The Smart Electric Network

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Abstract

When designing and setting up an electric power station, we must take into consideration the type of loads, load of future expansions and also study the effect of ambient conditions especially temperatures so that the power station is able to feed those loads,thus making it more stable ,so in this paper we study the effect of environment condition, especially the temperature degree , so if any increase or decrease in temp degree its mean increase in electric loads, therefore we need to increase the electric power generated from power station to match the incremental in the load .Therefore we design control devise depending on "Arduino technique" to control the number of units generators in power station that must work and connected to network to share the remain power unit with electric power generated when an increase or decrease in temperature degree to remain the electric power station with more stability in work.

Keywords: Power station, Loads, Temperature, Stability, Arduino, Generator, Ambient conditions.

Introduction:-

Electricity is a form of energy that transmit through the wires and fibers to light up and move life on the surface of the earth. The tremendous progress of the accelerated civilization of humanity results from it. Electricity consumption has become one of the indicators of the development and progress of societies. It has also become an important indicator of human activity and another indicator of the sudden weather fluctuations predicted by the seasonal seasons. Therefore temperature has become one of the main axes to predict the consumption of electricity Concerns about increased demand for electricity has increased after many studies have indicated that the planet is warming. [1]

It is clear that There is a general tendency to increase the temperature of the surface of the earth and the areas of tropical and semi-tropical will be the most needed for electric power to be used in the cooling processes and not limited to consumption in the warm areas where the consumption of electric energy is increasing in the cold areas where increasingly used in the heating processes.

In this sense, we see the deterioration of electric energy in our country in the summer and especially in the warm months that begin early in our regions and continue for several months in addition to the fluctuation of temperature during the day, this requires an increase in electrical loads means increasing cutting hours. The same problem in the winter whenever the temperature decreases, means increasing the load of the devices. [2]   .

On this bias, there is an urgent need to connect the electrical network with additional electric generators to control the increase of load on the electrical network at high or low temperatures. This means linking and separating these generators at least twice during the year. This process entails maintenance operations. This means increasing financial expenses, Work and Time .In this research we found a way for connecting and separating the generators from the network by self-reliance on high or low temperature and thus will secure and accelerate the process of reducing the impact of pregnancy on the electrical network. It is possible to control the number of generators to be connected to the network and also can control the connection of these generators or separated by any degree of temperature by a simple change in the program. [3]

Buildings store heat during the daytime and release it slowly during the night, with residual heat being retained, quite often for several days. Therefore, for a given day, indoor temperature is influenced by outdoor temperature and the residual heat stored in the building from previous days. This storage of heat can contribute to increasing air conditioning requirements even when the current outdoor temperature is low. The effect of residual heat in electricity consumption can be examined using the temperature difference between the present and previous days.

This temperature difference is referred to as the residual temperature. It can be calculated as:

$$\Delta T_{i,j} = T_{i-j} - T_i \qquad (1)$$

Where $\Delta T_{i,j}$ is the residual temperature in the ith day resulting from the $(i-j)$th day.

As cooling electricity consumption is investigated in this study, the analysis is performed on the days warmer than the base temperature for cooling, using: [4].

$$E = \beta_0 + \beta_1 T + \beta_2 q + \sum_{j=1}^{k} \beta_{2+j} \Delta T_j \text{ for } T > T_b \quad (2)$$

where E is the daily electricity consumption, T (°C) is the outdoor air temperature, ΔT_j is the temperature difference between two days as defined in equation (1), q (g/kg) is the specific humidity, T_b (°C) is the outdoor air temperature threshold beyond which building electricity consumption varies with air temperature. The daily electricity consumption includes two portions. The first, which is dependent on the weather conditions, is related to achieving indoor human comfort and in some cases maintaining specific materials at low temperatures. The other portion is associated with powering office equipment and lighting, and is not dependent on the weather conditions. The weather-independent component will be included in β_0, while the weather-dependent component will be reflected in the other terms in the regression equation.

The base temperature is usually determined from the scatter plot of electricity consumption vs mean daily temperature. Stepwise regression is applied to determine the number of residual temperature terms to be included in equation (2). Conventionally, the cooling degree days is calculated according to:[5].

$$\text{CDD} = \sum_{i=1}^{n}(T_i - T_b) \quad \text{for } T > T_b \qquad (3)$$
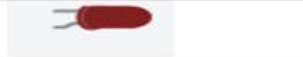
1-Project parts:-

The circuit controlling the process of connecting and separating the generators from the electrical network consists of two parts.

1-1-Electronic circuit.

1-1-1-(LM35) It is an integrated circuit that gives a change in voltage proportional to the temperature change as it is given 10mVto every degree and is characterized by accuracy and With degrees ranging from minus 55 to 150 degrees Celsius above zero [6].

1-1-2-Circuit Component

Table (1) Circuit Component

	Bread board	1
	LCD 16 x 2	1
	(G1&G2) Generators	2
	R1=220Ω, R2= 1KΩ R3= 220Ω	3
	Transistor Bipolar Junction	2
	D2 LED	2

1-2- The Arduino:

An Arduino is a tiny computer that we can program to process inputs and outputs going to and from the chip. The Arduino his hardware and his software are both Open Source. Which means (code, schematics, design, etc) are all open for anyone to take freely and do, as they like with it. [7].

Every Arduino board must have the same form as the standard Arduino. Power and ground pins on one eight or six pins header. And analog pins on a six-pin header next to that. Digital pins cover the other edge on the other side of the Arduino, an eight-pin header separated from a 10-pin by that weird 0.5 spacing. Some boards also require a connection to the Arduino's ICSP header.

Arduino consists of a programmable circuit board (called the microcontroller), as well as a programmable part of an integrated development environment (IDE) that runs on the computer and is used to write and load code from the computer to the Arduino board. [8].

Table (2) Arduino pins

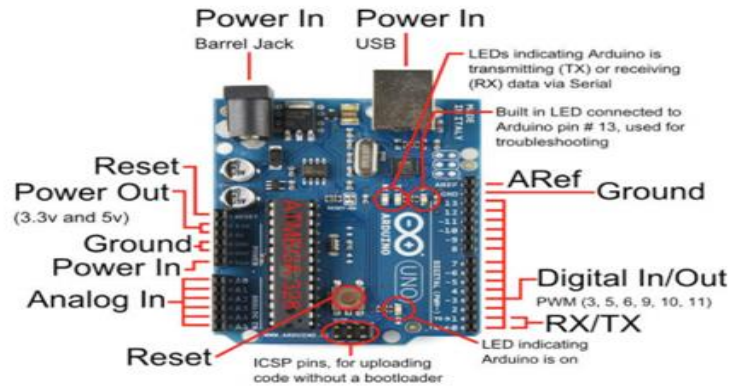| Reset	3.3V	5v	Gnd	Vin	Analog In	RX/TX	Digital	PWM(`~)	AREF
Resets Arduino sketch on board	3.3 volts in and out	5 volts in and out	Ground	Voltage in for sources over 7V (9V-12V)	Analog inputs, can also be used as Digital	Serial comm. Receive and Transmit	input or output, HIGH or LOW	Digital pins with output option of PWM	External reference voltage used for analog

Fig (1) - Arduino uno board
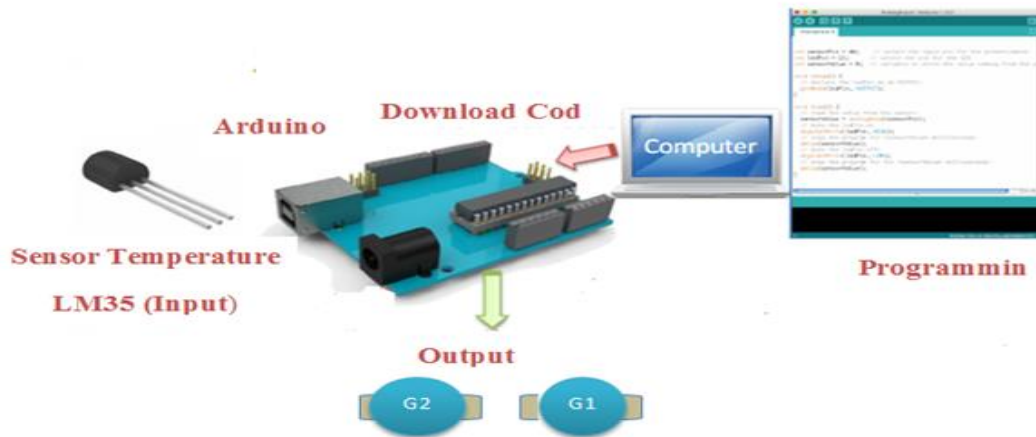
Fig (2) System Overview
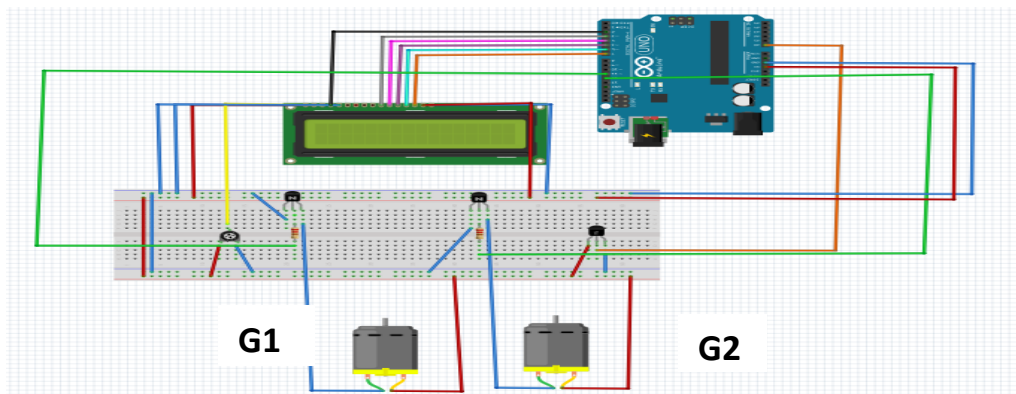
2-Circuit Practically.
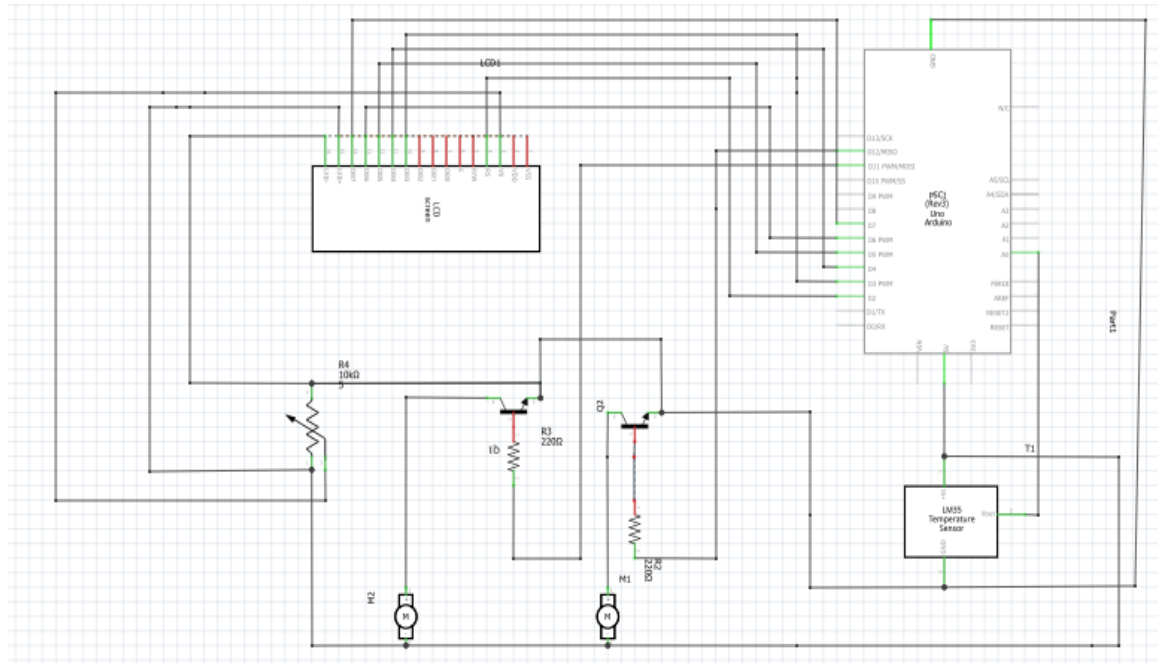

Fig (3) working circuit

Fig (4) schematic working circuit
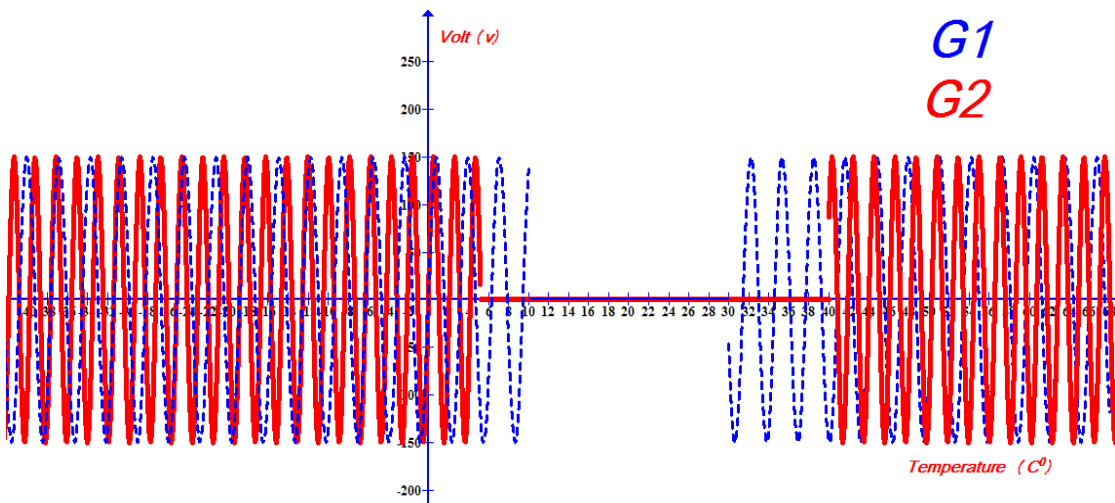
3-Work circuit:

Fig (5) G1&g2 working

The base of the work of the circuit is dependent on the high or low temperatures of the weather when the average temperature is moderate, i.e. the temperature is moderate. For example, the temperature is between $24C^0$-$30C^0$. The electric grid is stable. I.e. the load on the network is moderate. Additional generators G1 & G2 are separating .in LCD the temperature 24.9 C^0 and in LCD not appear" network con" fig (6).
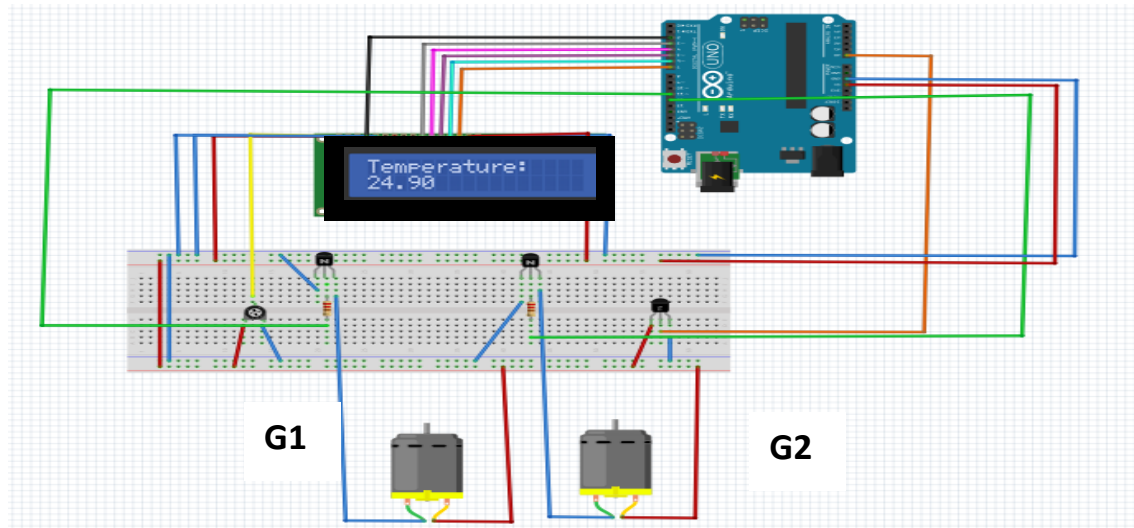
Fig (6) the electric grid is stable (the temperature is moderate)

(In temperature between $10C^0$-5 C^0 in cold weather fig (7) and between $30C^0$-$40C^0$ in hot weather fig (8)), G1 is connected with the network and the G1 start to work. in LCD the temperature 8.30 C^0. and in LCD appear" network G1 con".
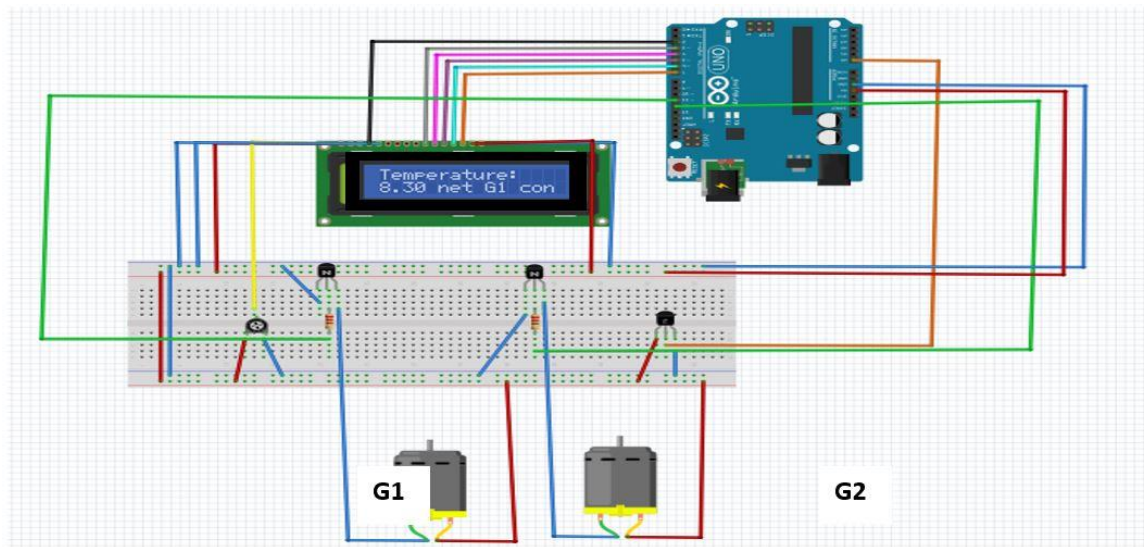

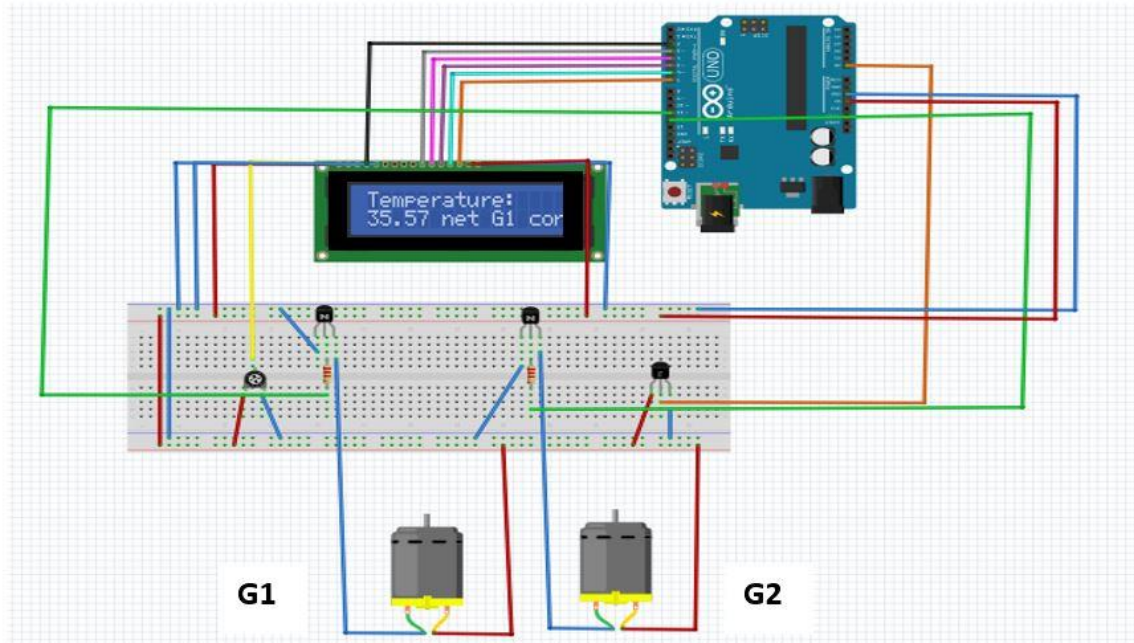**Fig (7) the G1 start to work in cold weather**

Fig (8) the G1 start to work in hot weather

When the temperature weather is increase or decrease more. The load on the network become large that is mean more generators in that is time G1&G2 are connected with the network.

Conclusion

The stability of electric power station is affected by the type of loads ,if it has enough capacity to feed it and also the change in ambient conditions especially temperatures , In this present work a control devise depending on "Arduino technique" was designed to work in electric power station that sensing the environment temperature degree if it increase or decrease up to the normal degree "means an electric load is increased ", the control device "Arduino technique" ordered to another unit generator to work with the remain unit and supply the electric network with extra power thus the electric power station will be more stability in work.

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Appendix: - Picture   of project circuit -
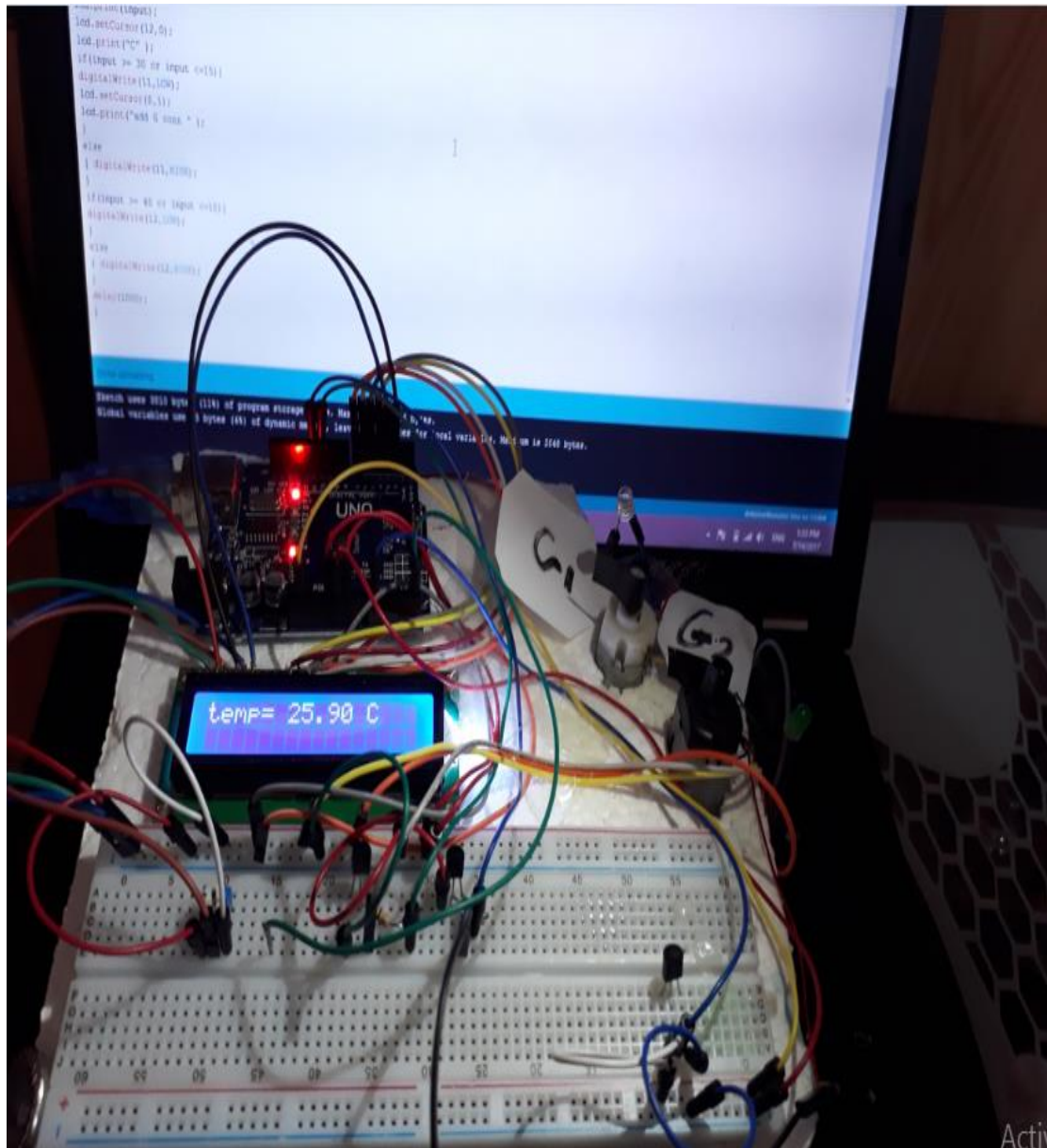
Appendix: Software   "Program of project"

```
1-#include <LiquidCrystal.h>
2-LiquidCrystal lcd ( 2, 3, 4, 5, 6, 7);
3-float  input=A0;
4-int G1 =11;
5-int G2 =12;
6-void setup() {
7-pinMode(input,INPUT);
8-pinMode(A0, INPUT);
9-pinMode(G1,OUTPUT);
10-pinMode(G2,OUTPUT);
11-lcd.begin(16,2);
12-lcd.clear();
13-}
14-void loop() {
15-input=analogRead(A0);
16-input=(input*0.49828125)-3.0;
17-lcd.clear();
18-lcd.setCursor(0,0);
19-lcd.print("temp= ");
```

```
20-lcd.print(input);
21-lcd.setCursor(12,0);
22-lcd.print("C" );
23-if(input >= 30 or input <=15){
24-digitalWrite(11,LOW);
25-lcd.setCursor(0,1);
26-lcd.print("add connect G" );
27-}
28-else
29-{ digitalWrite(11,HIGH);
30-}
31-if(input >= 40 or input <=10){
32-digitalWrite(12,LOW);
33-}
34-else
35-{ digitalWrite(12,HIGH);
36-}
37-delay(1000);
38-}
```

Appendix : Software   "Program of Ardunio "

```
Ardunio - program mm
#includeCrystal<LiquidCrystal.h>
LiquidCrystal lcd ( 2, 3, 4, 5, 6, 7 );
float input=A0;
int G1=11;
int G2=12;
void setup(){
pinMode(input,INPUT);
pinMode(A0, OUTPUT);
pinMode(G1 ,OUTPUT);
pinMode(G2 ,OUTPUT);
lcd.begin(16,2);
lcd.clear();

}

void loop(){
input=analogRead(A0);
input=(input*0.498828125)-3.0;
lcd.clear();
lcd.print(" temp= ");
lcd.print(input);
lcd.setCursor(12,0);
lcd.print("C");
if(input>= 30 or input <=15){
digitalWrite(11,LOW);
;
else
{ digitalWrite(11,HIGH);
}
if(input >= 40 or input <=10){
digitalWrite(12,LOW);
}
else
{ digitalWrite(12,HIGH);
}
delay(1000);
}
```

الشبكة الكهربائية الذكية

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الخلاصة

عند تصميم وانشاء محطة توليد القدرة الكهربائية يجب الاخذ بنظر الاعتبار نوع الاحمال التي يجب تغذيتها وكذلك الاحمال عند التوسعات المستقبلية والتغيرات في الظروف المحيطية وفي هذا البحث تمت دراسة تاثر استقرار عمل المنظومه القدره الكهربائيه بتغيرالظروف المحيطيه ومنها درجات الحراره لذلك اي ارتفاع او انخفاض درجات الحراره عن المعدلات القياسيه او المعتدله يعني زياده الاحمال الكهربائيه التي تتغذى من تلك المنظومه مما يتطلب زياده القدرة الكهربائيه المتولده من اجل رفد الشبكه بالطاقه نتيجه زياده الاحمال حتى تبقى المنظومه اكثر استقرار واتزان بالعمل. لذا تم تصميم متحكم بالآستفاده من تقنيه الاردوينو من اجل السيطره على ادخال عدد من الوحدات التوليديه الى العمل ضمن المنظومه من اجل رفد الشبكه بالطاقه الكهربائيه وحسب تغير الاحمال الكهربائيه نتيجه ارتفاع وانخفاض درجات الحراره وبذلك تكون منظومه القدره الكهربائيه أكثر استقراريه.

الكلمات الداله: محطة توليد القدرة، الاحمال، درجة الحرارة، الاستقرارية، اوردينو، المولد، الظروف المحيطية.