An Advanced Energy Management System Facilitated by GSM with Automated Power Scheduling

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Abstract

Electricity is one of the most popular forms of energy used in the modern society. Nowadays, electricity energy demands are increasing constantly. The availability electrical energy is also serious issue since demand is greater than generation. One way to meet those electricity energy demands is use of energy management systems to monitor and effectively manage major loads in response to demand and generation programs. This paper presents application of GSM-SMS technology for real time data acquisition. The application is based on a field data collection prototype system that is composed of field monitoring and host control platforms. This monitoring system consist of a new energy calculation algorithm, offering electricity packages with a intelligent monitoring system for daily power consumption connected to base-station via GSM network. Various data can be then fed and integrated into existing energy management systems located at power companies or organizations to provide the services without man-power. Energy Management System leads to savings in the overall cost. An Energy Management Controller (EMC), is used which checks electricity consumption and generation and remotely manages the load. Whenever utility company sends a command for load shedding, low priority appliances are cut off from power supply so as to reduce peak demand. The priority of the appliances can be set by the user through an easy interface to the EMC. The EMC contains a smart energy meter, a GSM modem, a microcontroller and a relay circuit (GSM), which is connected between the energy meter and the load. Power is equally shared here.

Keywords- Demand response, Energy management, GSM, Power scheduling, Power sharing, Smart grid, UPS

I. INTRODUCTION

Electricity is one of the most popular forms of energy used in the modern society. Nowadays, electricity energy demands are increasing constantly. The availability electrical energy is also serious issue. Demand of electricity is greater than that of generation of electricity. The difference between increasing demand and installation capacity appeals the researchers to design a system that help to reduce this threatening rise in peak. One way to meet those electricity energy demands is use of energy management systems to monitor and effectively manage major loads in response to demand and generation. This paper presents application of GSM-SMS technology for real time data acquisition. The application is based on a field data collection prototype system that is composed of field monitoring and host side control platforms. This monitoring system consist of a new energy calculation algorithm, offering electricity packages with a intelligent monitoring system for daily power consumption connected to base-station via GSM network. The proposed energy meter system when incorporated with embedded controller and GSM modem can be used to transmit the data like consumed energy in kWh, generated bill, security services (line Cut/On) over GSM mobile network. Such a data can be then fed and integrated into existing energy management systems located at power companies or organizations to provide the services among the customers without man-power.

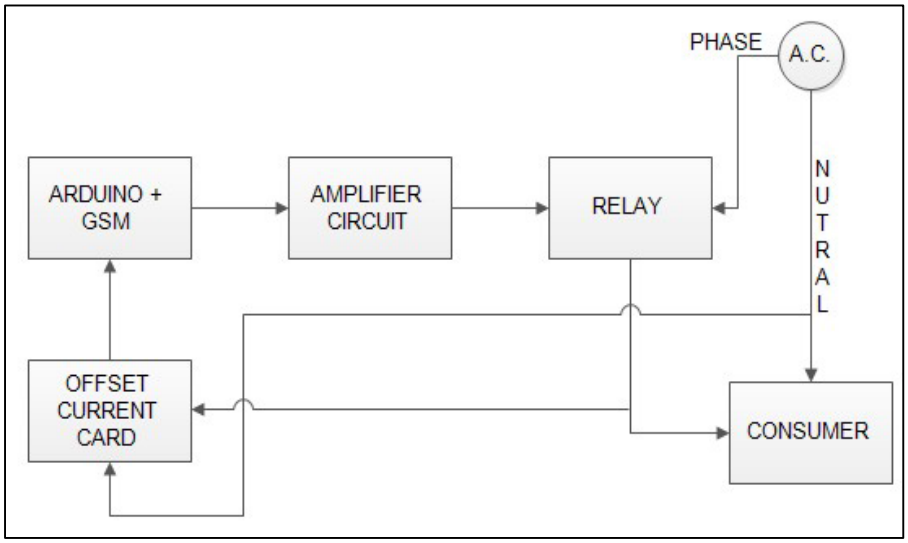

Fig. 1: Block Diagram of Proposed System

Energy Management System leads to savings in the overall cost. These savings may be come from better utilization of manpower, servicing cost, savings in the energy consumption, and non-breakdowns in the system. An Energy Management Controller (EMC), is used which checks electricity consumption and generation and remotely manages the load.. Whenever utility company sends a command for load shedding, low priority appliances are cut off from power supply so as to reduce peak demand. The priority of the appliances can be set by the user through an easy interface to the EMC. The EMC contains a smart energy meter, a GSM modem, a microcontroller and a relay circuit (GSM), which is connected between the energy meter and the load. They are three control modes full, custom and limited mode. These modes are operated based on the power generated. The proposed power scheduler is so designed that power is equally shared between all loads.

II. OPERATING PRINCIPLE

In India, there is a large difference between the peak demand and available electrical energy. But what will happen if available energy is used without load shedding. In this system the available electrical energy is distributed equally to each consumer. Consider 1 MW of energy is generated and consumers are 1000. Then this energy is equally distributed or as per requirement. This required value of energy is set through GSM shield. If this energy is distributed equally then each consumer can utilize energy up to 1000 Watt. If consumer exceeds the consumption value 1000 Watt then offset current card gives signal to the microcontroller and microcontroller activates the relay, which results in cut off power supply of that consumer. This system can be implanted into available Energy mater. The amplifier circuit is used to protect the control system form excessive current. There are three modes of operation full, custom and limited. In full mode the allocated power can be utilized fully as the consumer wish. Also the any type of load can be used. Whereas in custom mode, the power allocated is less than the full mode allocation and here also any type of load can be operated. But the consumer runs the risk of being cut off if the consumer uses the power allocated to him. In limited mode the power allocated is below the half of power allocated in full mode. The consumer is allowed to run the loads that are prescribed by the power generation board. By this, efficient use of power can be implemented and load shedding situation can be avoided.

A. GSM Shield

The main agenda to use the GSM shield is that there should not be restriction of distance. Connect the microcontroller GSM shield to microcontroller possible to access the internet. Just plug this module onto your microcontroller board, plug in a SIM card from an operator offering GPRS coverage and follow a few simple instructions to start controlling your world through the internet. It is also possible to make voice call and send as well as receive SMS by using the GSM shield.

B. Offset Current Conditioning Card and Microcontroller

The offset data conditioning card clamp the A.C. with reference to the applied D.C. voltage. The value of reference D.C voltage set according to the maximum load ratings. The offset data conditioning card consist of two operational amplifiers, UA741CN which are operated in inverting mode. The first op-amp is used as summing amplifier. It adds up the input signal with the DC reference voltage. The output of the first op-amp is inverted using the second op amp which acts as an inverting amplifier. The output of this op amp is taken out as the output of the offset data conditioning card. Here the +12V is connected to current offset conditioning card to its proper action. The current offset conditioning card sent energy consumed by consumer to microcontroller. By comparing this values microcontroller decides to cut off or not the power supply.

C. Software Implementation

A microcontroller with USB is connected to computers and it is also possible to external electronic circuit, such as motors, relays, various sensors, diodes, microphones and loudspeakers etc. The microcontroller used here is ATmega328 IC. The microcontroller used as has dual power arrangement that means it can be powered using 5V D.C. A battery or supply can provided through USB connected to computer. The microcontroller is firstly programmed through computer and after disconnection it can work independently. The software has standard programming language compiler and it also contains boot loader that runs on the microcontroller board. The microcontroller works on Windows, Linux.

D. Information of Amplifier Circuit

The microcontroller gives signal to the relay. For operation of relay, current is needed. Relay draws current through control system. So op-amp is used since relay might damage the microcontroller by drawing current. And also amplifier circuit is used to protect the control system from damages. This control system contains transistor connected in common emitter voltage divider biasing mode, because if common emitter gain is nearly equals to 100 and voltage divider biasing provides the high stabilization.

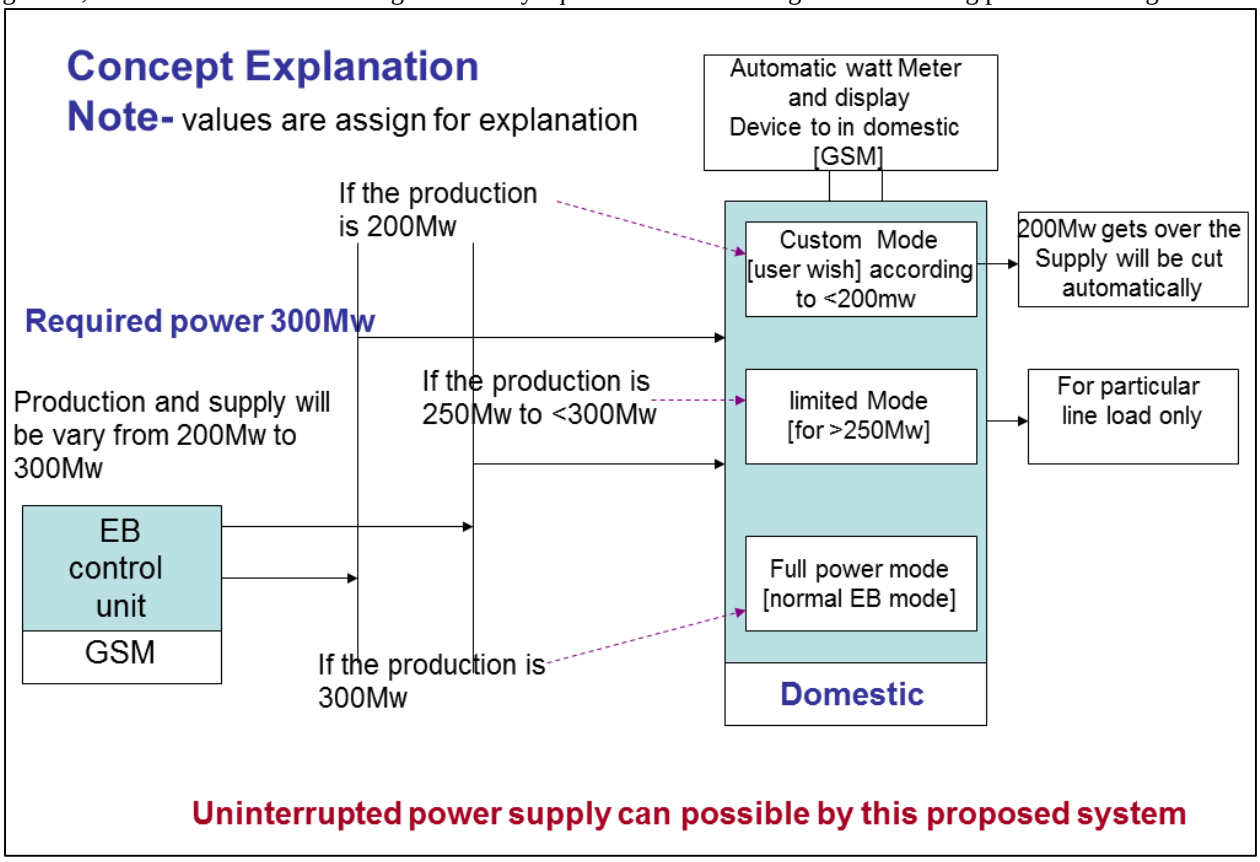

Fig. 2: Proposed System

III. CONCLUSION

The offset current conditioning card gives the energy consumed by consumer after 10 minutes to microcontroller. Microcontrollers sense this value; here this value is less than programmed value means less than 30 Watt. The relay will not activate and power of that consumer remains continue. The graph is plotted Energy Consumption vs. Time. Programmed value is 30 Watt. The consumer starts to consume the electricity. If consumer exceeds 30 watt then relay get activated and power supply of that consumer get cut off.

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