Intelligent Remote Battery Monitoring and Control System

Mr. Rahul Satish Ulagadde[1] Prof. S. B. Jamge[2]
[1]Student [2]Assistant Professor
[1,2]Department of Electronics Engineering
[1,2]Walchand Institute of Technology, Solapur

Abstract— Remote monitoring and control is one of the most important requirements for maximizing process plant availability. With the development of modern industry, the requirement for industrial monitoring system is getting higher. At remote places where continuous power requirement is necessary battery banks and inverters are used to cater the power to different systems and instruments, in case of AC mains failures. This means the life and proper functioning of batteries is very important aspect in such scenarios. The best way to ensure the integrity of backup power system is battery maintenance and a sound battery management program, which identifies and predicts battery failure. System measures the remote signals and controls the remote devices through reliable protocols and communication network as a web server. The main objective of this project is to provide uninterrupted power supply to a load, by selecting the supply from any source out of 3 such as mains, secondary supply, and solar cell automatically in the absence of any of the source. The demand for electricity is increasing every day and frequent power cuts is causing many problems in various areas like industries, hospitals and houses. An alternative arrangement for power source is a must. This arrangement can be designed by using Controller and relays. When a source, say mains fails the supply automatically shifts to next priority source and so on. The output could be a lamp can be used to show that which source is used to provide the supply.

Key words: Battery System, Web Server, Controller, Power Sources

I. INTRODUCTION

An important requirement of electric power distribution systems is the need for automatic operation. In particular, the rapid and reliable transfer of the system from one power source to another during certain system events is important to achieving the reliability goals for such systems and the facility serves. However, the design of such an automatic transfer system is all–too-often considered "less important" then many other aspects of the overall power system design.

As we know that the demand for electricity is increasing every day and frequent power cuts is causing many problems in various areas like Railway short station, industries, hospitals, offices and houses which are necessary to be prevented. An alternative arrangement for power source must be used. The main objective of this project is to provide uninterrupted power supply to a load, by selecting the supply from different sources such as mains, generator/secondary supply and solar automatically in the absence of any of the source and monitoring and control remotely.

The project of BMS (Battery Monitoring System) gives online and offline status of batteries which are monitored by the bank so that we can prevent the batteries prior to failure However, Battery Monitoring System specifically measure, record and analyze the individual cell and battery module parameters in detail. Continuous monitoring and analysis of these parameters can be used to identify battery or cell deterioration, hence prompting action to avoid unplanned power interruption. Battery Monitoring System (BMS) is a microprocessor based intelligent system capable of monitoring the health of battery bank. BMS calculates the battery's capacity, deterioration of batteries in battery bank during the charge / discharge cycles and actual efficiency of the batteries. It continuously monitors each cell in the battery bank to identify deterioration in the cell prior to failure, identifies the net charge in the battery bank by monitoring charging and discharging currents.

Battery management system (BMS) forms a crucial system component in various applications like electric vehicles (EV), hybrid electric vehicles (HEV), and uninterrupted power supplies (UPS), telecommunications and so on. The accuracy of these systems has always been a point of discussion as they generally give an error of maximum 10% considering all the parameters together. In this paper a system is presented which is developed using low cost microcontrollers for measurement of electrolyte temperature, electrolyte level and no. of backup hours parameters of lead-acid batteries. Since the batteries, which would be used in the hybrid electric vehicle (HEV), are lead-acid batteries, they will be the focus of this project. While the present prototype system accounts only for measuring backup hours of a car in a stationary as well as in a running mode. With the help of this, we are able to know the battery life span and its efficiency. Data backup is also provided to save the all records of battery.

With the increasing awareness of global warming around the world, the demand for clean fuel/energy is on the rise and as a result there is a continuous shift towards the electric vehicles (EVs) and hybrid electric vehicles (HEVs). Battery forms one of the most critical systems in any electric vehicle. Battery performance is influenced by factors such as depth of discharge (DOD), temperature and charging algorithm. EVs and HEVs use battery management system (BMS) to address the implementation of monitoring system parameters such as current, voltage and temperature. This paper attempts to provide a measurement of electrolyte temperature, electrolyte level and no. of backup hours parameters of lead-acid batteries.

The another system is developed and it consists of total 5 slave modules connected to each 12V battery unit. This unit collects all data regarding battery and sends it serially to master microcontroller.

A. Slave Unit:

To each 12V battery, there is a Slave unit is attached, which is used to measure surrounding temperature, actual voltage level of a battery. This unit is also indicates the low water level in a battery. This data is then sending serially to a Master unit. Block diagram of a slave unit is shown in Figure 1.

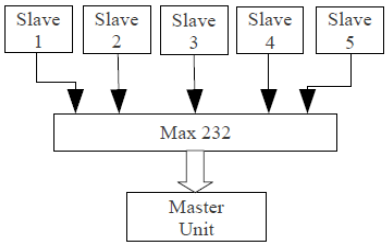

Fig. 1: Slave Unit

B. Master Unit:

This is a main part of this system. It is used to collect all data coming from Slave via RS232 cable. It also records this data with respect to time with the help of RTC and sends it to a LCD and PC. Hall Effect IC is used to measure current. The block diagram is shown in Figure.2

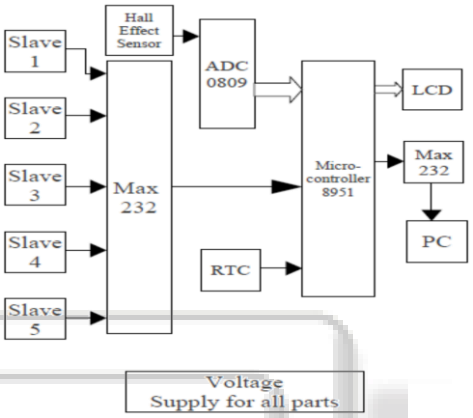

Fig. 2: Master Unit

In particular, the rapid and reliable transfer of the system from one power source to another during certain system events is important to achieving the reliability goals for such systems and the facility serves. However, the design of such an automatic transfer system is all–too-often considered "less important" then many other aspects of the overall power system design. This paper deals with the four switches to demonstrate the respective failure of that power supply. The switches used are of "normally open" type switch. When any of the switches is pressed it shows the absence of that particular source, switches are connected to PLC as input signals. A PLC of Allen Bradley Micrologix 1000 is used. The output of microcontroller is given to the relay driver IC, which switches appropriate relay to maintain uninterrupted supply to the load. The output shall be observed using a lamp drawing power supply from mains initially. On failure of the mains supply (which is actuated by pressing the appropriate switch) the load gets supply from the next available source, say a generator. If the generator also fails it switches over to the next available source and so on Four LEDS will be used to demonstrate the source of the power supply.

Using uninterrupted power supply in an automated mode, we always have a substitute arrangement as backup to take place of main power supply in case of power-cut in an emergency case, where the power cut cannot be avoided. In many cases load can be changed as per the requirements, it could be a motor, lamp or anything else which is essentially required at the time.

In some applications, human beings have been replaced by unmanned devices that will acquire data and relay the data back to the base. There are data-acquisition and control devices that will be a substitute for a supervisor in a multisite job operation [1].

Different nontechnical and technical methods were proposed in the past to monitor and control power supply to avoid the breakdown.

This project uses four switches to demonstrate the respective failure of that source of supply. A controller family is used. The output of the controller is given to the relay driver IC, which switches appropriate relay to maintain an uninterrupted supply to the load. When any of the switches is pressed it shows the absence of that particular source. Switches are connected to controller as input signals. The output is observed using a lamp drawing power supply from mains initially.

On failure of the mains supply (which is actuated by pressing the appropriate switch) the load gets supply from the next available source, say an secondary supply. If the secondary supply also fails it switches over to the next available source and so on. The current status, as to which source supplies to the load is also displayed on an LCD.

In these applications, data are compiled in a central server and are then served to the clients via the Internet. The client framework is in a central server and has all the applications. A person that needs to access any data must first access the server. In this system, a reliable bidirectional Point-to-Point Protocol (PPP) link for real-time control and surveillance via web. In an embedded PC card placed on the Internet allows interaction through commands sent through Transmission Control Protocol/IP (TCP/IP) and User Datagram Protocol [2]

II. PROPOSED SYSTEM

The major drawbacks of above methods and system will be overcome in our proposed project. As per railway communication system or any other communication field where uninterrupted power supply is required .Some site are unmanned or some are at remote location where man cannot reach immediately after failure of supply. To avoid this we implementing a remote monitoring auto power supply control system which reduces this downtime and significantly reduces downtime cost.

In this paper embedded systems and Internet technology are combined to form a new technology the Embedded Internet Technology, which developed with the popularization of computer network technology in recent years. The heart of communication is TCP/IP protocol. Network Communication is performed by the IEEE 802.3 Ethernet standard. It is the most modern technology of embedded systems. Since ARM embedded web server based on Raspberry Pi has fast execution capability and Ethernet standard can provide internet access with reasonable speed, this system is suitable for enhancing security in industrial conditions by remotely monitoring various industrial applications.

The implementation of embedded Internet technology is achieved by means of the embedded web server. It runs on embedded system with limiting computing resources to serve web documents including static and dynamic information about embedded system to web browser. We can connect any electronic device/equipment to web server and can obtain the real-time status information and control remote equipment without time and space

restriction through web page released by embedded web server. Embedded server is a single chip implementation of the Ethernet networking standard. It consists of two primary elements communicating with each other: i) a server consisting of an ARM processor with an Ethernet controller and ii) a client computer which is connected to controller through this RJ45 interface. The client computer sends/receives data to/from the arm microcontroller using TCP packets.

Fig.1. Embedded Web Server Module The client has to enter IP address to access this server. This request is taken by the operating system of the client and given to the LAN controller of the client system. The LAN controller sends the request to the router that processes and checks for the system connected to the network with the particular IP address. If the IP address entered is correct and matches to that of the server, a request is sent to the LAN controller of the server and a session is established and a TCP/IP connection is establishes and the server starts sending the web pages to the client through which we can remotely monitor and control the sensor and device status respectively.

In this paper we are proposed to develop a web based monitoring system that will select one of the available power source automatically for providing uninterrupted power to the load through battery and provides information of health condition of battery.

The information about connected power source, health condition of battery is forwarded to remote PC using internet for a required action to be taken.

The availability of AC mains input voltage is checked and if it is available then that will be given to the battery and then to the load. On the failure of AC mains supply the battery will get supply from the next available source i.e. secondary supply. If the secondary supply also fails, it will switch over to the next available source automatically by the controller action, and so on. If all supply sources fail, the load gets supply from the battery.

The system will continuously monitor battery parameters like battery voltage, battery temperature and also measure battery Run Time (Time for which supply to load was given from battery). The information about present power source and battery parameters on site is forwarded to remote pc using internet and appropriate action will be taken if necessary.

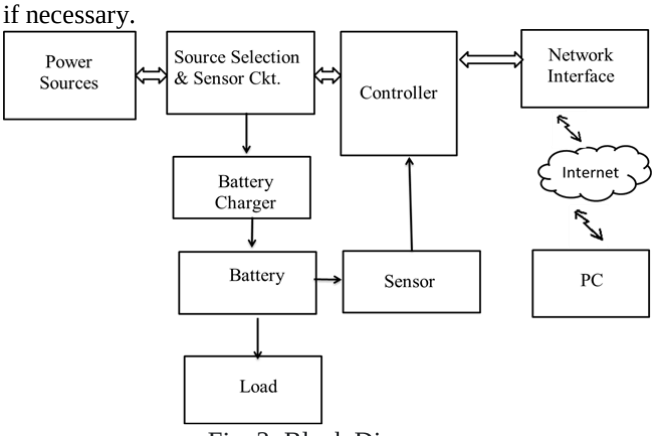

Fig. 3: Block Diagram

The proposed method uses client server architecture for monitor and controlling conditions at remote location. Controller is the responsible part for measuring signals and controlling the devices. Measurements can be done by DACS mode and the data are shared with clients through embedded web. The real time operating system manages all the tasks such as measuring signals, conversion of signals, sending HTML pages and connecting/ communicating with users.

This paper deals with the three switches to demonstrate the respective failure of that power supply. The switches used are of "normally open" type switch. When any of the switches is pressed it shows the absence of that particular source, switches are connected to Controller as input signals. A Controller is Raspberry Pi is used. The output of microcontroller is given to the relay driver IC, which switches appropriate relay to maintain uninterrupted supply to the load. The output shall be observed using a lamp drawing power supply from mains initially. On failure of the mains supply (which is actuated by pressing the appropriate switch) the load gets supply from the next available source, say a secondary suply. If the secondary supply also fails it switches over to the next available source and so on. Three LEDS will be used to demonstrate the source of the power supply.

Using uninterrupted power supply in an automated mode, we always have a substitute arrangement as backup to take place of main power supply in case of power-cut in an emergency case, where the power cut cannot be avoided. In many cases load can be changed as per the requirements, it could be a motor, lamp or anything else which is essentially required at the time.

III. Conclusion

The proposed work will select one of available power source for providing uninterrupted power to the load through battery. The system also provides information of health condition of battery for driving the load. The information about present power source and battery parameters on site is forwarded to remote pc using internet and appropriate action will be taken if necessary.

Acknowledgments

We would like to take this opportunity to thank one and all who have provided their valuable advice, without their guidance this work would not have been a success, we have to thank who have helped us directly or indirectly since they have given us more than just guidance. Our profound thanks to Dr. S R Gengaje, Head of the Department, Department of Electronics Engineering, Walchand Institute of Technology, Solapur and for his invaluable advice and constant encouragement to complete this work in a successful manner. I would like to convey our sincere thanks to management and supportive staff of Walchand Institute of Technology, Solapur, for encouraging us to come up with this paper work.

References

[1] Boccaletti C.; Fabbri G. & Santini E. (2007). Innovative Solutions for Stand Alone System Powering, Proceedings of INTELEC, pp. 294-301, 978-1-4244-1628-8, Rome (Italy), September 2007, IEEE, Rome.
[2] Indian Railway Telecom Manual.

[3] Yu-Lung Ke, and Ying-Chun Chuang. A Novel Single-Stage Power-Factor-Correction Circuit With High-Frequency Resonant Energy Tank for DC-Link Inverters. IEEE Transactions on Circuits And Systems—II: Express Briefs, Vol. 53, no. 2, FEBRUARY 2006.pp.115-119.
[4] The Embedded Web server based Electrical Ethernet Monitoring system using ARM, International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 5, May 2013 K.Bharath reddy1, Ch. Rajendra Prasad
[5] Jacek W, "Embedded Internet technology in process control devices," IEEE Internet Computing, Vol. 34, 2000.
[6] Implementation of Tcp/Ip on Embedded Web Server Using Raspberry Pi In Industrial ApplicationBhuvaneswari.S1, Sahaya Anselin Nisha. A2International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 3, March 2014.
[7] Journal of Information, Knowledge and Research in Electronics and Communication Engineering ISSN: 0975 – 6779| Nov 12 to Oct 13 | Vol– 02, Issue - 02 Page 583.
[8] Implementation Of Smart Industrial Automation System Using Embedded Web1 MR. R. C. Aghara, 2 Mr. R. H. Bhuva, 3 Prof. D. S. Pipalia 1.
[9] Yu-Lung Ke, and Ying-Chun Chuang. A Novel Single-Stage Power- Factor-Correction Circuit with High-Frequency Resonant Energy Tank for DC-Link Inverters. IEEE Transactions on Circuits and Systems—II: Express Briefs, Vol. 53, no. 2, FEBRUARY 2006. Pp.115-119.
[10] Manivannan M & Kumaresan N. Anna University of Technology Coimbatore Coimbatore, Tamilnadu, India "Embedded Web Server & GPRS Based Advanced Industrial Automation Using LINUX RTOS",Vol. 2(11),2010, 6074-6081.
[11] Auto Power Supply Control From Four Different Sources: Mains, Solar, Inverter and Generator To Ensure No Break Power Garima Pandey1, Khanda Anum2, Waqar Ateeq3, Vivek Tripathi4IJSART - Volume 1 Issue 4 –APRIL 2015 SN [ONLINE]: 2395-105

