INTERNET OF THINGS (IOT) BASED SMART GRID

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Abstract: - The present work is dedicated about the internet of things that has been risen as empowering Innovation for the power grids. The concept is that whenever one grid station which transfers the power to consumers is cutoff due to some faults with the help of IOT based technologies we can connect all the loads connected to grid station with some other grid station so that power supplied does not get interrupted. The work is dedicated in order to find the power, current, voltage, energy consumption, power theft, faulty grid and to display the data on webpage. The IOT performs the function and maintenance by using different type of sensors. The sensors are mainly used for both maintenance and theft prevention. All consumers get electricity through power transmission hubs known as Power Grids and sometimes problems rise due to failure of the power grids and results in black out of an entire location getting electricity supply from that particular power grid. In this proposed work the VSC and CSC is interfaced with the microcontroller and results are displayed on LCD. The model proposed in this research solve this problem using IOT as the means of communication and also tackling various other issues which a smart system can deal with to avoid unnecessary losses to the Energy producers. The proposed work is thus resolving in proteus suit and with the help of DB9 connector the data is transferred to the lab view and then displayed on the webpage.

KEY WORDS:IOT, SENSORS, LABVIEW, SMART, THEFT, FAULT.

I. INTRODUCTION

A. Overview

Smart Grids is the advancement of traditional electrical grid. In traditional electrical grid the generation of energy is done in centralized power plants. It is a unidirectional communication, In order to achieve high reliability in power systems the smart grids comes into picture. This system equipped with sustainable models of energy production distribution. The smart concept means deployment of technologies to make the system more and more dynamic. As for analysis IOT technology can change the electrical power hubs or grids into a new approach or we can simply the smart grids. It is not simple and easy to deploy IOT technology in existing problematic power grids. To encourage this organization of IOT-based frameworks in local situations, we propose IOT-network, a programmable, little scale matrix that can be effectively executed with low-control equipment with restricted preparing limit. The proposed network receives moderately shoddy DC-DC converters which give high change productivity as well as oblige existing little scale DC control frameworks (e.g. sun powered boards). We at that point investigate the correspondence parts of IOT-matrix to be specific, control and checking capacities. We observe that processing delays of IOT devices have large impact on IOT-grid, which cause a chain of control commands to take considerable longer time as the number of commands increases. To mitigate this problem, we propose a mechanism based on sending burst commands with scheduled responses. Our experimental results will show that, in the presence of processing delays, this method can significantly reduce the overall response time.

To make power systems more efficient and Information Technology enabled, it is very important to incorporate smart concept in Grid Stations. A Smart Grid is simply a combination of electrical and infrastructure using IT service within existing electrical network.

B. Proteus software

Proteus is a simulation and plan programming device created by Labcenter Electronics for Electrical and Electronic circuit outline It likewise have 2D CAD drawing highlight. It deserves to bear the tagline From concept to completion. It is a product suite containing schematic, simulation and additionally PCB outlining. The product ISIS is mainly used for schematics and recreate the circuits in genuine time. The simulation permits human access amid run time, thus giving constant simulation. ARES is utilized for PCB designs. It has the element of review yield in 3D perspective of the composed PCB layout segments. The planner can likewise create 2D illustrations for the products.

C. Lab view software

Lab view Software which is a graphical programming environment and is based on the concept of data flow programing. Originally designed for test and measurement applications, the program has been modified over last 15 years to design and analyse various complex systems. It is widely accepted by industry, university, and research laboratories around the world as a standard data acquisition (DAQ) and instrument control software .User of Lab VIEW can build instrumentation called virtual instruments (VIs) using software objects. With proper hardware, these Vis can be used for remote data acquisition, analysis, and distributed control. The built-in library of Lab view has a number of Vis that can be used to design and develop any system.

Lab view can be used to address the needs of various courses in a technology and science program).A sketch for the microcontroller acts as an I/O engine that interfaces with Lab view VI's through a serial connection. This helps you quickly move information from microcontroller to Lab view without adjusting the communication, synchronization, or even a single line of C code. Using the common Open, Read/Write, and Close convention in Lab view, you can access the digital, analog, pulse-width modulated, I2C, and SPI signals of the microcontroller.

II. PROBLEM FORMULATION AND METHODOLOGY

A. Problem formulation

Electricity is very essential for part of life and the service is supplied through power hubs or power grids. The power grids face number of problems like climate and results in complete black out of the area getting the electricity from the particular power grid. My research is based on how to implement information Technology in electrical domain especially in power grids. In my research I am going to deploy IOT and new trend in power grids to make them smarter. Apart from monitoring the Grid it is very important to monitor energy consumption and even theft of electricity to make proper use of electricity. The amount of electricity consumed needs to be updated on the webpage along with the Energy Grid information.

B. Research objectives

The main objectives of my research are described below:

- To monitor energy consumption of smart gird on virtual terminal as well as on web page.
- To detect and display the power theft of smart grid on virtual terminal as well as on web page.
- To monitor the load status using PWM duty cycle on virtual terminal as well as on web page.
- Due to faulty party of grid using smart grid transferal system to avoid power interruptions displayed on virtual terminal as well as on web page.

C. Proposed work

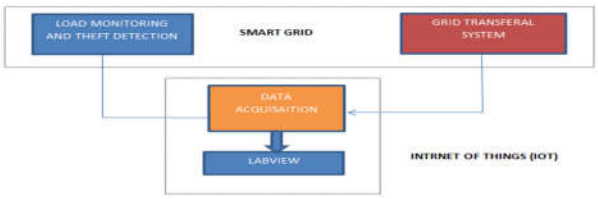


Figure 1: Proposed Work

The model is based on the concept that whenever one grid station which transfers the power to households is interrupted due to some fault ,with the help of IOT based technologies we can connect all the loads connected to grid station with some other station so that power supplied does not get interrupted. The existing methodology does the same work but manually The current thesis provide us the way to connect the IOT technology to the power station so that this can be done with the help of a particular software with the help of the single click.We know sometimes there is possibility of number of problems that rises due to different technical issues in electric power grids. The model proposed really solves these problems using the popular IOT Technology. The present grid system needs remote or robotic monitoring for better power supply and the implementation of IOT and other related technologies make it possible.

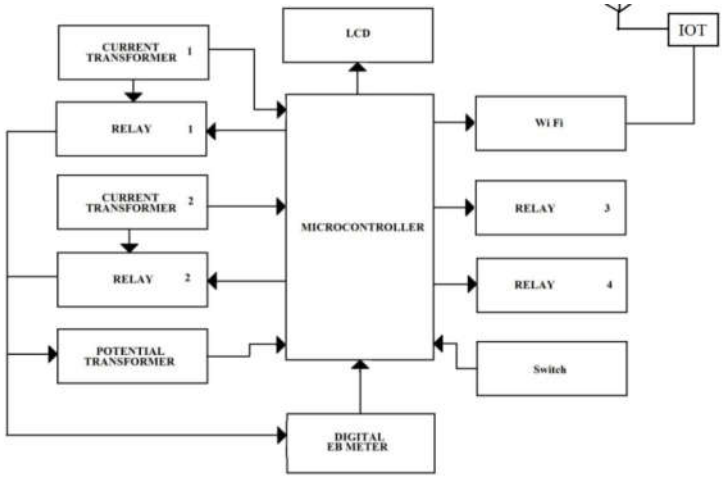


Figure 2: Block Diagram of proposed work

The IOT based Smart Energy Grid is based on microcontroller (PIC16F877A) concept of microchip to control and manage various events of the system. This system communicates over the internet by utilizing Wi-Fi technology. To demonstrate valid and invalid power consumer's bulbs will be used. The leading thing that the model simplifies is re-connection of transmission line to the active grids. The system is very useful because if there is any fault or technical problem present in power grid the system will automatically shifts the Transmission Lines towards the active or alternative grid thus enabling continuous electricity supply to that particular area whose power grid is faulty. And the important thing is that the information of active grid is updated through IOT based GUI webpage where the experts can login and view the updates. Not only monitoring the power grids this model has other advanced abilities of monitoring energy consumption with the option electricity theft. This information is regarding the quantity of electricity consumed and the estimated cost of the usage gets updated on the IOT webpage with the complete energy grid information. Two switches will be deployed to simulate the conditions in the system. Switching one each time will simulate a theft condition and also will alert the experts over the IOT GUI interface. In this way, the Smart Energy Grid venture ensures that the power supply is nonstop and aides in keeping up a refreshed record of utilization and burglary data which is a significant profitable data for the vitality delivering organizations.

D. Working

The technology is highly accessible and has a complete command to operate the devices.

The scope of this is widely varying to all the sectors like medical, industrial, education etc. The main aim of this project is to control the devices using IOT and monitoring the energy consumed. In application of this project it can be used in domestic as well as industrial purposes, the methodology of this project is the loads are connected to the relay and the relay is connected to the microcontroller. The current and the power transformers are connected to the signal conditioning board and signal conditioning board changes AC to DC and the microcontroller has operating voltage as 5V so the signal conditioning board gives 5V to microcontroller. The energy is calculated from voltage and current consumed and uploaded in webpage. We can monitor the devices anywhere in the world so users can easily follow the energy consumption.

Internet of Things plays a vital part of Smart Grid as it facilitates an uploading of various parameters like temperature, current, humidity, pressure etc. and downloading of commands from utilities. Because the utilities or the main controller will monitor this devices for that it requires statics. Moreover, Internet Of Things also plays pivotal role in smart grids automation. Each and every devices has its own IP and MAC addresses for realization of integrated operation with other network devices and central controller various communication protocols such as ZIGBEE, WILAN, Cellular technologies, Wireless HART, Bluetooth, WIMAX etc can be easily used for communication between network devices. The choice of this communication Protocols depends upon the coverage area, data rate required, type of application etc..

Figure 3:- BASIC FEATURES OF SG

III. SIMULATION RESULTS

The simulation of the IOT based smart grid is shown below in figure no 4.4.1. The main of this simulation is to detect the results by using the proteus software in order to implement the IOT in Smart Grid. The basic layout is schematics well as general circuit administration is covered in the software. Proteus toolbox joins with the blended mode spice circuit simulation, animated components and other models in order to encourage co-simulation of microcontroller based plans. . The results are displayed in virtual terminal and then the same data is transferred to the lab view software. With the help of VSPE data from lab view is displayed on the webpage

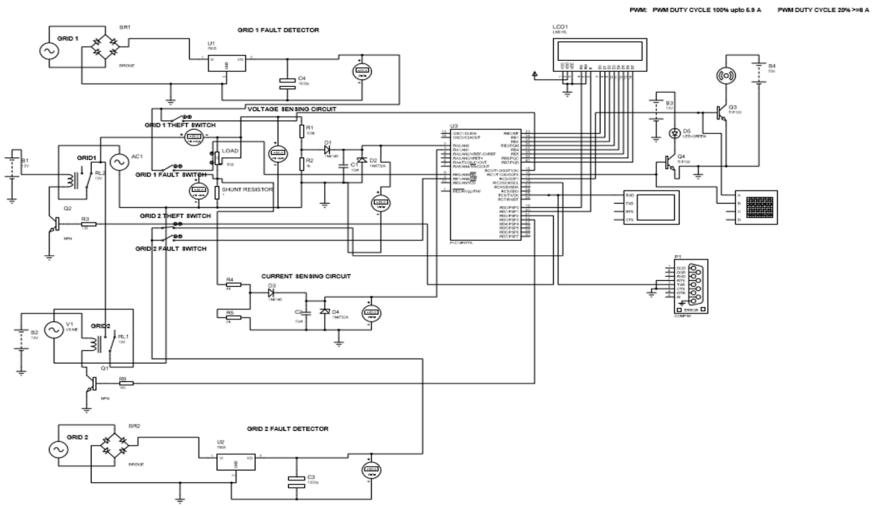


FIGURE 4:- SIMULATION CIRCUIT DIAGRAM OF IOT BASED SMART GRID IN ISIS PROFESSIONAL

A. Results : The results of the simulation are as :

CASE I: - AT NORMAL CONDITION, WHEN GRID 1 OR GRID 2 IS ON

When either grid 1 or grid 2 is on, the reading of power, current, voltage , energy consumption are displayed in virtual terminal as well as in lab view.

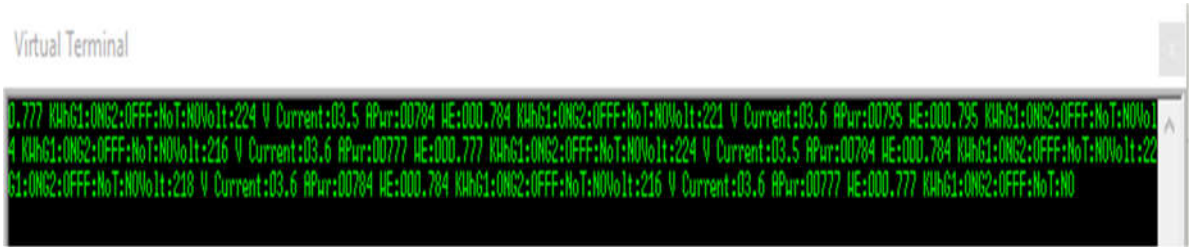
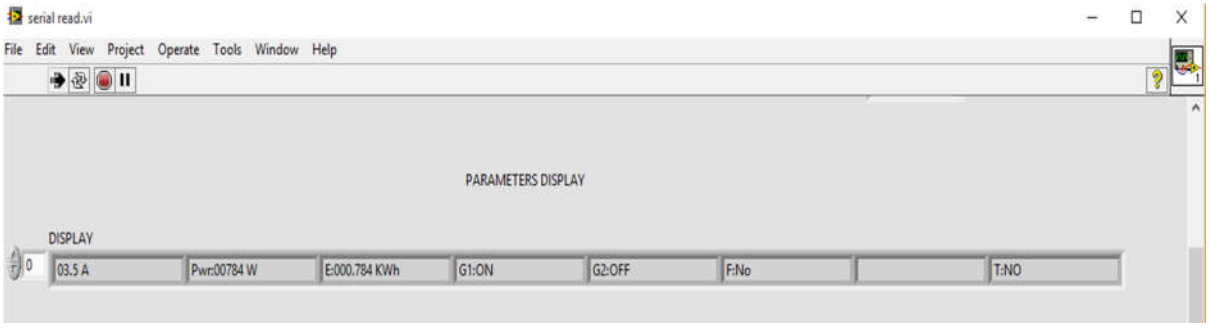


Figure 5(a):- Virtual Terminal Reading



(b) Lab view readings

CASE II:- WHEN THE LOAD IS BELOW THE PEAK VALUE CURRENT (i.e. NORMAL CONDITION).

When the load is below the peak value current “Normal condition” (i.e. Below 6.2 amps as set in a simulation circuit daigram) then the real time monitor status of the load is displayed on the virtual terminal as well as on web page through the lab view by the help of virtual serial port emmulator (VPSE).

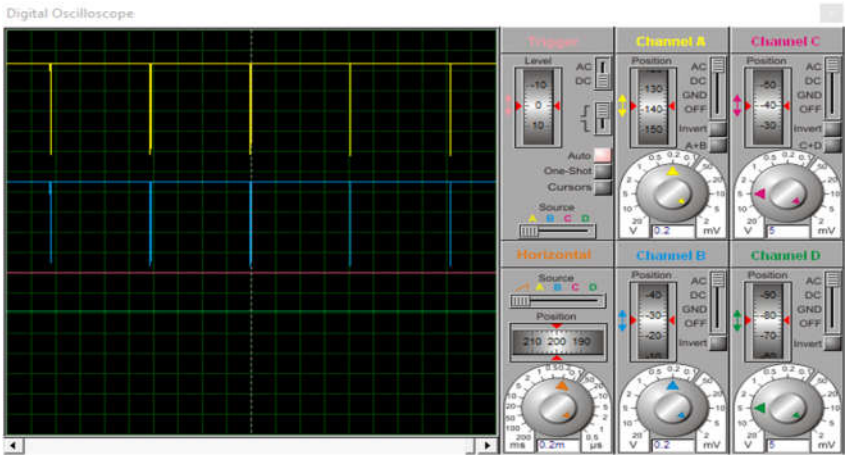
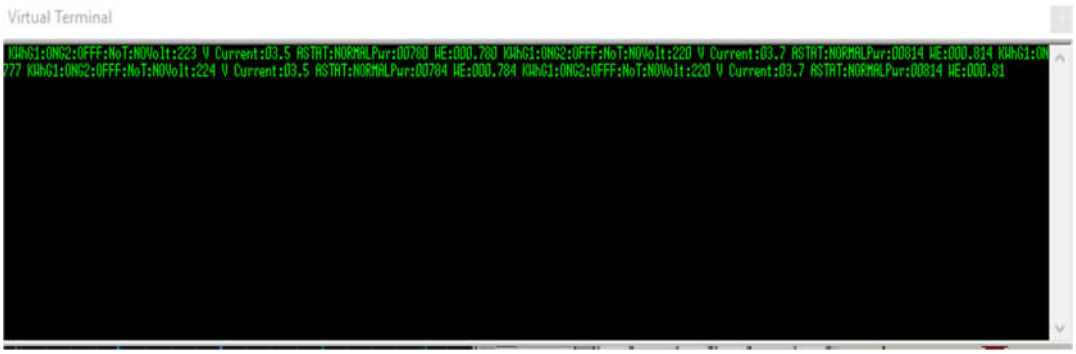
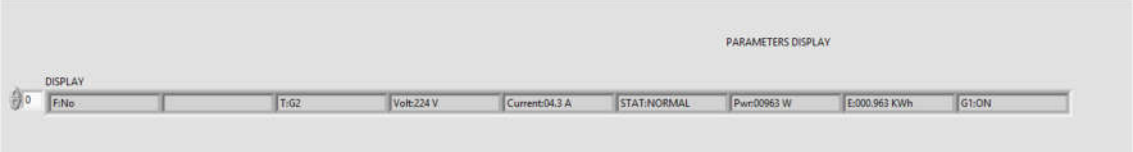


Figure 6(a):- PWM duty cycle



(b) Virtual terminal reading



(c)Lab view reading

WHEN THE LOAD EXCEEDS LIMIT OF THE PEAK VALUE CURRENT (i.e. ABNORMAL CONDITION).

As the load exceeds limit of the peak value current "Abnormal condition" (i.e. above 6.2 amps as set in a simulation daigram) then the real time monitor status of the load is displayed on the virtual terminal as well as on web page through the lap view by the help of virtual serial port emulator (VSPE).

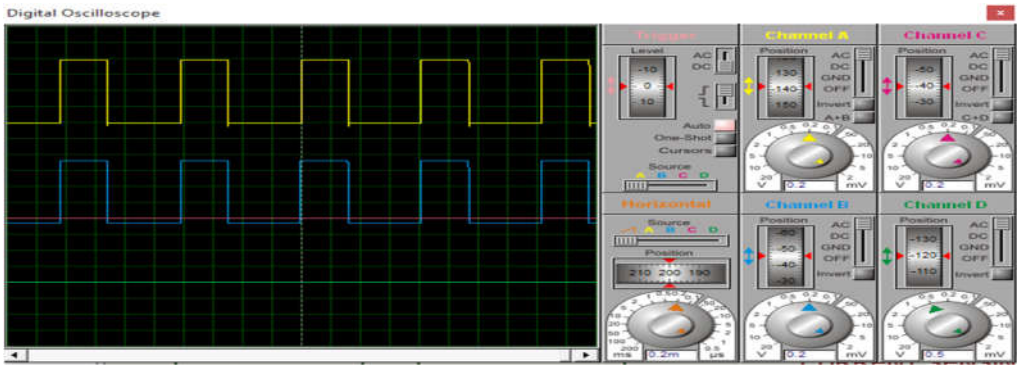
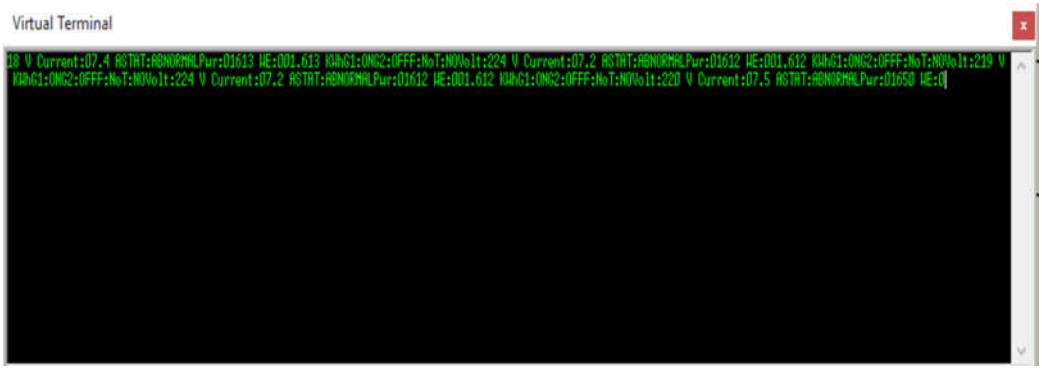
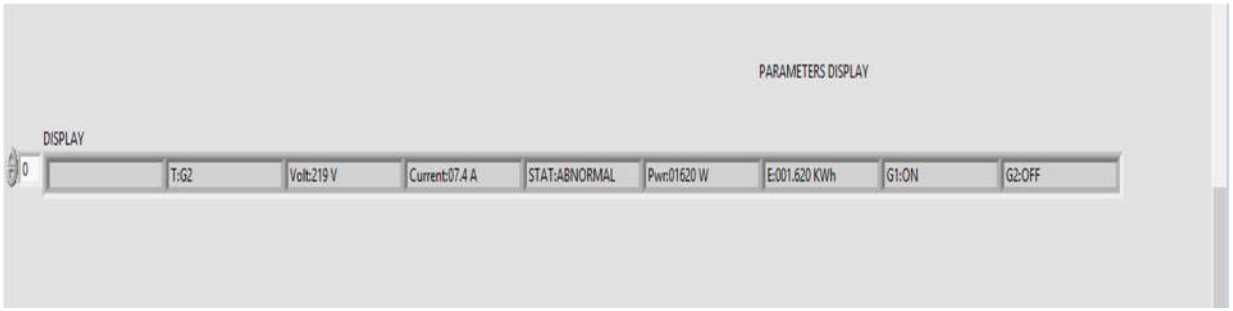


Figure 7 (a):- PWM duty cycle



(b) Virtual terminal reading



(c) Lab view reading

Table 1:-Shows the real monitor status of the laod in both conditions.

CURRENT	STATUS	PWM DUTY CYCLE
up to 6.2amps	Normal	100%
above 6.2amps	Abnormal	20%

CASE III: - WHEN POWER THEFT OCCURS ON TRANSMISSION LINES

As theft occurs on transmission lines e.g if supply is from grid 1 and at the same time fault will occur on the transmission line then automatically it will be displayed as THEFT ON GRID 1 i,e T= G1

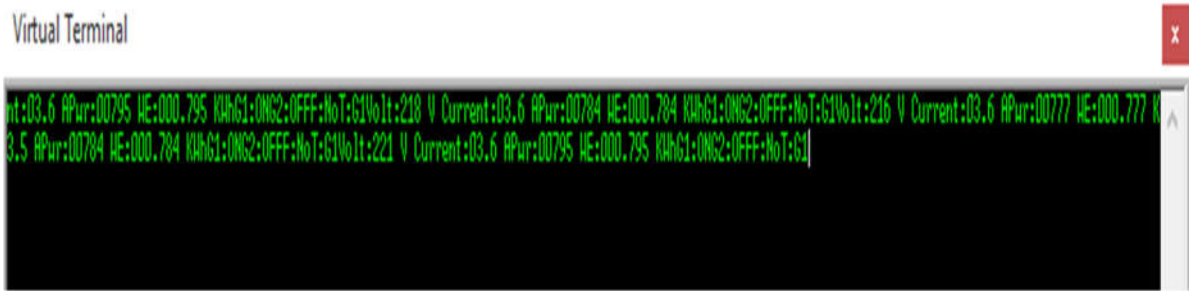
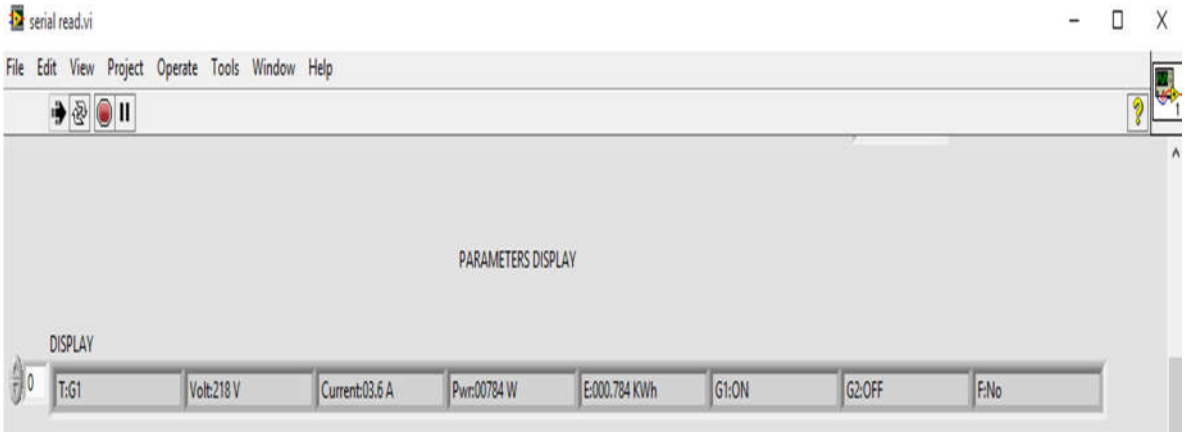


Figure 8 (a):- Virtual Terminal Reading



(b) Lab view readings

CASE IV :-WHEN FAULT WILL OCCUR EITHER IN GRID 1 OR GRID 2 THEN AUTOMATICALLY SUPPLY WILL CHANGE EITHER FROM GRID 1 TO GRID 2 OR GRID 2 TO GRID 1 RESPECTIVELY

If grid 1 is faulty then automatically all loads on grid 1 will change to grid 2 and vise versa till the fault will be rectified on grid 1 , in the virtual terminal and lab view reading it is displayed Grid 1is fault as F= G1 similarly if fault will occur in grid 2 then it will be G2 =F

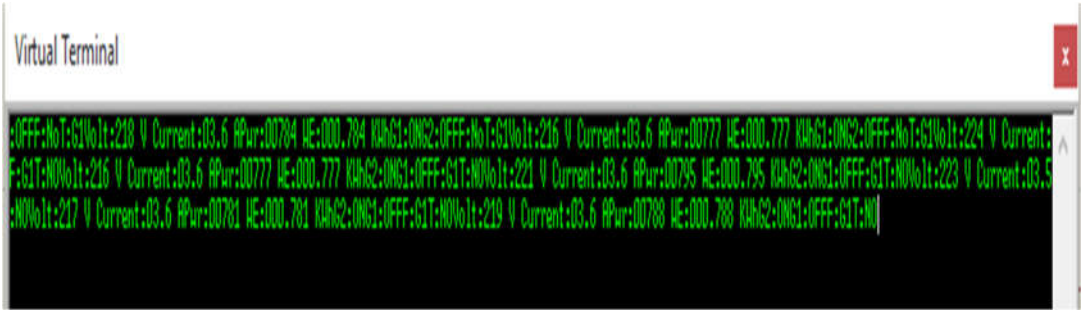
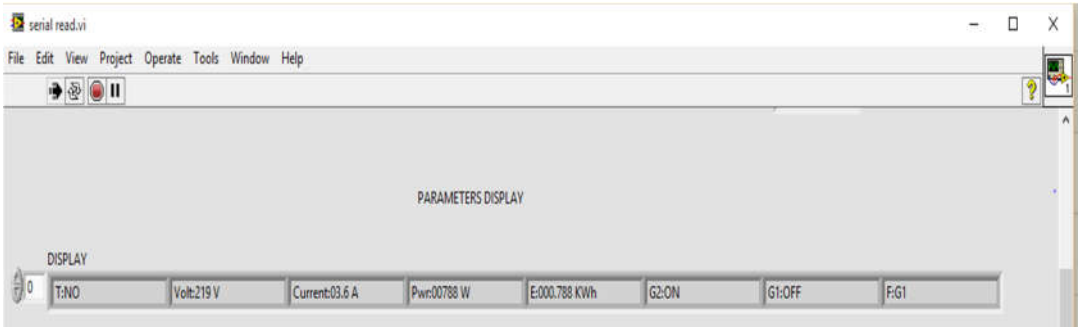


Figure 9 (a):- Virtual Terminal Readings



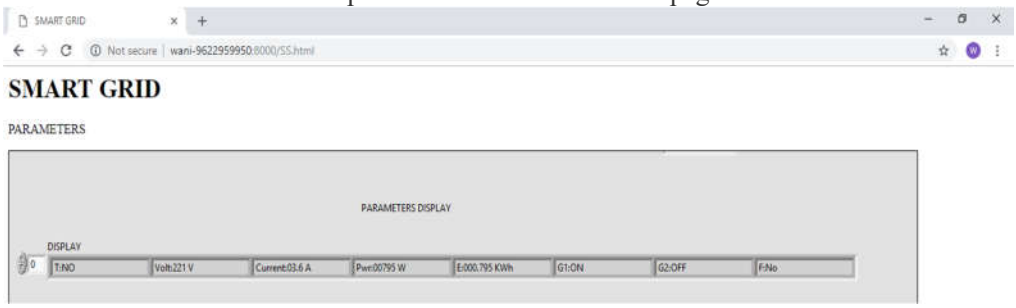
(b) Lab view Readings

B. Implementation of IOT

This is the main motive behind our work to implement all the above results on webpage. In order to implement the results on webpage data is transferred from proteus to the lab view with the help of virtual serial port emulator and then from lab view we can implement the same data on webpage. Also if we will make any changes in proteus same changes will be displayed on webpage. Further if we have same network connection for many pcs or mobile phone we can easily access that webpage on that pcs or mobile phones. The results displayed of three cases of lab view are implement on webpage are shown

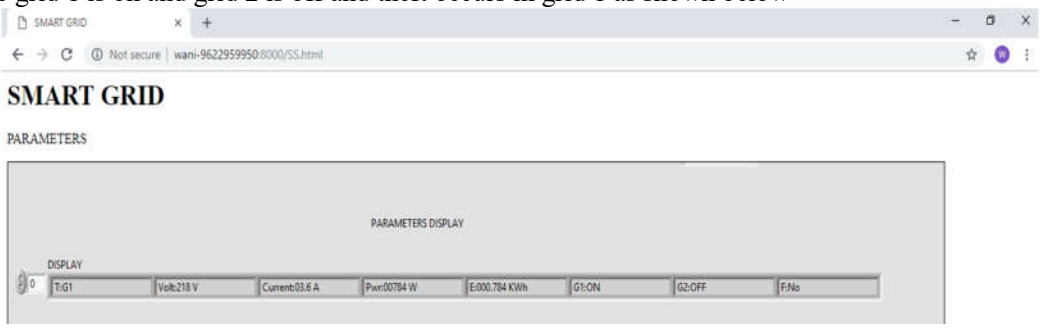
a. At normal condition , when grid 1 or grid 2 is on

At this time there will be no fault or power theft as shown on webpage

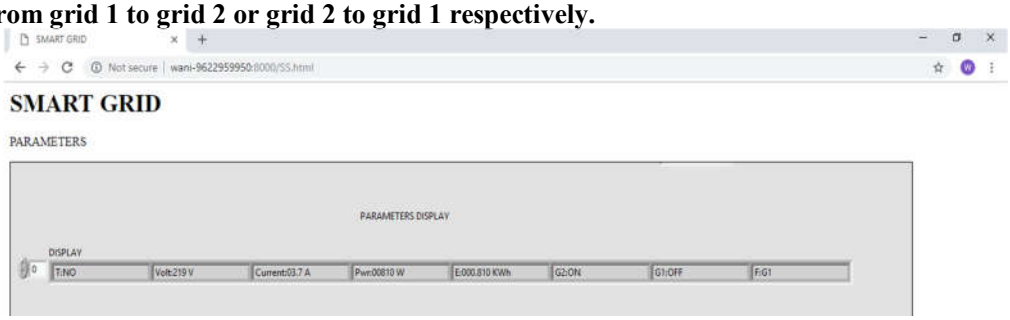


b. When fault will occur either in grid 1 or grid 2 then automatically supply will change either from grid 1 to grid 2 or grid 2 to grid 1 respectively

Here grid 1 is on and grid 2 is off and theft occurs in grid 1 as shown below

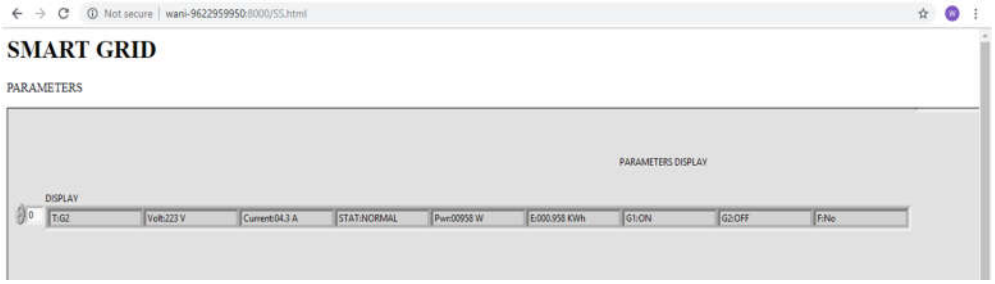


c. When fault will occur either in grid 1 or grid 2 then automatically supply will change either from grid 1 to grid 2 or grid 2 to grid 1 respectively.



d. When the load is in normal either abnormal condition, then the same real time monitor status is displayed on the wep page respectively.

Web page of smart grid shows real time status of the load from the consumer (residential, commercial, or industrial) is in normal condition.

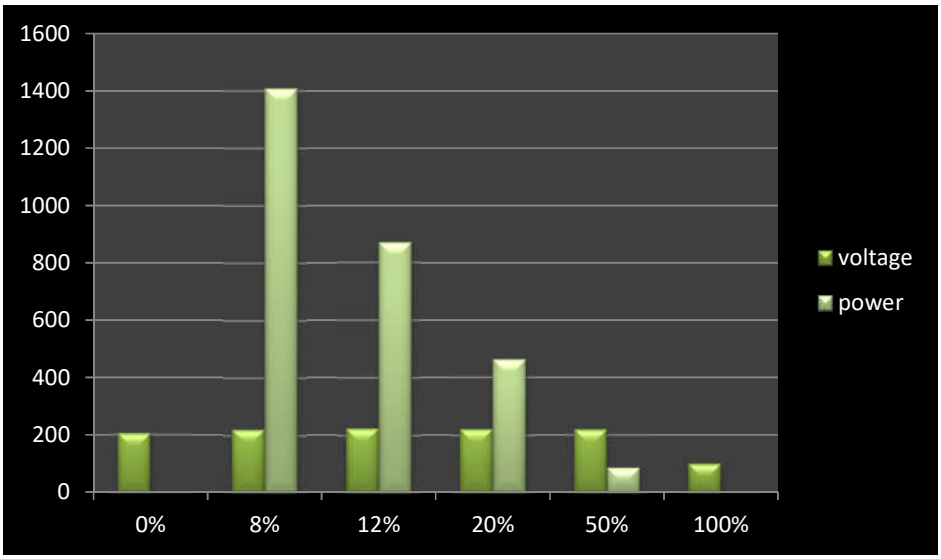


Web page of smart grid shows real time status of the load from the consumer(residential, commercial, or industrial) is in abnormal condition.

Table 2:- Based on the above we had tabulated results :

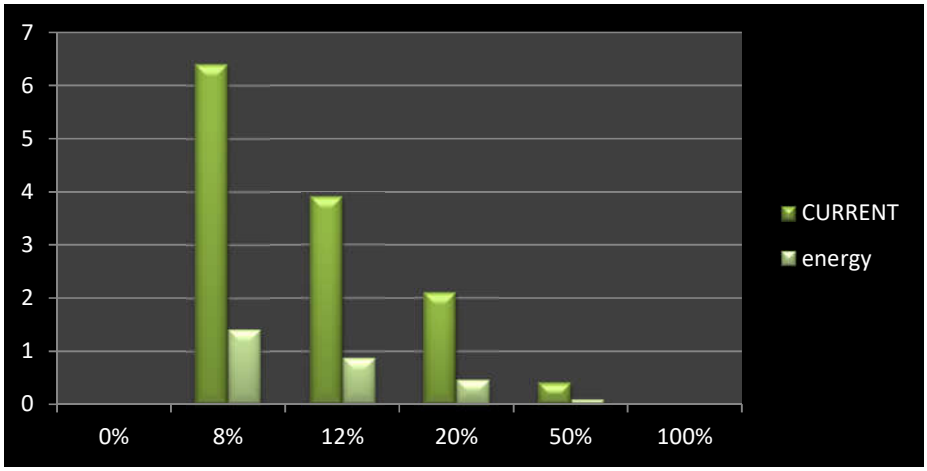
Load percentage (%)	Voltage(volts)	Current(amps)	Power(watt)	Energy(kwh)
0	204	0	0	0
8	220	6.4	1408	1.408
12	223	3.9	869	0.869
20	220	2.1	462	0.462
50	218	0.4	87	0.087
100	225	0	0	0

Comparison between voltage and power at different load percentages



Load VS Voltage and Power

Comparison between current and energy at different percentages



Load VS current and energy

IV. CONCLUSION

Based on the above results, we discussed about the main issues and challenges for the Smart Grid, with the help of Smart Grid User can check daily consumption from any location using internet. Smart grid represents one of the most promising and prominent internet of things applications. From the above results we had find out the power, current, voltage power theft , faulty grid to the efficient transmission of electricity. Also all the results are implemented in webpage so end-client could effectively and safely take an interest in the energy consumption/production equilibrium. Internet of Things, is the subsequent stage towards an all-around and inescapable association with any correspondence and calculation empowered articles/gadgets, in any case their entrance innovation, accessible assets and area.

The smart Grid can exceedingly profits by the IOT vision. By the help of IOT ,things allows object to be sensed and controlled remote across the existing network infra-structure creating opportunities and more direct integrated between the physical as well as computer based system and regulating in improved efficiency. Apart from this by the use of IOT the country economic can grow up easily. Now day's power theft is major issue and is increasing day by day. It mainly affects the economy of the country. In order to overcome all these problems we can use IOT to stop these issues

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