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New Age UPS with Battery Monitoring using Raspberry Pi

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ABSTRACT: In this paper a real time web based system is proposed to monitor and 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 at remote site. The whole system is built on Raspberry Pi using the Raspbian operating system and framework library for remote access. The programming of the system is done by using Python for GPIO programming of Raspberry Pi development board. The availability of three input sources are detected by ADC and information is forwarded to Raspberry Pi using SPI protocol. The information about available and connected and disconnected power sources are detected by using logger function which log the data in a file. Threading library used for continues sensing of the all sources. The port forwarding technique used to access the system remotely. This gives information about connected power source, health condition of battery is forwarded to remote PC using internet for a required action to be taken. This dissertation attempts to study the remote monitoring and control is one of the most important requirements for maximize the process plant availability.

KEYWORDS: Battery, Power source detection, Remote monitoring, Remote Controlling.

I. INTRODUCTION

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 power supply 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 monitors the remote signals and controls the remote devices through reliable protocols and communication network. 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 Raspberry Pi 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. 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. 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. This paper deals with the three switches

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to demonstrate the respective failure of that power supply.

II. METHODOLOGY

In our system we are designed two modes of operation, one is auto mode and other is manual mode. Depending upon priority basis the availability of solar cell input voltage is checked and if it is available then that is be given to charge the battery and then to the load. On the failure of solar cell supply the battery will get supply from the next available source i.e. Primary supply (Mains1). If the primary 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 information of selected power source and the present condition of battery parameters is forwarded to remote pc using internet. In a manual mode provision of selection of input power source other than prescribed priority list is made available on remote pc. This is helpful during some unwanted situation. The system will continuously monitor battery parameters like battery voltage, status of battery(charging/not charging) and selected power source to charge the battery. The individual testing of different modules are developed and the final setup was made arranging all devices in proper manner. After this final arrangement the whole system was tested. The available all three power sources are made step down by using voltage divider circuitry. Output of divider circuit is read by specified ADC channel and then the analog value is converted into digital by means of analog to digital converter in order to read controller by using SPI protocol. R Pi is programmed to read this digital value corresponding to source selected it is stored in the controller. The ADC is continuously sense sources .This data is logged in a file it contains all information about available, connected power source and battery voltage .The final arrangement was made and the system was run, the data from proposed system received by RPi which is acting as server. Now when a remote computer requests for this data to the server it serves the data through a webpage as displayed in fig.The protocol used for the communication between webserver and web browser is Hyper Text Transfer Protocol or HTTP protocol. This protocol defines all the basic frame work of web communications by handling requests and also by providing control information to be transferred between browser and server.

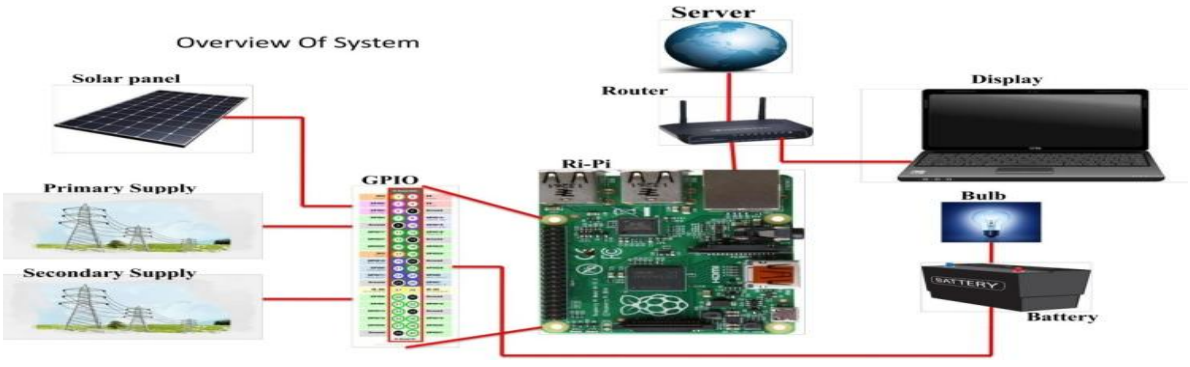

Figure 1. Structure of system

III. SOFTWARE DESIGN

The main hardware structure of the remote monitoring and controlling system based on Raspberry Pi .The remote monitoring and controlling system based on R Pi platform has high universality. Sensors is used for current sensing from three different sources monitoring and for process control. There are three input sources are chosen I.e. Solar Mains

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1(Primary supply),Mains 2(Secondary supply).There are two modes of operations
1 . Automatic Mode 2.Manual Mode
In auto mode source is selected depending upon priority based to charge the battery. In manual mode the source is selected depending upon user choice as which is convenient to them to charge the battery. The Only three power sources are considered for supplying power to charge the battery. Load up to 1 A will be considered for the system. The three input sources are selected depending on priority basis i.e. I/O channel of ADC can select a depending on mode of operation. The variety of electrical and non electrical signals like current, voltage, resistance etc. are continuously monitored by current sensor. These all data is read by ADC and forwarded to Raspberry Pi by using SPI protocol

A. RASPBERRY PI

The Broadcom SoC used in the RaspberryPi is equivalent to a chip used in an old smartphone (Android or iPhone). While operating at 700 MHz by default, the RaspberryPi provides a real world performance roughly equivalent to the 0.041 GFLOPS. On the CPU level the performance is similar to a 300 MHz Pentium II of 1997-1999, but the GPU, however, provides 1 GPixel/s, 1.5 Gtexel/s or 24 GFLOPS of general purpose compute and the graphics capabilities of the RaspberryPi are roughly equivalent to the level of performance of the Xbox of 2001

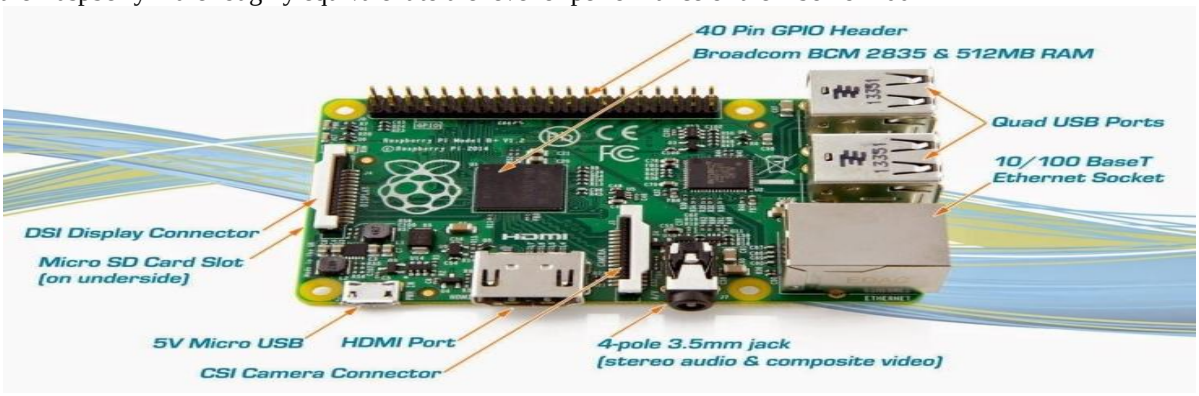

Fig2.raspberry pi

a) Powersource

The Pi is a device which consumes 700mA or 3W or power. It is powered by a MicroUSB charger or the GPIO header. Any good smart phone charger will do the work of powering the Pi.

b) SD Card

The Raspberry Pi does not have any onboard storage available. The operating system is loaded on a SD card which is inserted on the SD card slot on the Raspberry Pi. The operating system can be loaded on the card using a card reader on any computer.

c) GPIO– General Purpose Input Output

General-purpose input/output (GPIO) is a generic Pin on an integrated circuit whose behavior, including whether it is an input or output Pin, can be controlled by the user at run time.GPIO Pins have no special purpose defined, and go unused by default. The idea is that sometimes the system designer building a full system that uses the chip might find it useful to have a handful of additional digital control lines, and having these available from the chip can save the hassle of having to arrange additional circuitry to provide them.
GPIO capabilities may include:

- GPIO Pins can be configured to be input oroutput
- GPIO Pins can beenabled/disabled
- Input values are readable (typically high=1,low=0)
- Output values arewritable/readable
- Input values can often be used as IRQs (typically for wakeup events)

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B. RESPONSIVE SCREEN DESIGN

In today's world of smart devices and internet of things (IoT), web pages that we design using JAVA are not enough to display all pages on standard device like laptop or computer. This generates a need to create web pages responsive. In responsive design pages becomes device agnostic or in simple word if one web page we are observing using web browser on laptop, it will align its display characteristics as per laptop. If same page is being accessed using same browser using tablet / mobile phone, page will align its display characteristics of tablet / mobile phone.

This kind of responsive design ensures same data across multiple devices is shown seamlessly.
In earlier cases if we want to get same content of website on mobile phones, one need to design mobile app. One mobile app will never serve the purpose. Hence in order to maintain single data source, we need to maintain a) Website b) android app c) iOS app d) Multiple app's per tablet support.Because of this responsive screen design data creation and maintenance is only once and output we produce is device agnostic.

III. FUTURE SCOPE

- To have a surveillance of the battery room, a CCTV camera can be placed and can be remotely monitor through this device.
- Further a provision can be made to add a series of batteries.
- Output load can be monitored

IV. CONCLUSIONS

We have implemented new age ups with battery monitoring using raspberry pi system that will select one of the available power source automatically for providing uninterrupted power to the load through battery and also which is screen responsive.

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