in the case of Kenya) to ensure synchronization of the National grid. This allows to ensure that there is a proper flow of power in the grid and standardization of the equipment utilized in a country. The Underfrequency load shedding scheme ensures the stability of the power system by isolating the overloaded part of the power system (Mozina, 2007). This helps to restore the frequency back to the desirable value to avoid complete blackout.

Both the Undervoltage and Underfrequency load shedding criteria are applied to minimise the impact of disturbances and prevent blackouts in power systems.

2.3 The working of the load Shedding System

The load management system can be installed on the consumer's side. It will have current sensors for sensing the current being drawn by the loads continuously. Our system will be observed during both peak and off-peak hours. During peak hours, the load current may surpass the Set value from the threshold, making it necessary to remove some of the heavy loads. As a result, the microcontroller will send a trip signal to the attached relay to disconnect some of the heavy loads. This action will help to ensure that only the necessary loads are connected during peak hours. During the off-peak hours, the system will give an alarm to alert the consumer to use any heavy loads during this time. The load shedding system helps balance demand and supply to avoid load shedding during off-peak hours. This project mainly aims to ensure the Kenyatta University load is adequately managed by ensuring automatic control during off-peak and peak hours. The system will rely heavily on the load forecasting data that will state the trend of how power is utilized in Kenyatta University in the lecture halls, administrational offices and students' hostels. The system will also have and RTC sensor to monitor the real time of the day.

2.4 Benefits of load shedding to the consumer

- The consumer may enjoy the low-cost tariffs since they are encouraged to use heavy loads during off-peak hours. This makes it cost-effective and economical for the consumer.
- It helps to solve the problem of demand and supply by ensuring proper load management.

2.5 Benefits to the Power Distribution Company

- It decreases the load consumed from costly power plants such as Thermal Power plants and helps lower electricity prices due to low costs of generation. During peak hours the demand is above the set limit and as a result there is need for more power. Thermal plants play a vital to generate power during peak hours since they can easily be switched on and takeover the extra load in the system. The disadvantage in the operation of thermal plants is that they operate on diesel fuel which is very expensive. This leads to higher prices to the consumers to cater for this cost.
- The company can maintain a specific load on a feeder. This ensures the feeder is not overloaded and can function properly with minimal faults
- It ensures a reliable power supply by eliminating blackouts that may occur due to the overloading of the system.
- It also ensures that each unit of electricity is used more efficiently, and hence lowering the demand throughout the day.

2.6 Methods of electrical load management

Electrical load management is active control of electrical consumption by users with an aim of ensuring proper utilization of electricity. It is majorly referred to as the Demand Side Management commonly known as DSM. It is majorly based on financial trends from the electricity market.

Smart grids have adopted the techniques of load management by equipping the existing power system infrastructure with necessary monitoring and control technologies. These systems are equipped with current sensors, protective relays and circuit breakers that monitor the electrical load flowing in the power system.

Some of the methods of electrical load management are as follows:

2.6.1 Load Shifting

Load shifting is a flexible control method that is mostly found in industrial processes. It refers to either scaling load down or up based on the external electricity pricing tariffs. Power utility companies tend to charge high prices for electricity during peak hours and low prices during off peak hours with an aim of encouraging industries to utilize power during off peak hours. As a result, most companies prefer to operating during off peak hours hence shifting their loads to off peak times (periods when the price of electricity is low). One of the differences of load shifting as compared to load shedding is that in load shifting there is no less electricity consumption as earlier planned. During off peak hours the national grid is mainly supplied by renewable sources of energy such wind, hydroelectric and solar systems. Load shifting enables to save on the cost incurred in the electricity bill.

2.6.2 Load shedding

This entails on of targeted reduction of the total power consumed by an industry. It can also sometimes be referred to as scheduled load shedding method. Internal load shedding refers to the control measures involving technical faults or malfunctions and is done to protect a load consuming process against excessive overheating and wear of the machinery. One of the negative implications of load shedding is that a company might have to cut down on its electricity consumption and as a result reduce on their production. Due to this some companies prefer to have their back up systems such as generators to ensure continuous operation of their systems. They may also have better cooling systems and scheduled maintenance for their machinery.

Other methods that maybe used include peak clipping, flexible load shape, valley filling and electrification. Electrification involves load building hours by increasing the number of power generating stations and connection more people to the national grid. This will help in balancing the demand and supply of power. Flexible load shape method involves making the load responsive to reliability conditions of power supply. Peak clipping is a method used to reduce the peak load by directing the consumers to shut down some loads to lower the power demand (Moors and Van Cutsem, 2000). It is known to significantly improve the load factor of a power system. It is highly effective and easy to implement. Valley filling refers to the increase in the demand of power during the off-peak hours to ensure uniform distribution of the load.

CHAPTER THREE

3.0 METHODOLOGY AND SYSTEM DESIGN

This project will have a circuit design that will be used for its implementation. The circuit components will include ACS712 current sensors, Relay Module, AtMega328P, 12V Transformer (power supply), Arduino Uno, LCD module, SIM800L GPRS GSM Transmission module, RTC D51307, and a Printed Circuit Board.

The circuit will be designed in proteus and simulated to ensure it works. Afterwards, a PCB circuit will also be designed for the prototype of the project.

The components will be briefly discussed here:

3.1 ACS712 Current Sensor

The ACS712 is a current sensor that utilizes its conductor to measure and calculates the amount of current drawn by a load. It has a low-resistance current conductor and hall effect-current based current sensor with 2.1kVRMS voltage isolation. Its working principle is that current flows through the integrated hall sensor circuit, which detects the incoming current through its magnetic field generation. Once the current has been detected, the hall effect sensor generates a voltage proportional to its magnetic field used to measure the current flowing. The ACS712 has a wide range of applications for example;

- In motor control circuits to control motor speed
- Protection for overcurrent
- Detection and management of electrical loads.

Figure 1: ACS712 Current sensor

3.2 Relay Module

The relay module works as a switch that makes or breaks a contact in a circuit.

In this project, the ACS712 Current sensor detects and measures the amount of current being drawn by a given load; in case the current is beyond the set threshold, a trip signal is sent to the relay module, which will break the circuit and shed off the specified load during peak hours.

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Figure 2: Relay module

3.3 ATMEGA328P MICROCONTROLLER

The ATMEGA328P microcontroller is the brain of the project. It is a high performance and yet low power consumption 8-bit AVR microcontroller that can carry out several powerful instructions. In addition to its low power consumption, it saves cost and makes the circuit look compact.

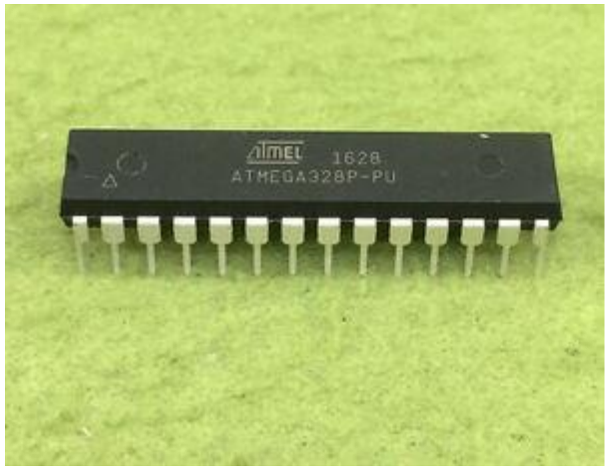


Figure 3: Atmega328p Chip

3.4 Liquid Crystal Display (LCD)

The LCD can be connected to microcontroller in two modes: 8-bit mode and 4-bit mode. 8-bit mode is much easier to program however, to save the number of microcontroller pins 4-bit mode is used in this proposal. In 4-bit mode only the higher nibble of the data pins (DB4-DB7) is used. The following figure gives a full schematic of how it is connected to the microcontroller.

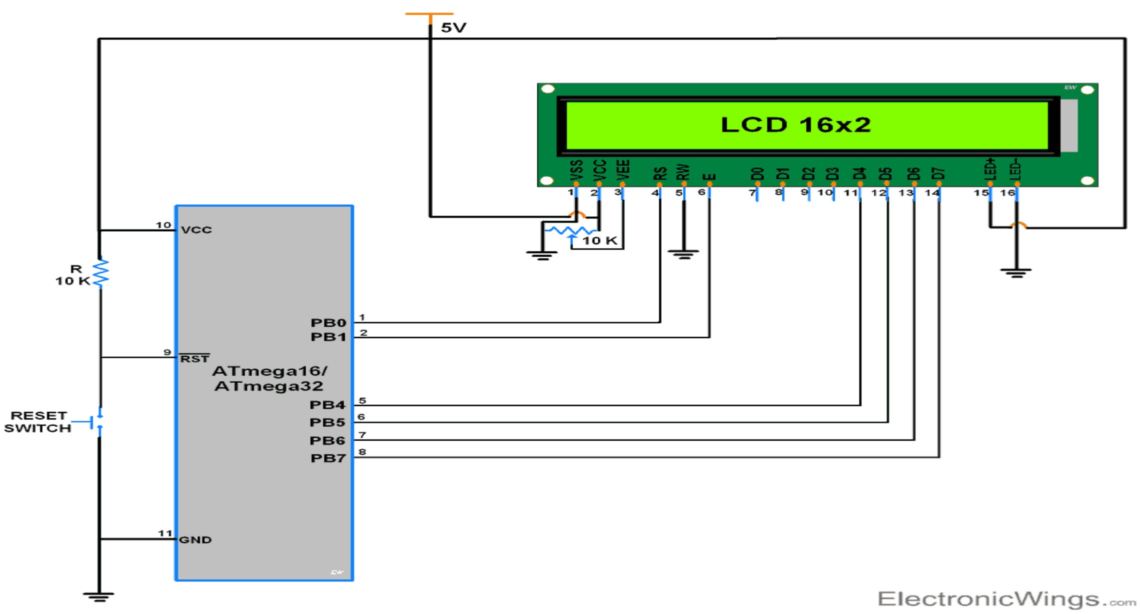


Figure 4: LCD connection to Atmega328P

3.5 SIM800L GPRS GSM Transmission Module

SIM800 is a complete quad-band for GSM and GPRS transmission solutions. Its bandwidth range is between 850MHz to 1900MHz. It can transmit voice, SMS and data information with low power consumption. It can operate with a voltage of about 4.3V to 5V.

Figure 5: SIM800L GSM Module

3.6 RTC D51307

The RTC D51307 serial real-time clock commonly referred to as RTC is a low power, full binary-coded decimal (BCD) clock/calendar plus 56 bytes NV SRAM. Address and data are transferred serially through an I2C, bidirectional bus. The clock/calendar provides year, month, date, day, hours, minutes and seconds information.

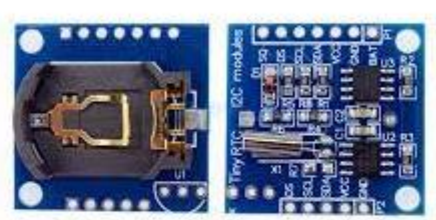
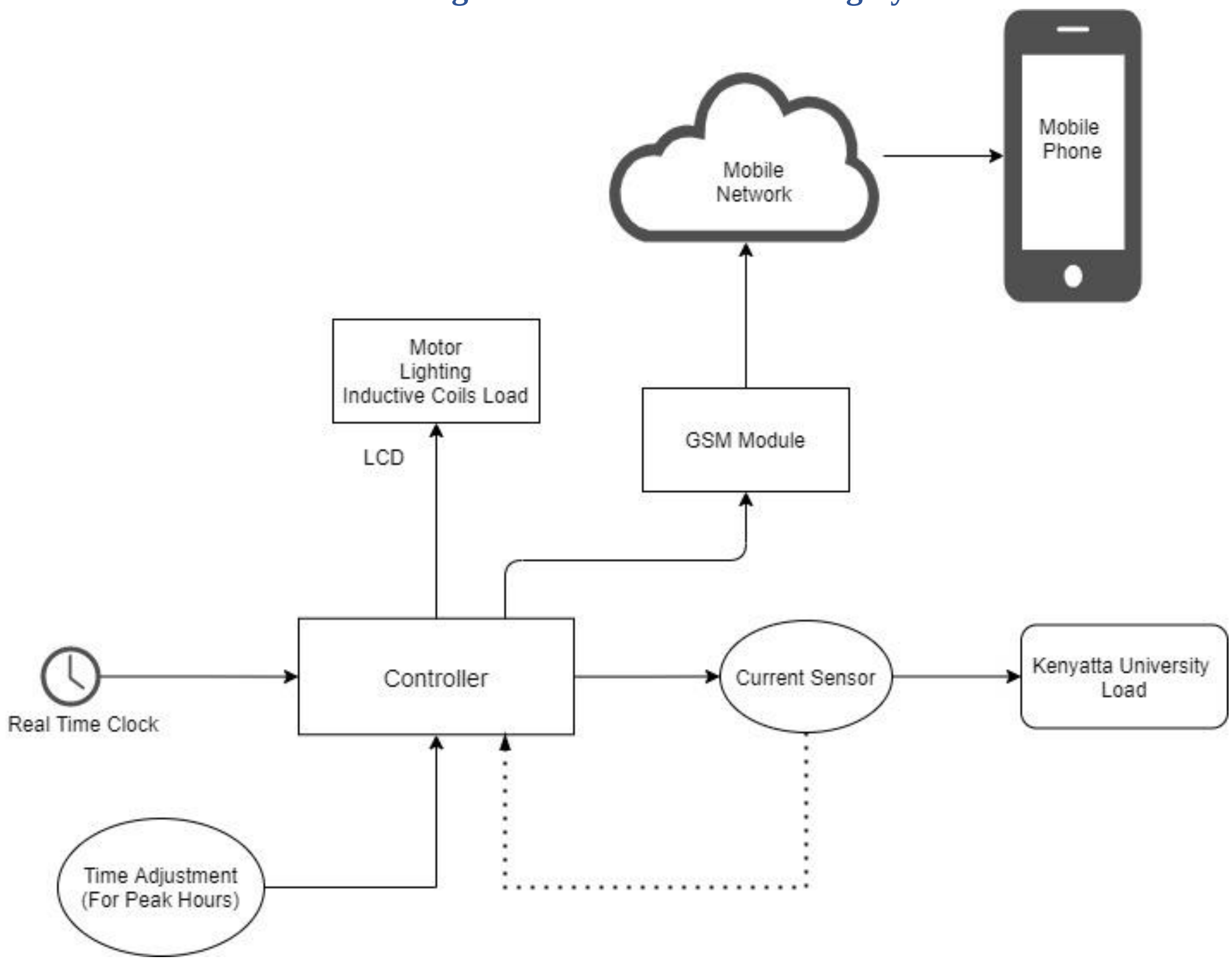


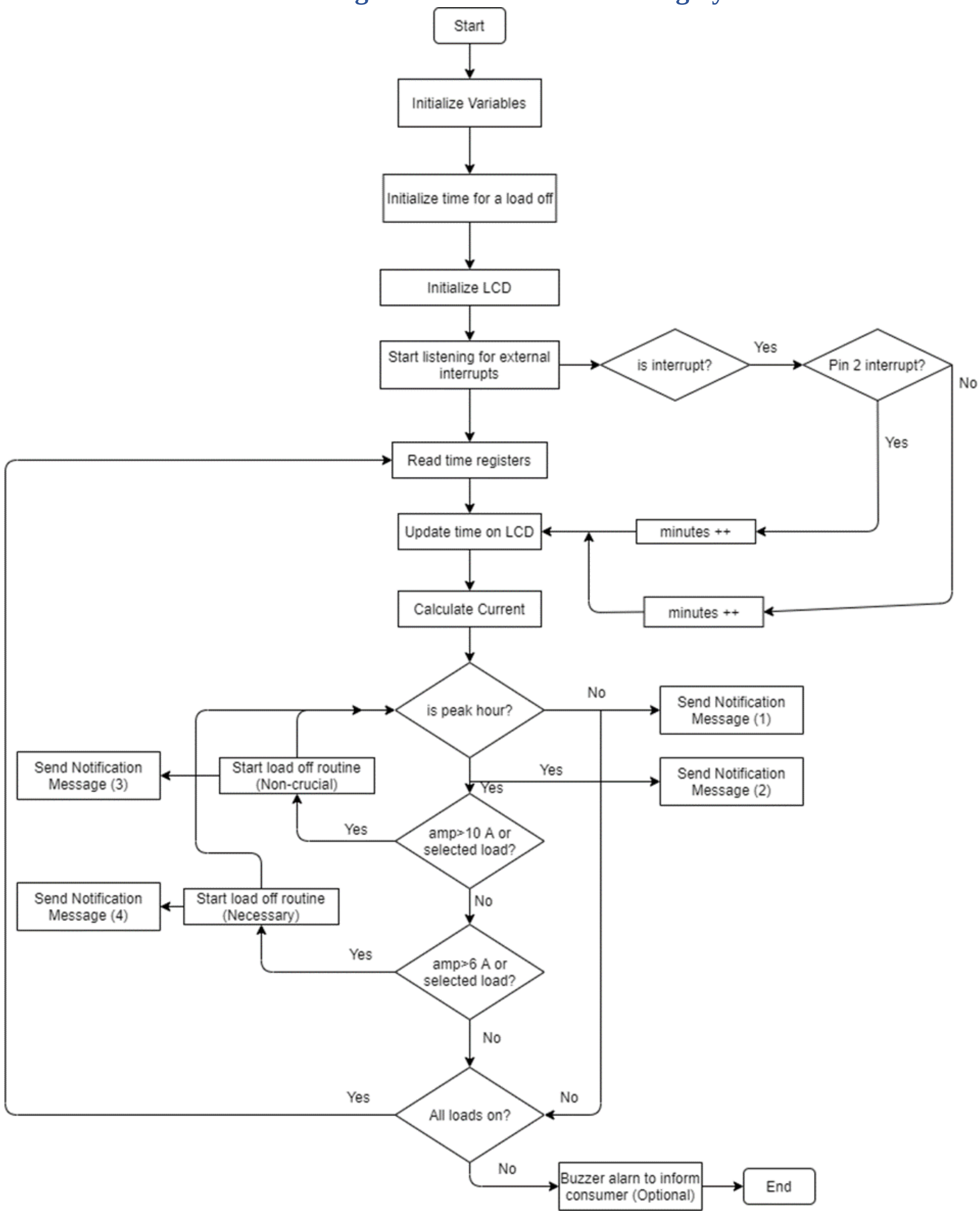
Figure 6: RTC D51307

3.7 Block Diagram for the Load Shedding System



The GSM module, current sensors, Real-Time Clock (RTC) and loads are all connected to the ATmega 328P microcontroller. The microcontroller is programmed in such a way to ensure that some of the loads are shed during the peak season, and all the loads will be connected during the off-peak hours. The GSM sends messages to the consumer to let them know when the peak season is approaching and that some loads are about to be disconnected.

3.8 Flow Diagram for the Load Shedding System



3.9 PROTEUS CIRCUIT FOR THE LOAD SHEDDING SYSTEM

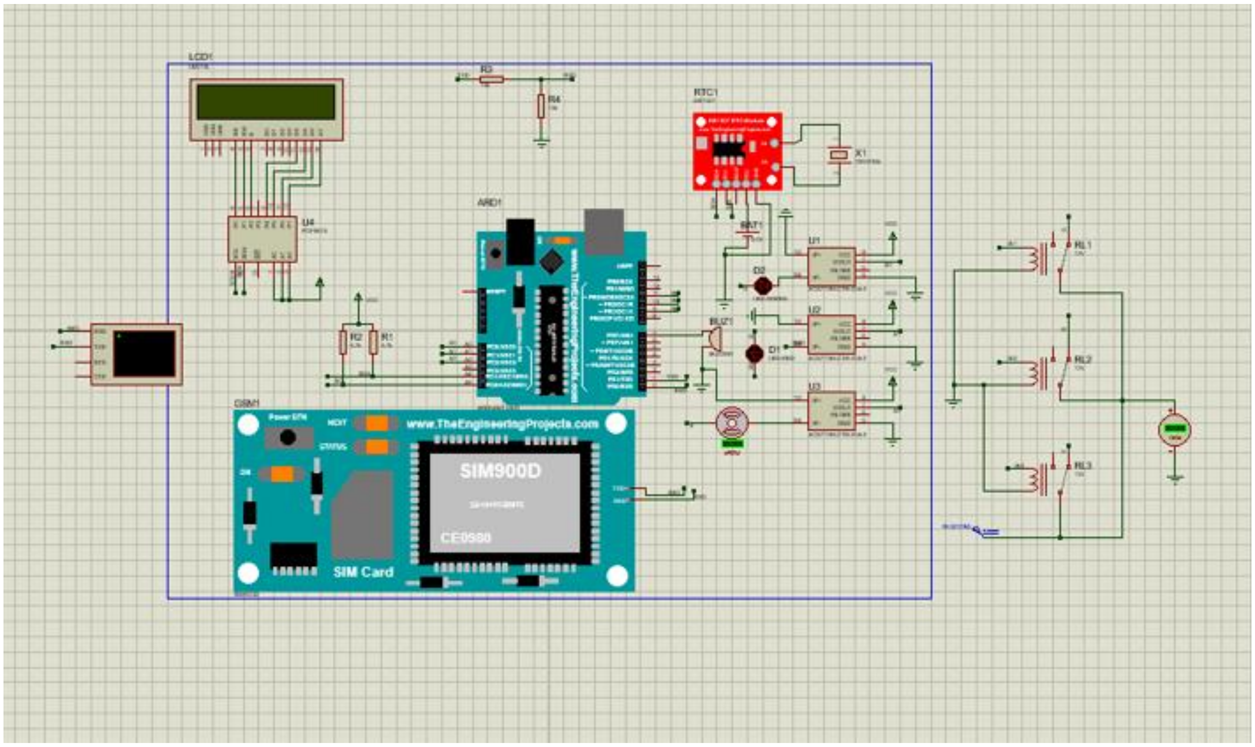


Figure 7: proteus circuit for the load shedding system

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

The proteus circuit was simulated in the proteus circuit and the following results were obtained.

Figure 8: Simulation of the prototype

During off peak hours the three loads are operating since the demand is assumed to be lower than the supply hence the power system is not overwhelmed. It is able to sustain the load. The simulation time for off-peak hours is 3 minutes and the peak hours will be 2 minutes. For Kenyatta University, the students' hostels will be in off-peak hours during class time which can be during the day from 8am to 5pm. During this time the University lecture halls and administration offices will be in peak hours. In the evenings from around 6pm to midnight the students' hostels will be at peak hours since students will be using power for lighting, charging their electronic gadgets and inductive coils to cook. However, from 6pm to 6am the University lecture halls and administration offices will be in off-peak hours. The RTC DS1307 Clock functioned properly by displaying the real time for the simulation as shown in above diagram.

In simulation three loads are used the Red LED represents the necessary load, the Green LED represents the Lighting load and the Fan represents the luxury load. The Fan will be disconnected during peak hours to avoid disconnection of the whole system. The luxury load in an actual case could be an air conditioning system.

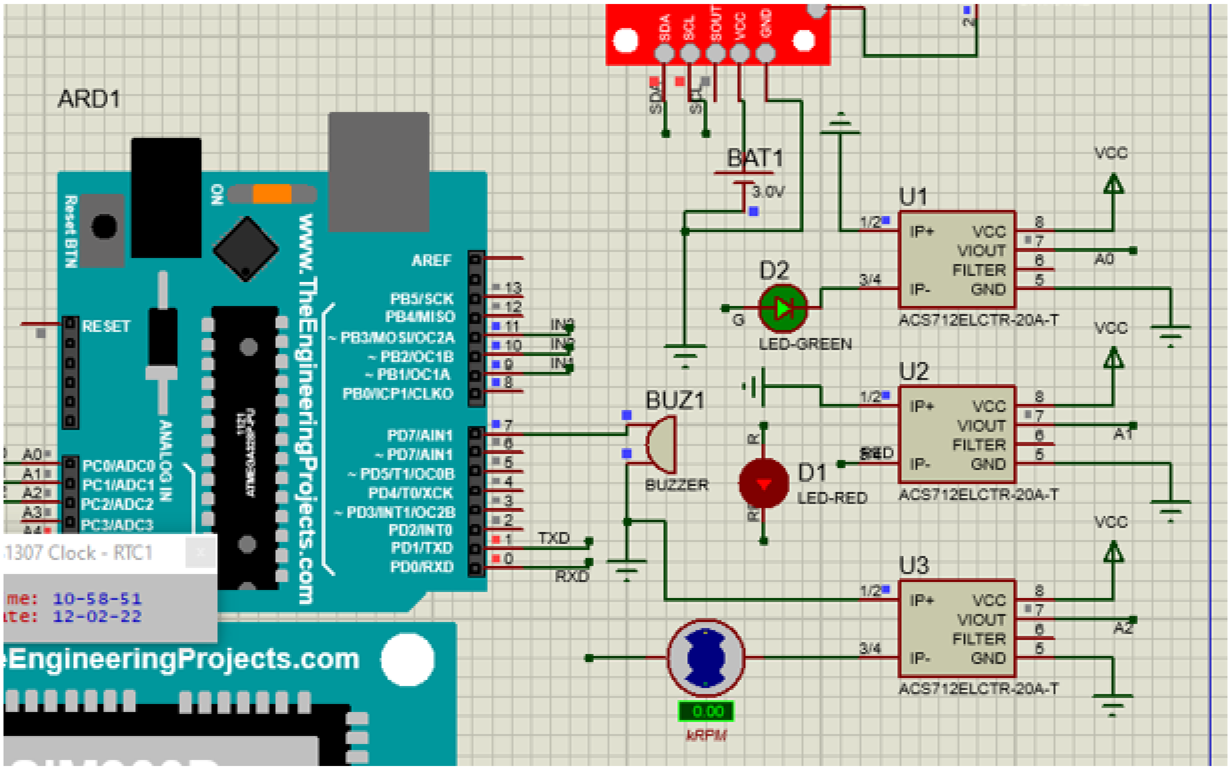


Figure 9: Simulation when luxury load is off

In case all the loads remain connected during peak hours and total current exceeds the set limit, the three relays will be opened and the three loads will be disconnected. This condition represents a total blackout since the load was not shed to prevent this condition.

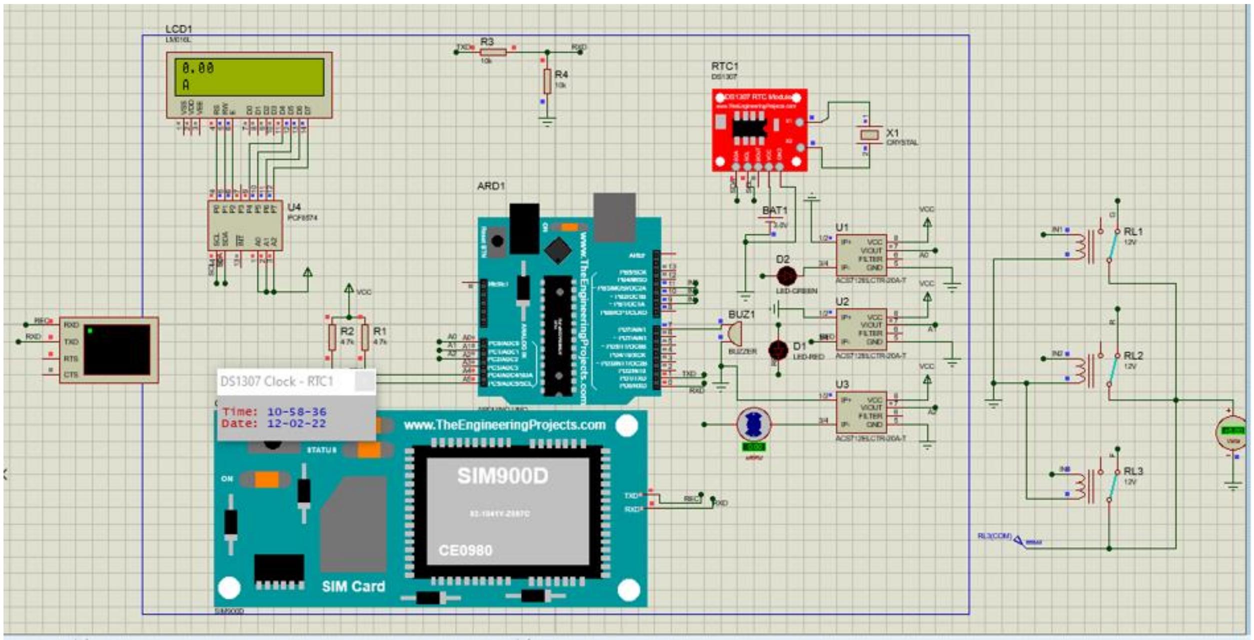
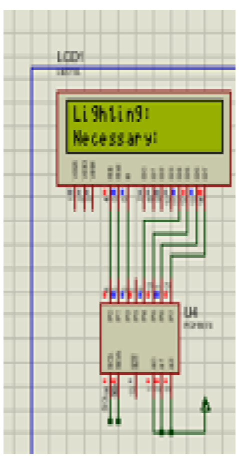
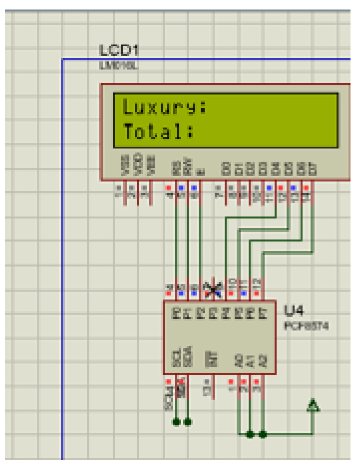


Figure 10: Simulation when all loads are disconnected

When all loads are disconnected the current measured by the current sensors will be zero as displayed by the LCD. It shows that the loads are off. The LCD worked properly since it displayed the welcoming message, the “necessary”, “lighting” and “luxury” loads, and finally the total current measured.





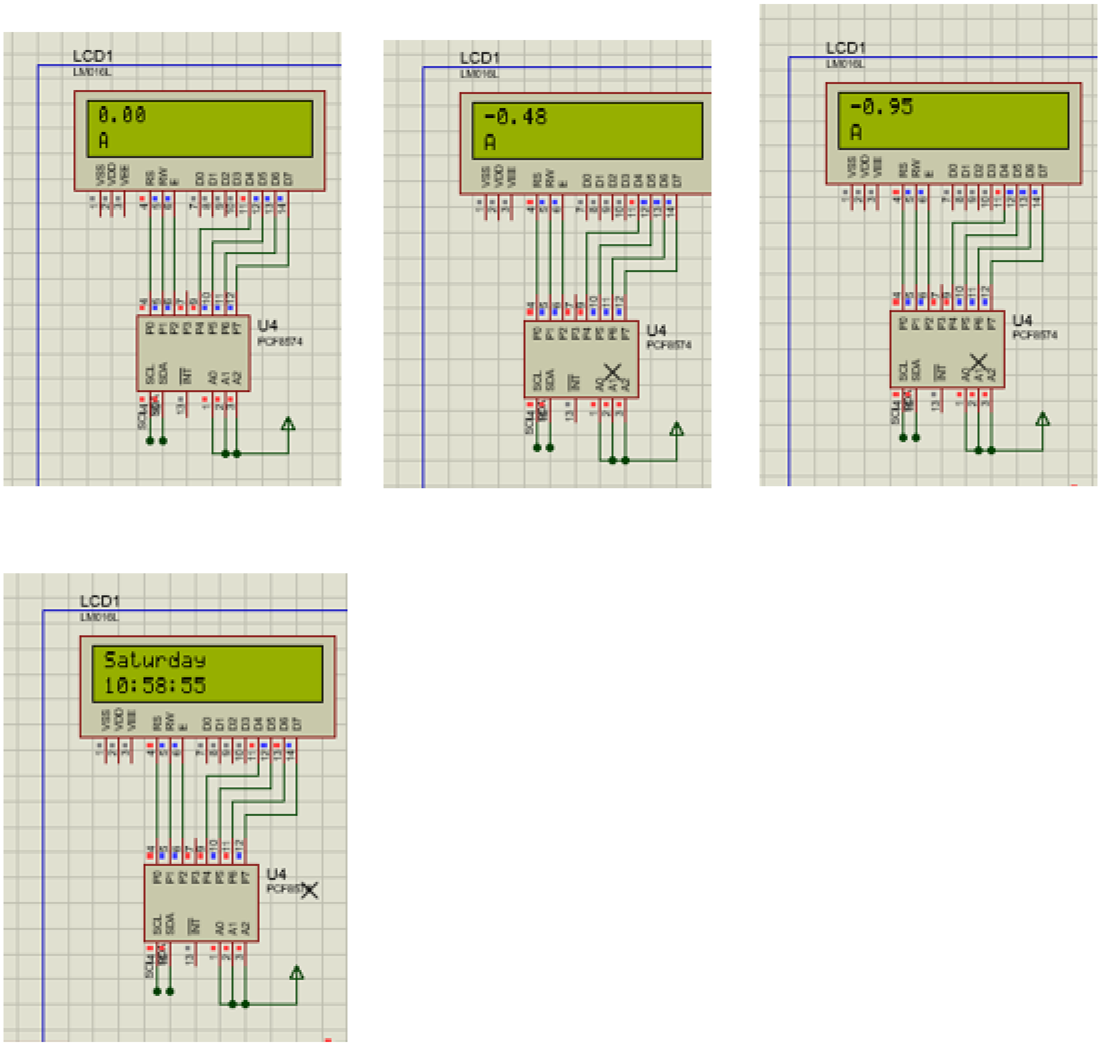


Figure 11: Simulation of the LCD module

4.1 THE PCB CIRCUIT

The following is the PCB circuit developed on Eagles Cad. It was sent to Gearbox company for printing for the Prototype of the project.

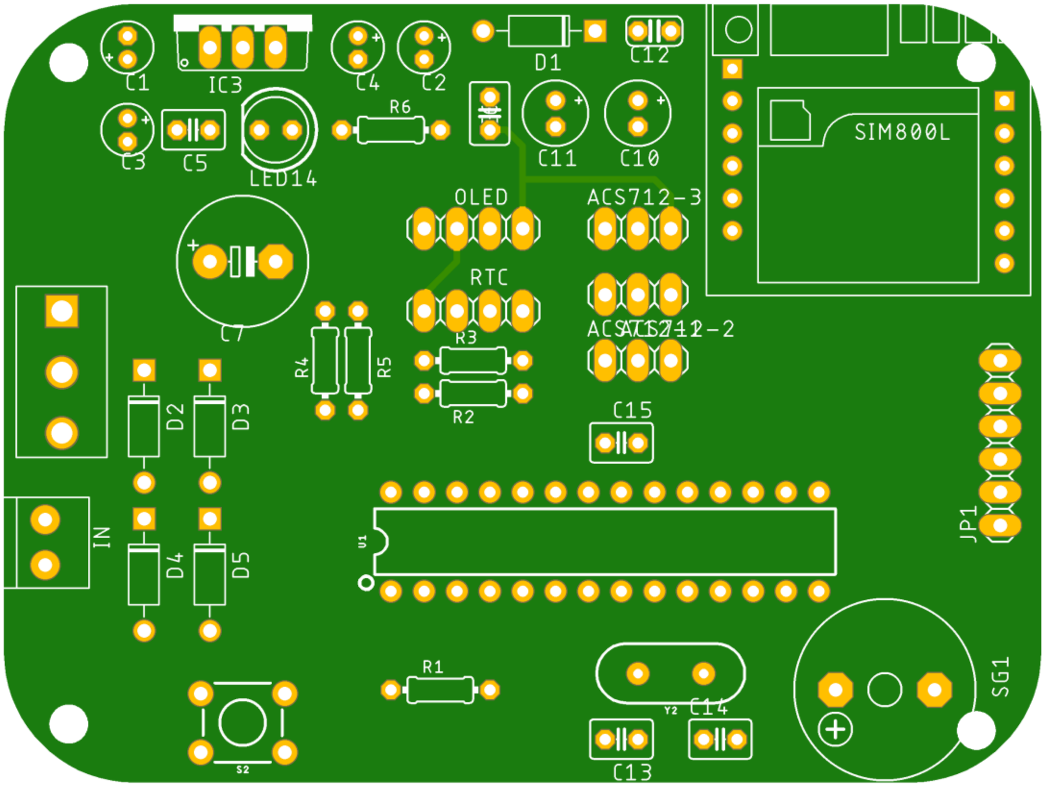


Figure 12: Front view of the PCB circuit

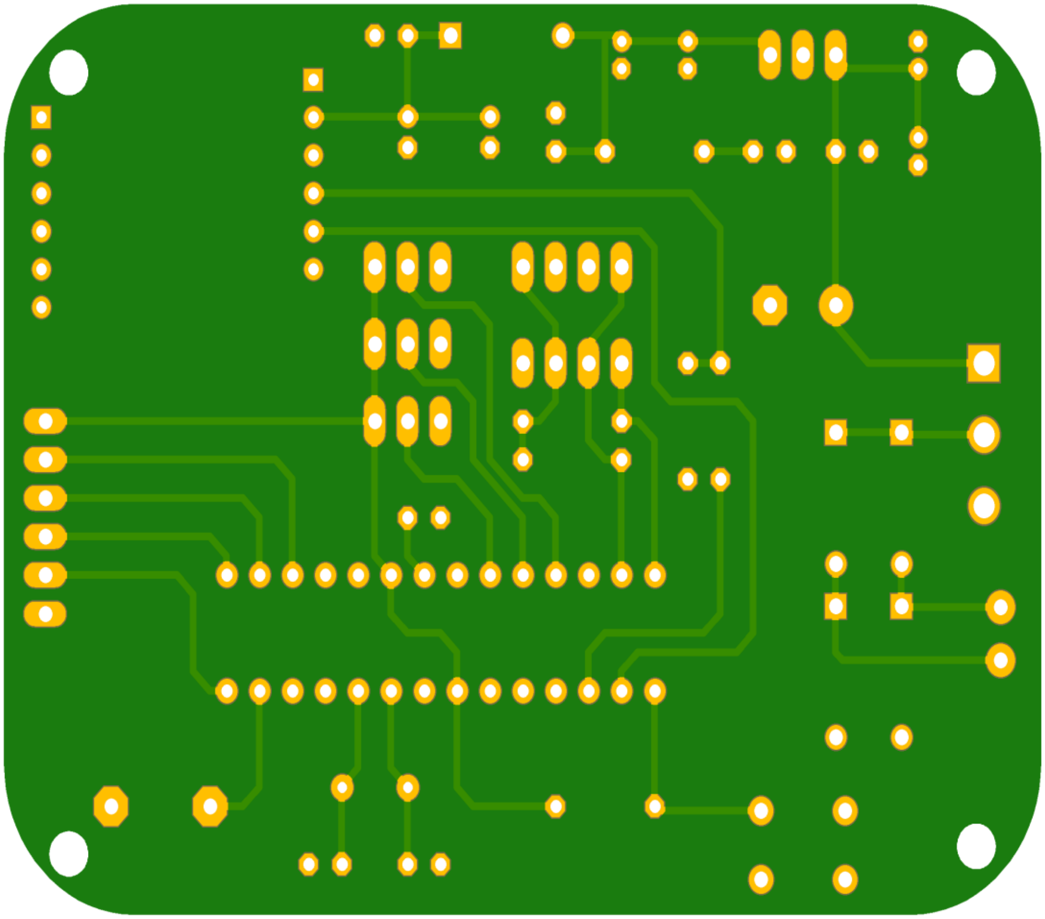


Figure 13: Back view of the PCB circuit

4.2 THE PROJECT PROTOTYPE

After the PCB was printed the components were soldered according to the designed circuit. Here are the diagrams;

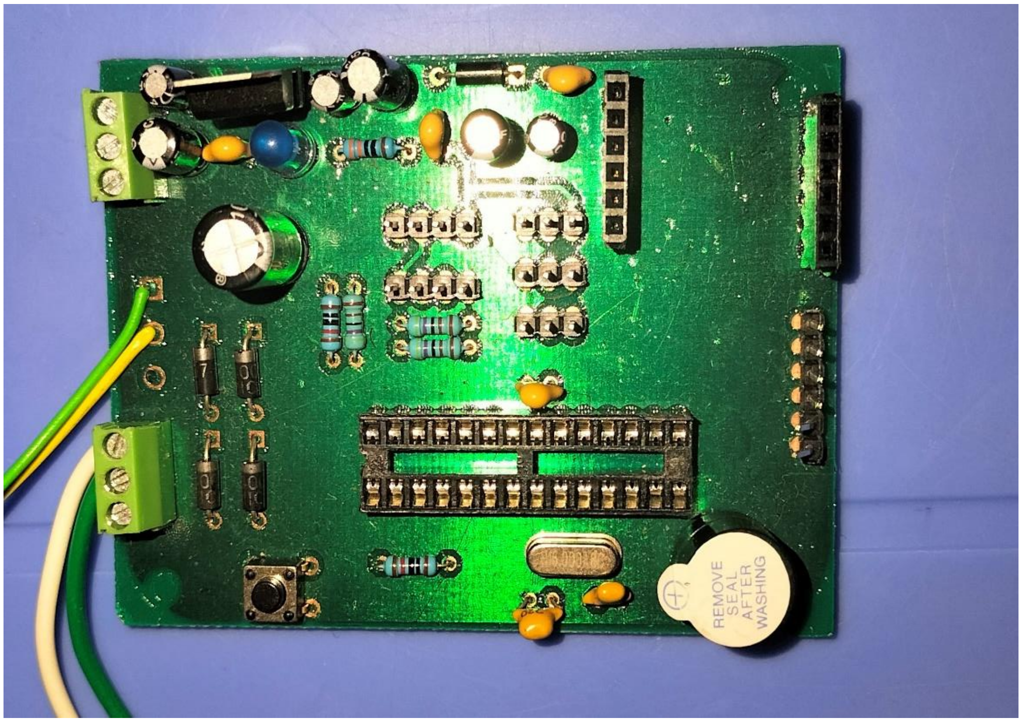


Figure 14: PCB after soldiering

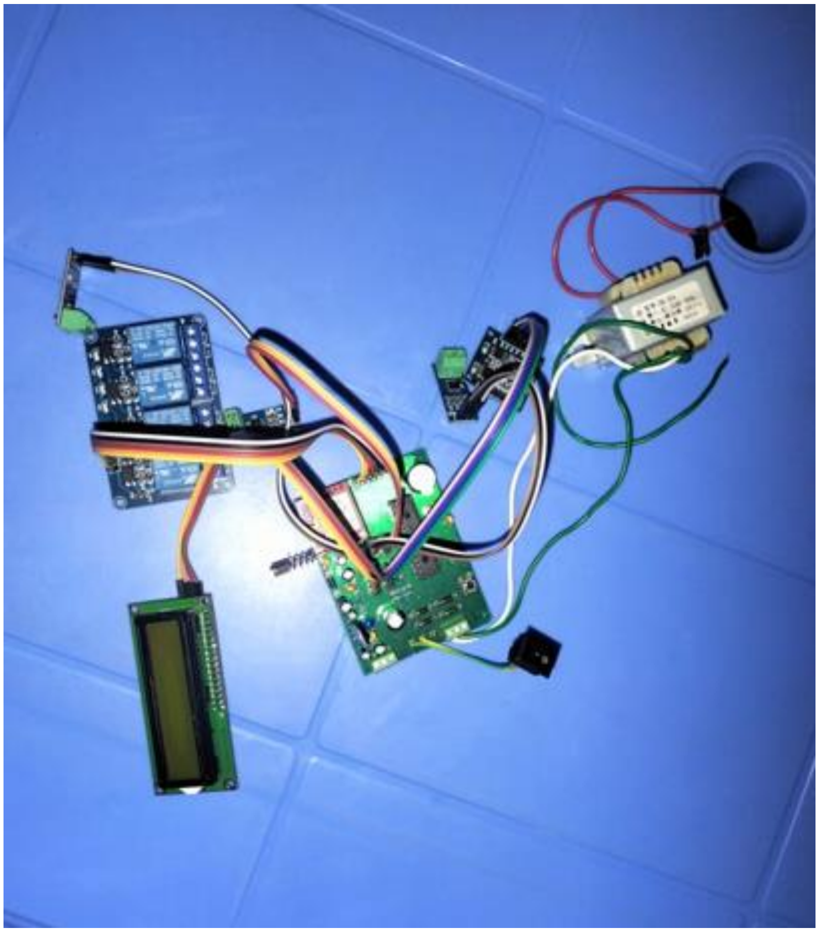


Figure 15: Complete circuit of the prototype

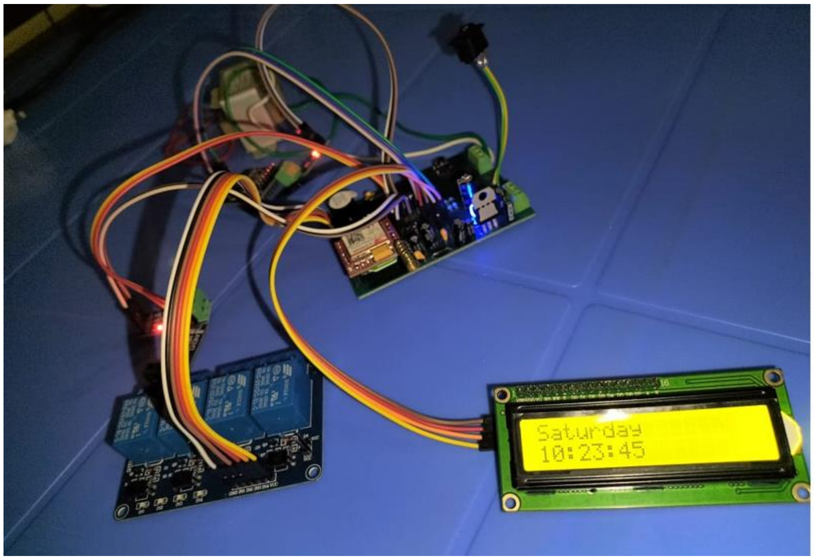


Figure 16: working of the LCD on the prototype

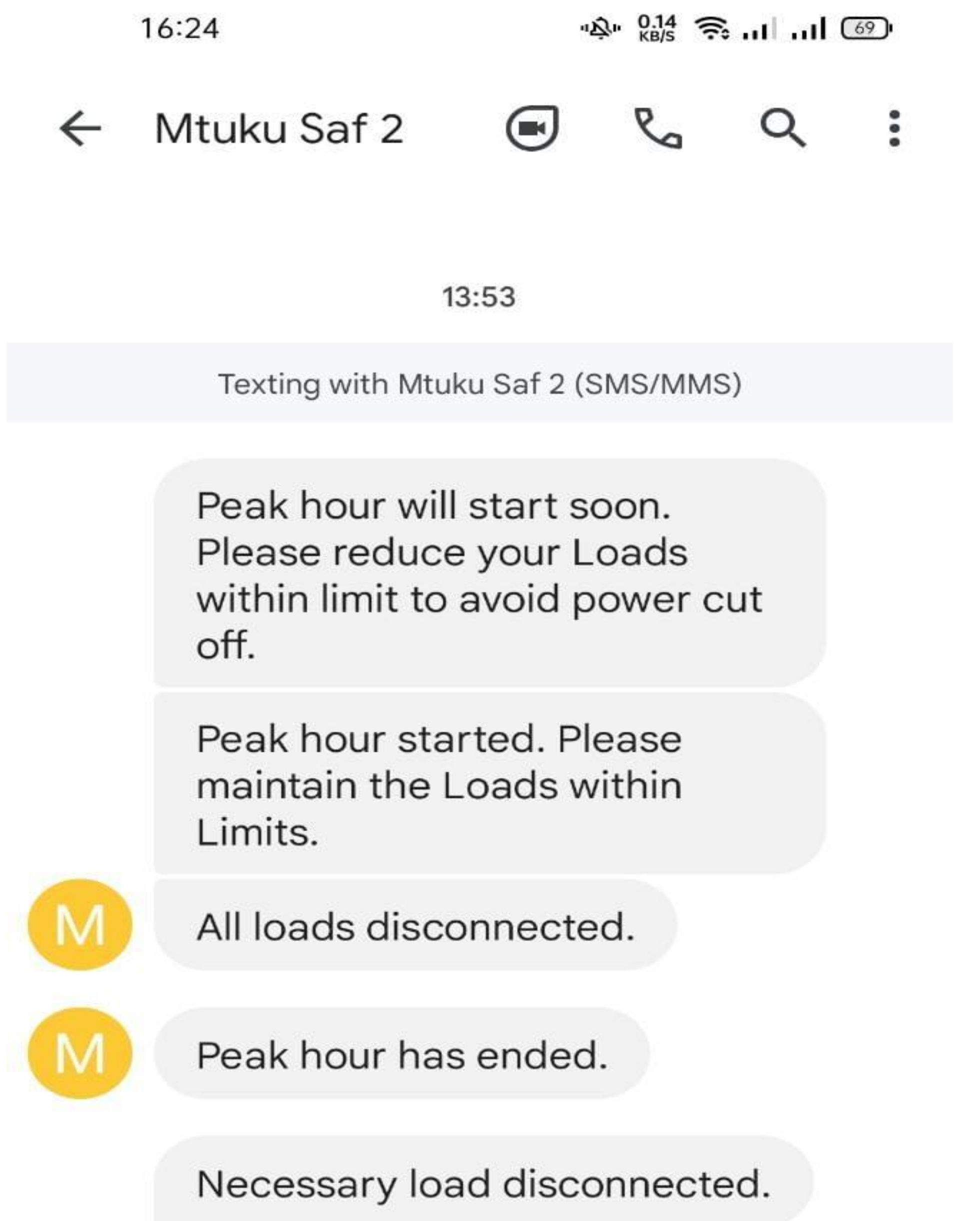


Figure 17: Messages sent from the GSM to the customer.

The SIM 800L GSM Module worked effectively and sent me the messages alerts of when the peak hour was going to start and the loads were about to be disconnected. The messages alerts would let the customer know of when to disconnect the luxury loads when the peak hour approaches

CHAPTER 5

5.0 CONCLUSION AND RECOMMENDATION

The set objectives for this project were all achieved. The circuit for load shedding was designed in proteus for simulation and Eagles Cad for the PCB circuit. It worked as it was expected. One of the challenges that was faced was GSM module was taking long to receive network hence there was some delay in the sending of messages but the messages were finally sent.

The electric utility companies prefer to reduce the load during peak hours and encourage the consumers to use their loads during off peak hours to avoid blackouts. As a result, this system can be recommended to be installed in the consumers side to allow for proper management. It can be installed in offices, homes and institutions as well. The system is cost-effective and simple in design. The load shedding system can switch off heavy loads automatically during peak hours and allows consumers to use them during off peak hours. The consumers will enjoy lower cost electricity bills since they will be shifting most of their loads to off peak hours.

Further research can be carried out to improve this system design by adding real -time load monitoring at the consumers end via faster means of transmission of data such as DSL.

PROJECT TIMELINE

TASK	TIMELINE
Designing a circuit	2 weeks
Simulation of the circuit in Proteus	3 weeks
Designing the hardware prototype	4 weeks
TOTAL	**9 Weeks**

ACTUAL BUDGET

EQUIPMENT	COST(KSH)
3-ACS712 Current sensors	1500
Relay module	300
12 V Transformer	500
LCD module	600
SIM800	1000
RTC D51307	450
Electronic Components	1000
PCB design printing	1200
TOTAL	6550

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Moors, C., Lefebvre, D., & Van Cutsem, T. (2000, January). Design of load shedding schemes against voltage instability. In *2000 IEEE Power Engineering Society Winter Meeting. Conference Proceedings (Cat. No. 00CH37077)* (Vol. 2, pp. 1495-1500). IEEE.

APPENDIX

```
#include<LiquidCrystal_I2C.h>

#include <Wire.h>

#include <RTClib.h>


#define SCREEN_WIDTH 128 // OLED display width, in pixels

#define SCREEN_HEIGHT 64 // OLED display height, in pixels


#define Lighting A0

#define Necessary A1

#define Luxury A2

#define Buzzer 7


#define Light 8

#define Nec 9

#define Lux 10

#define All 11


#define sensitivity 185

#define offsetVoltage 2500

#define refVoltage 5000


#define SimulateTime 30000

LiquidCrystal_I2C lcd(0x27, 16,2);


RTC_DS3231 rtc;


char daysOfTheWeek[7][12] = {"Sunday", "Monday", "Tuesday", "Wednesday", "Thursday",
"Friday", "Saturday"};
```

```
int LightADC = 0;
double LightVolts = 0.00;
double LightAmps = 0.00;

int NecessADC = 0;
double NecessVolts = 0.00;
double NecessAmps = 0.00;

int LuxADC = 0;
double LuxVolts = 0.00;
double LuxAmps = 0.00;
double total;

char buff [16];
uint8_t thisSec, thisMin, thisHour, lastMin;

bool oneTime = true;
bool oneText = true;

String time;

void setup() {
  Serial.begin(9600);
  lcd.init();
  lcd.clear();
  lcd.backlight();
```

```
pinMode(Lighting, INPUT);
pinMode(Necessary, INPUT);
pinMode(Luxury, INPUT);

pinMode(Light, OUTPUT);
pinMode(Nec, OUTPUT);
pinMode(Lux, OUTPUT);
pinMode(All, OUTPUT);
pinMode(Buzzer, OUTPUT);

delay(1000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("LOAD SHEDDING");
lcd.setCursor(0,1);
lcd.print("BY:OMBUI HENRY");
delay(5000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Lighting:");
lcd.setCursor(0, 1);
lcd.print("Necessary:");
delay(2000);
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("Luxury:");
lcd.setCursor(0, 1);
lcd.print("Total:");
```

```
  delay(2000);

  rtc.begin();
  delay(1000);
  rtc.adjust(DateTime(F(__DATE__), F(__TIME__)));

  DateTime now = rtc.now();
  lastMin = now.minute();
  time.reserve(10);
}

void loop() {
  DateTime now = rtc.now();

  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print(daysOfTheWeek[now.dayOfTheWeek()]);
  /*================Display Time================*/
  time = "";
  time += now.hour();
  time += ':';
  //thisMin = now.minute();
  time += now.minute();
  time += ':';
  time += now.second();

  lcd.setCursor(0,1);
  lcd.print(time);
```

```
delay(5000);

LightADC = analogRead(Lighting);
LightVolts = (LightADC / 1024.0) * refVoltage;
LightAmps = ((LightVolts - offsetVoltage) / sensitivity);

NecessADC = analogRead(Necessary);
NecessVolts = (NecessADC / 1024.0) * refVoltage;
NecessAmps = ((NecessVolts - offsetVoltage) / sensitivity);

LuxADC = analogRead(Luxury);
LuxVolts = (LuxADC / 1024.0) * refVoltage;
LuxAmps = ((LuxVolts - offsetVoltage) / sensitivity);

total = LightAmps + NecessAmps + LuxAmps;

lcd.clear();
lcd.setCursor(0, 0);
lcd.print(LightAmps);
lcd.setCursor(0, 1);
lcd.print("A");
delay(5000);

lcd.clear();
lcd.setCursor(0, 0);
lcd.print(NecessAmps);
lcd.setCursor(0, 1);
lcd.print("A");
```

```
delay(5000);

lcd.clear();
lcd.setCursor(0, 0);
lcd.print(LuxAmps);
lcd.setCursor(0, 1);
lcd.print("A");
delay(5000);

lcd.clear();
lcd.setCursor(0, 0);
lcd.println(total);
lcd.setCursor(0, 1);
lcd.print("A");
delay(5000);

rtc.now();
thisMin = now.minute();

if (thisMin < (lastMin + 3))
{
  digitalWrite(Light, HIGH);
  digitalWrite(Nec, HIGH);
  digitalWrite(Lux, HIGH);
  digitalWrite(All, HIGH);
}
else if (thisMin == (lastMin + 4))
{
```

```
    if (oneTime)
    {
      Send_Data("Peak hour will start soon. Please reduce your Loads within limit to avoid power cut off.");
      oneTime = false;
    }
    digitalWrite(Light, HIGH);
    digitalWrite(Nec, HIGH);
    digitalWrite(Lux, HIGH);
    digitalWrite(All, HIGH);
  }
  else if (thisMin == (lastMin + 5))
  {
    if (oneText)
    {
      Send_Data("Peak hour started. Please maintain the Loads within Limits.");
      oneText = false;
    }
    if (total > 0.55)
    {
      digitalWrite(Light, HIGH);
      digitalWrite(Nec, HIGH);
      digitalWrite(Lux, LOW);
      Send_Data("Luxury load disconnected.");
    }
    else if (total > 0.35)
    {
      digitalWrite(Light, HIGH);
      digitalWrite(Nec, LOW);
```

```
      digitalWrite(Lux, LOW);
      Send_Data("Necessary load disconnected.");
    }
    else if (total > 0.25)
    {
      digitalWrite(All, HIGH);
      Send_Data("All loads disconnected.");
    }
  }
  else if (thisMin > (lastMin + 5 ))
  {
    Send_Data("Peak hour has ended.");
    lastMin = thisMin;
    oneTime = true;
    oneText = true;
  }
}

void Send_Data(String sms)
{
  Serial.print("AT+CMGF=1\r");
  delay(1000);
  Serial.print("AT+CSMP=17,167,0,0\r\n"); //AT+CSMP=17,167,0,0
  delay(1500);
  Serial.print("AT+CMGS=\"+254707575010\"\r"); //AT+CMGS="+254790566616"
  delay(1500);
  Serial.print(sms);
  delay(1000);
```

```
  Serial.print((char)26);
  delay(500);
  Serial.println();
}
```