International Research Journal of Engineering and Management Studies (IRJEMS)
Volume: 03 Issue: 04 | April -2019 e-ISSN: 2395-0126

A review and case study on automatic generator monitoring using GSM module for better performance of Indian Power distribution system

Naveenkumar R Kulkarni*, Aniket Divati[1], Akshay Kadam[2], Paresh Vilkar[3], Talif Latif[4],Adish Shah[5]

* Asst. Professor, Dept. of Electrical Engineering, Sanjay Ghodawat Institutes, Kolhapur, India
1-5, UG Students, Dept. of Electrical Engineering, Sanjay Ghodawat Institutes, Kolhapur, India
Mail:akshaykadam8397@gmail.com , pareshvilkar552@gmail.com , aniketdivati1010@gmail.com

Abstract — **In Maximum infrastructure companies the use of Generators has become a very common, Industries, hospitals, Townships etc. while using these Generators the most challenging task is maintaining the Quality of grid power, asset protections, generator maintenance, real time capturing, monitoring the generator through remote, monitoring the fuel theft, Data collection Analysis issues, Human dependency etc. The specific design of Generator Monitoring System (GMS), detects pre-alarms or failures, and also emergency power generators which monitors engine operations and ensures you of increase generator availability.The main purpose of GMS is to monitor the power generators which is being placed at the remote areas and also it increases its efficiency by monitoring various parameters of generator and also reporting the critical problems by minimizing downtime and maximizing the availability by sending generator failure messages instantly to you for diagnosis and emergency service dispatch if required.**
It works on GSM technology, in which GMS can monitor various parameters such as external power supply, the battery voltage, fuel level, etc. This complete system of automatic generator monitoring system provides an ideal solution for the problems caused due to wired connection between a remote appliances or devices. The main purpose of complete project is to analyse and test the use of mobile phones to remotely monitor an appliance control system through GSM based wireless communication.

Keywords- Generator switching, GSM module, ADC, micro controller, transformer, automatic transition system .

I. INTRODUCTION

The development of project basically comprises of three sections : GSM MODULE, Microcontroller, Sensor; each of them having a specific area of operation and function.As the name of the project implies we will focus on operating the generator using GSM system.The real time point to point data reporting architecture is useful for remote surveillance and control. In the new age technology mobile phone redefines technology, Sending written text messages is very popular among mobile phone users. Remotely the user can efficiently monitor and control via mobile phone by sending commands in form of texts. This system gives ideal solutions to the problems caused in situations when a wired connection between the appliance and the control unit is not practical . This is done by remote control. GENERATOR Control device is possible through Embedded Systems. The use of "Embedded System in Communication" has given rise to many interesting applications that fortify comfort and safety to human life . The main aim of the project is to design a SMS electronic generator control toolkit which can be able to replace the traditional generator control Devices. The toolkit receives the SMS, validates the sending Mobile device Identification Number (MIN) and perform the desired operation after necessary code conversion. The system is made efficient by SIMs so that the SMS can be able to received by number of devices boards in a locality using techniques of time division multiple access. The main components of the toolkit involving microcontroller, GSM modem. These components are placed with the device board and hence include the wireless features. The GSM modem gets the SMS. The AT commands are serially send to the modem. In return ,the modem sens the stored message through the wireless link. The microcontroller confirms the SMS and then runs specific task on the device. The microcontroller used in this case is ATMEL AT89C52 .Motorola W220 is used as the GSM modem. In this prototype model, for simulation purpose LCD display is used. The results presented in the thesis support the proper functionalities and working of the system. The timing diagram suggests the retalization of the modem to different AT (attention) commands.

II. NEED FOR GSM SYSTEM FOR MONITORING

The hunch delineated of this project is immense in the ever changing technological world. It allows a greater degree of freedom to an different to sway via GSM. In particular the suggested system will be a powerful, that can be changed easily (flexible) and secure tool that will offer this service at any time, and from anywhere with the constraints of the technologies being applied. The controllers are able of sensing and controlling the different parameter of generator in steady conditions and abnormal condition .this proposed system givess the immediate solution for catastrophic failure of generator using GSM communication. The embedded controller offers a high level scope of application in the field of remote digital controllers in the diesel generator industry. Automation forms substation active, upgraded and allows

bidirectional power flow through it. SAS need for analyzing globally the response of system in cause of fault take place. Substation automation control threats and security requirement. Improve PQ by using power devices in automating the substation. Power Quality Improvement using specific Power Devices in Squirrel Cage Induction Generator Wind Farm to Weak-Grid connection by using Neuro-fuzzy control. Kopella Sai Teja, R.B.R.Prakash.

III. DESIGN AND IMPLEMENTATION METHODS FOR GENERATOR MONITORING

3.1. Smart Emergency Generator Monitoring System through IoT using IEC 61850.

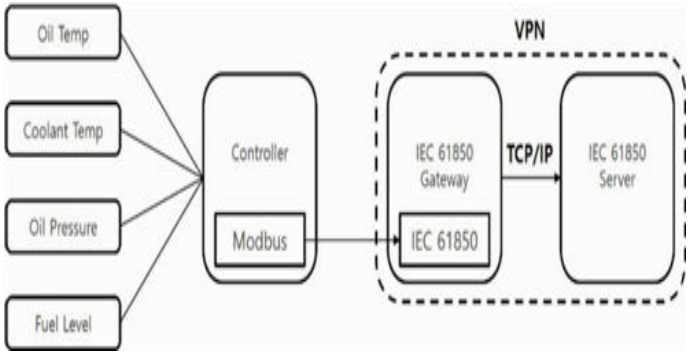

Figure 3.1 Architecture for IoT system

Korea Electrical Safety Corporation's statistics dated June 2013, the country wiyh 69,986 emergency generators with a total capacity of 21GW, which is equivalent to the capacity of nearly 20 nuclear power generating unit. If from them some of emergency generators are utilized ad demand resources, they might significantly decreases peak power. To get in use the emergency generators, we required integrated system because the resources are dispersed. The integrated system will help reducing the energy wastage by continuously monitoring and controlling the emergency generators. Since the system has TCP/IP protocol with Ethernet modem in order to fix t IoT. The values from sensors can be continuously monitored and alarmed over/under values for electrical safety. Automation system online makes user to operate the system even when user is not in vicinity of the automation. Emergency generator maintenance lists by KOSHA CODE are fuel system, lubrication system, cooling system, exhaust system. Maintenance steps divided visual inspection, inspection, replacement, cleaning, test and R is replacement if necessary. Inspection period is separated every week (W), every month(M), every quarter(Q), every half(S), everssy year(A). The user should make a plan to manage emergency generator and operate the system. However, it needs a remote monitoring and controlling technology due to field manager do not reside. The advances in computer, control and analysis, and communication technologies make new multi-functional universal devices, generally called IEDs (Intelligent Electronic Devices), have been developed to provide an integrated device for measuring, metering, and some basic monitoring and control functionalities. Such IEDs are net worked over high-speed communication networks based on standardized communication protocols. The use of existing communication standards and commonly accepted communication principle jointly with the new standards.

3.2. Emergency Generator Monitoring System using Android.

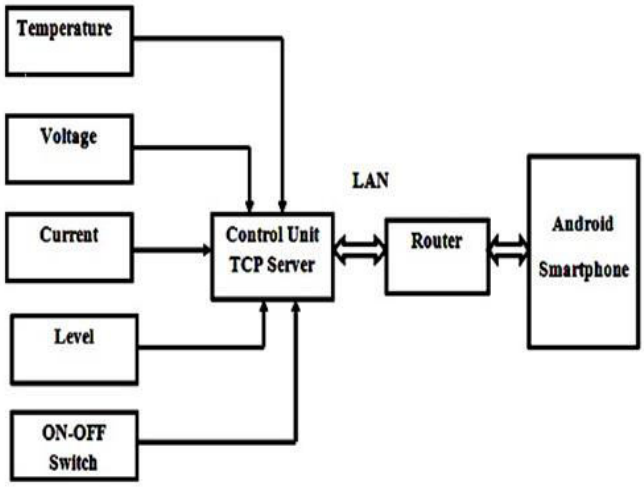

Figure 3.2 a) System Design and Implementation process for android

This system fundamentally consists of two parts, the controlling part, and the monitoring part; describing how the application controls the electrical generator, and offers a range of monitors to help keep the user up to date with the significant aspects that affect the functionality of the generator. The control that this paper offers to the user is the ability to start and turn off the generator in case of malfunction or when being present in a remote location without the need to be near the generator allowing the user easy access to generator and providing more security. The monitoring part allows the user to keep in touch with the major components that the generator acquires to operate properly, the fuel level, its temperature, in addition to keeping the user on a minute to minute basis.

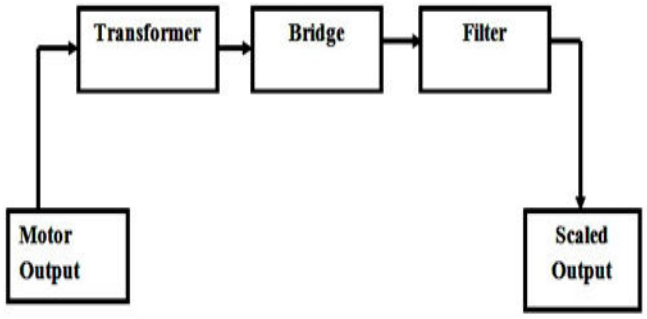

Fig.3.2. b) Self made voltage sensors

3.3. Generator control using GSM module.

The system has two parts, hardware and software. The hardware architecture has a stand-alone embedded system that is based on Microcontroller a GSM handset with GSM Modem and a driver circuit. The GSM modem gives the communication by means of SMS. The SMS message is sent to the GSM modem through the GSM public networks as a text message with a definite prefixed format. Once the GSM modem receives negative signal from the EB supply, it sends the SMS to the user consisting of non-availability of power supply, fuel level, coolant temperature, etc.

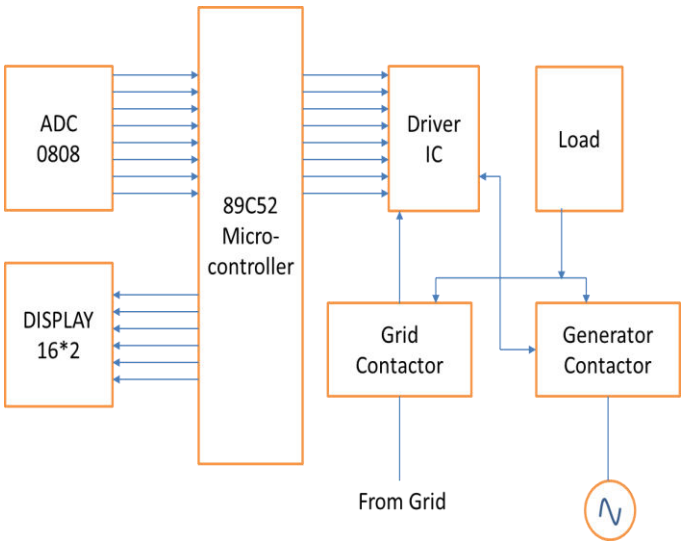

Figure 3.3. Block Diagram for generator monitoring depicting hardware components

The main components of the toolkit also with microcontroller, GSM modem. These components are integrated with the device board and hence incorporate the wireless features. The GSM modem accepts the SMS. The AT commands are serially send to the modem. In return the modem transmits the stored message via the wireless link. The microcontroller proves the SMS and then perform specific task on the device. The microcontroller used is ATMEL AT89S52 .Motorola W220 is used as the GSM modem. In this prototype model the LCD display is used for simulation purpose. The results presented in the thesis support the specific functionalities and working of the system. The timing diagram prepare the response of the modem to various AT (attention) commands. This remote controlled generator control device is possible via Embedded Systems. The use of "Embedded System in Communication" has given rise to many interesting applications that ensures fine and safety to human life . The main vision of the project will be to design a SMS electronic generator control toolkit which will be able to replace the traditional generator control devices. The toolkit receives the SMS, validates the sending Mobile Identification Number (MIN) and perform the desired operation after necessary code conversion. The system is made capable by SIMs so that the SMS can be received by number of devices boards in a locality by using techniques of time division multiple access.

3.3.1.Software Implementation:

send and receive SMS or make/receive voice calls.

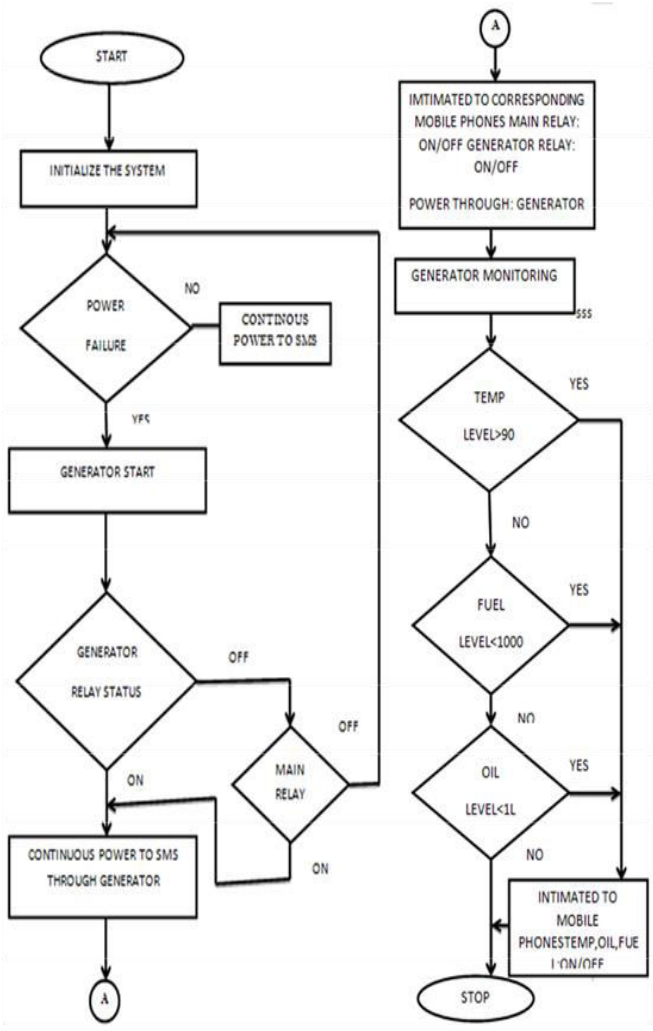

Fig. 3. Flow Chart.

Figure3.3.1. Flowchart for software implementation

3.2. Algorithm

Step 1: Start the program

Step 2: To initialize the system

Step 3: Get Hardware Software for relevant application.

Step 4: To monitoring the generator performance and EB power and if any abnormal conditions occur it is automatically intimated to authorized person.

Step 5: If new SMS received on mobile and go to step3 else, go to step1

Step 6: Receive SMS

Step 7: Check SMS pattern

Step 8: Control the device based on performance and operator can making a decision.

Step 9: Notify end user

Step 10: Go to step1

3.3.2. Simulation using Proteus

The proteus design is one of the proprietary software tool suite used generaly for electronic design automation. The software is used for electronic design engineers and technicians to form schematics and electronic prints for building of printed circuit boards (PCB).

Simulation Diagrams:

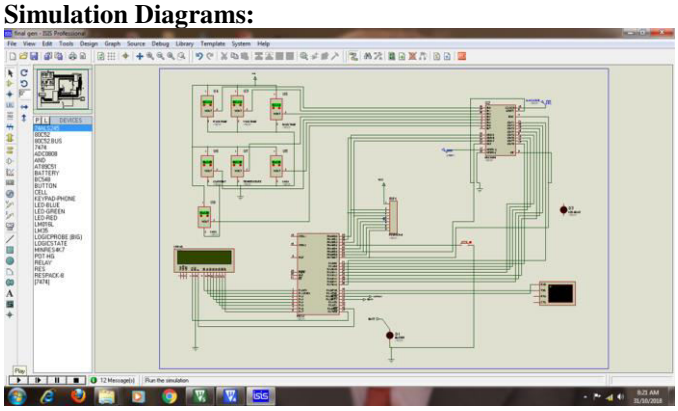

Figure 3.3.2.a) Proteus architecture when supply is OFF

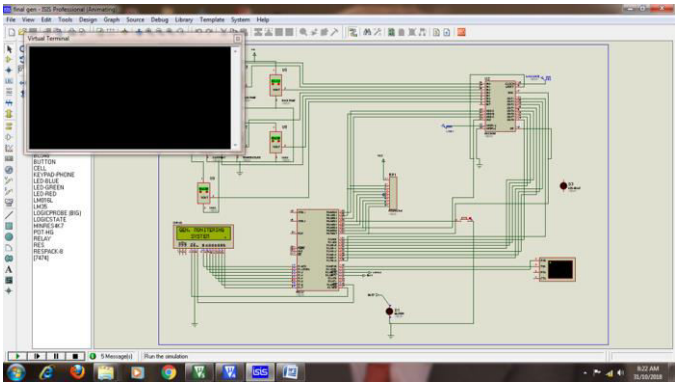

Figure 3.3.2.b) Proteus architecture when system is in normal operating state

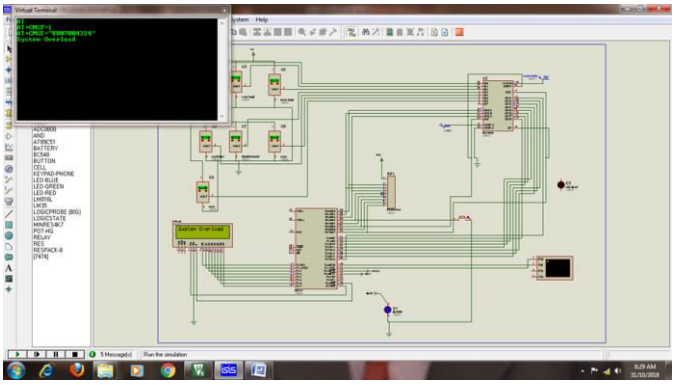

Figure3. 3.2.c) Proteus architecture when system is under disturbance

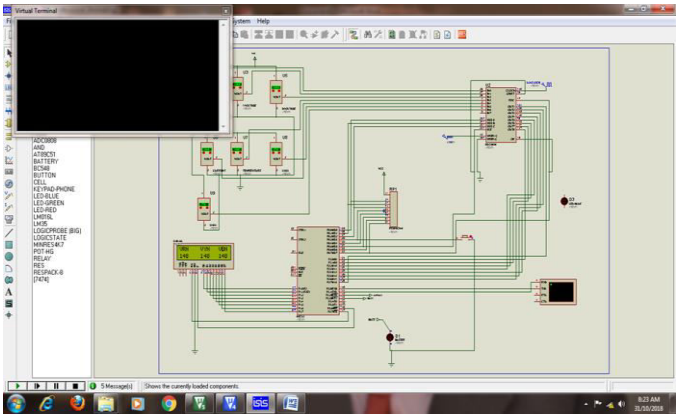

Figure 3.3.2.d) Proteus architecture when supply is ON

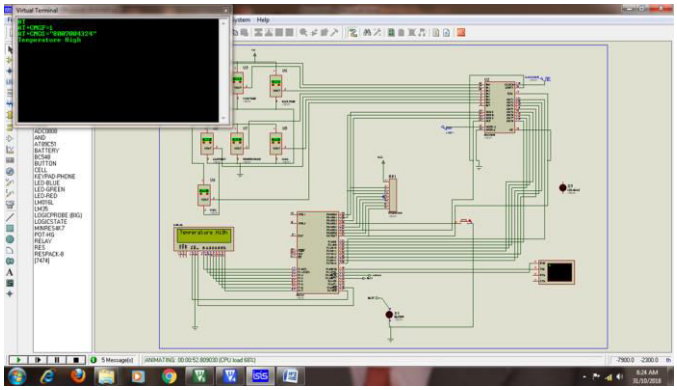

Figure3. 3.2.e) Proteus architecture for sudden increase in temperature of generator

3.3.3. Selection of hardware components

The Relay switching stage: This block has the combination of the voltage monitoring relay(VMR) and the finder relays (11-pin relays) which serve as sensor used to determine the availability of voltage supply from either power sources before triggering the control sections of the ATS. The VMR is used for computing and differntiating the voltage level of the utility supply with a set voltage tolerance range (185-250V A.C).

The Timer relay Stage: This block is form a delay timer relays operating as normally open timed closed (NOTC) timer relays on each section of the ATS. The Timer relay on the benefit section helps to delay the supply of electric power from the public utility section, thus preventing the existance electrical damage due to fluctuations in voltage supply. The Timer relay on the GENERATOR section is helps to stabilize the power generator and able to allows it to warm up before it finally supplying power to the connected load. The delay time for the utility timer relay is 5-6 seconds while that of the generator is about 10 seconds occured.

The contactor switching stage: This block is made up of Contactors on each side of the ATS (i.e. in this, the utility contactor (KN) and the generator contactor (KG)). The function of the contactor is to switch the current to the connected loads easy and healthy. This is because they able to handle large amount of current flow in electrical installations. The maximum load rating of the contactors is 12Amps.

CONTACTOR SELECTION

In this ,input voltage supply from either power sources

(V) = 220-240V

a.c supply Generator power rating

(P) = 2.5KVA

Assuming Power factor (Cos Θ) = Unity

Rated generator set current (I) in Ampere = 11.36 ≈ 12A

Therefore the contactor selected for the ATS is a 12A rated contactor.

IV. CASE STUDY

A DG room used as a backup located at Sanjay Ghodawat University, Kolhapur in western Maharashtra is considered for case study analysis. It feeds power to the entire institutional buildings of the locality. This is given to three distribution transformer, where each feeds to two villages. The capacity of transformer is 4MW each, namely T1, T2 and T3. Each feed to feeder village T1 feed to Hatkalangle and Atigre T2 fed to Alate and Nimshirgaon and T3 only feed to Jathar i.e domestic and agriculture feeder.

There are three incoming lines connected ti incoming bus bar namely 220KV Tilwani, choundeshwari (Jaysingpur) and Kumbhoj 33KVsubstation in Kolhapur District of Western Maharashtra. In case if 220KV main line Tilwani fails the supply continuity is maintained by rest three. In faulty conditions, test charge are done at the interval of 5 minutes. If after test charge fails again supply trips then and that particular faulty feeder is disconnected from healthy line.

This Substation is modeled in Power Word Simulator (PWS) and it is simulated to understand the variation in generation and load switching for different feeders connected.

V. RESULTS AND DISCUSSION

By using Proteus Simulation software, considered generator system is modelled and case wise analysis is done. The generator parameters such as temperature, oil level, voltage, current, etc. are displayed on the display once the simulation is completed. The obtained outputs are helpful to tabulate time schedule of generator monitoring to maintain system parameters with in standard limits. This data is taken as reference and work is in progress to develop Automatic system that can monitor load fluctuations and take intelligent decisions on critical conditions using GSM module.

This paper is an attempt to understand the present advancements in the fields of generator protection system and results obtained on case study clearly demands a huge scope on improvements to be done in generator monitoring asystems to upgrade system performances. We are currently working with development of Intelligent and smart system that can manage substations in better way with reduced human efforts and updates of work carried will be explained in our upcoming papers with successful experimentation and validation of results with real time systems.

ACKNOWLEDGEMENT

We would like to express gratitude to the engineering staff and management of Sanjay Ghodawat Institute, Kolhapur for constant support and guidance. We also thank to all technical staff of Electrical DG Room (Sanjay Ghodawat University), Kolhapur, Maharashtra, India for their support in carrying out case study.

REFERENCES

[1] "Microcontroller Monitoring and Gsm Modem applied Control System" IOSR Journal of Electrical and Electronics Engineering, ISSN: 2278-1676 Volume 1, Issue 6 (July-Aug. 2012).by Amit Sachan,

[2] Mallikarjun Sarsamba "The Load Monitoring and Protection on Electricity Power lines using GSM Network"

[3] International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 9, September 2013 ISSN: 2277 128X.

[4] S.Vimalraj, Gausalya.R.B, "GSM Based Controlled Switching Circuit between Supply Mains and Captive Power Plant" International Journal of Computational Engineering Research, Vol, 03, Issue, 4.April 2013.

[5] Kwang Seon Ahn "Diesel Generator Digital Controller with applications" International Journal of Information Processing Systems, Vol.2, No.3, December 2006.

[6] Henrik arleving "ways to cut power generator maintanence"the journal, December 2013.

[7] "Base Transceiver Station (BTS) Safety and Fault Management", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-3, Issue-7, December 2013.by Chetan Patil, Channabasappa Baligar

[8] Y Jaganmohan Reddy, Y V Pavan Kumar, K Padma Raju, Anilkumar Ramsesh, "PLC Based Energy Management and Control Design for an Alternative Energy Power System with Improved Power Quality", International Journal of Engineering Research and Applications (IJERA) ISSN: 22489622 Vol. 3, Issue 3, May-Jun 2013.

[9] Alper T. Alan "A Field Study of Human-Agent Interaction for Electricity Tariff Switching", Agents, Interaction and Complexity Group, University of Southampton, Southampton, UK.