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Raspberry Pi based Intelligent UPS System

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Abstract

In this paper we propose an automated intelligent UPS. This system will be priority based where higher priority will be decided according to the requirement of situation .The normal UPS system only switches on the backup power when mains is absent. But it can't differentiate the devices according to the level of priorities. This system will first identify the capacity level of battery and differentiate the devices for activation according to its own priority levels. Likewise higher priority devices will be given maximum time thus optimum use from available charge in the battery.

Index Terms: *Raspberry pi, voltage regulator, Sensor, etc.*

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1. INTRODUCTION

Anyone who has ever used a Windows, Linux or OSx machine know the drill If you aren't aware of why this needs to be done then just stop for a moment and consider what might happen to your computer if it were to be turned off while it was in the pro cess of writing to a file. If it happens to be an important system file then it may well refuse to boot up the next time you turn it on. The Raspberry Pi and other similar machines are no different. Some of my clients solve the problem by simply providing general purpose UPSs to keep all of their equipment alive during power outages. Some ignore the problem all together think ng that it probably won't happen very often and if it does then t hey will simply re-program the SD card. They have considered the risks and decided that a UPS is more trouble than it's worth

. Using classic widely available UPS from any computer shop f or back-up power for your Raspberry Pi might seem as a pretty good idea. Until you find out problems assigned with these cheap off-line UPS. One of the main problems is that some models last 50 minutes maximum (no matter how much battery is charged, it will power off after certain time amount). Second problem comes with double voltage conversion. Normally UPS use built-in 12V battery which is converted to 230V AC voltage (if you have UPS under low load there will be pretty high lost) an d then 230V AC is converted with your Raspberry Pi adapter t o 5V DC. So there are two conversions, time limit and most importantly cheaper UPS do not allow you to measure battery voltage(you may buy more expansive one and connect it to your Raspberry Pi with USB UART convertor. Considering these Facts I do not recommend classic computer UPS Some people are starting to use one of the "Smart Raspberry Pi UPSs" that are slowly becoming available and we will also make it priority based.

2. BLOCK DIAGRAM & ITS DESCRIPTION

In this Project, The entire home is fully automated and installed by intelligent UPS system by RPI.Each Room will have the lights and Fan for demo purpose. Let's suppose there will be total 6 device in home out of which 4 are connected to UPS system, then these 4 devices will be categorized in priority levels. Let's suppose Battery level is 80% and light goes off then the system will start 4 devices out of 6. Let's assume pc is on highest priority (device2) and battery goes down 40% then system automatically shutdowns Device with 3rd and 4th priority. Meanwhile if user shuts down any of the high priority device then system will automatically transfer power from higher priority to lower priority device like turning on 3rd priority device. In this way the system will work.

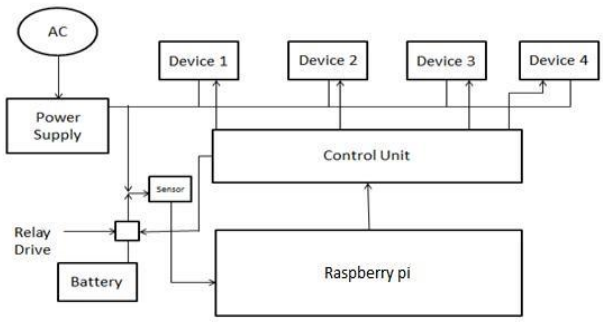

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Fig No. 1 Block Diagram

3. COMPONENT & DESCRIPTION

3.1 Raspberry Pi

The Raspberry Pi is a series of credit card-sized single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and developing countries. Several generations of Raspberry Pis have been released. The first generation (retrospectively known as the Raspberry Pi 1) was released in February 2012 in basic Model A and a higher specification Model B. Improved A+ and B+ models were released a year later. The Raspberry Pi 2 was released in February 2015 and Raspberry Pi 3 in February 2016. These boards are priced between US$20 and 35. A cut down "compute" model was released in April 2014, and a Raspberry Pi Zero with smaller size and limited input/output (I/O), general-purpose input/output (GPIO), and abilities released in November 2015

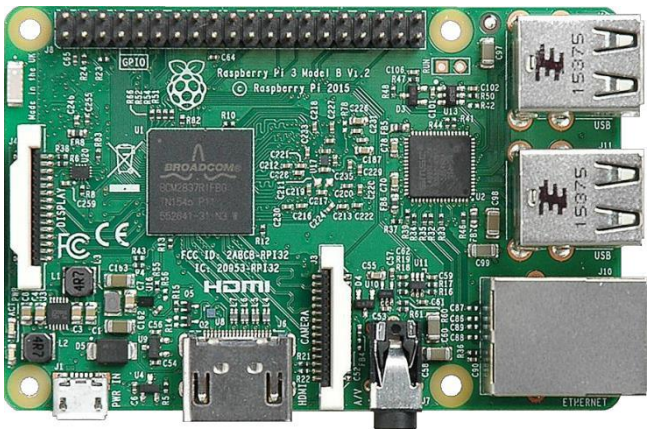

Fig No. 2 Raspberry Pi

All models feature a Broadcom system (SoC), which includes an ARM compatible central processing unit (CPU) and an on chip graphics processing unit (GPU, a Video Core IV). CPU speed ranges from 700 MHz to 1.2 GHz for the Pi 3 and on board memory range from 256 MB to 1 GB RAM. Secure Digital (SD) cards are used to store the operating system and program memory in either the SDHC or MicroSDHC sizes. Most boards have between one and four USB slots, HDMI and composite video output, and a 3.5 mm phone jack for audio. Lower level output is provided by a number of GPIO pins which support common protocols like I²C. The B-models have an 8P8CEthernet port and the Pi 3 has on board Wi-Fi 802.11n and Bluetooth.

3.2 Relay Driver

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations

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Fig No. 3 Relay Driver

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contractor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

3.3 Transistor

The BC547 is a general-purpose NPNbipolar junction transistor commonly used in European electronic equipment. It is notably often the first type of bipolar transistor hobbyist's encounter, and is often featured in designs in hobby electronics magazines where a general-purpose transistor is required. The BC547 is low in cost and widely available.

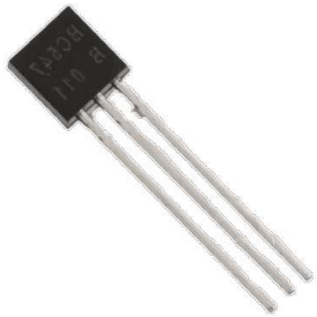

Fig No.4 Transistor

As viewed in the top-right image, going from left to right, the p inout is as follows: lead 1 (left in diagram) is the collector, lead 2 is the base, and lead 3 is the emitter. The BC547 part number is assigned by Pro Electron, which allows many manufacturers to offer electrically and physically interchangeable parts under one identification.

3.4 LED

A light-emitting diode (LED) is a two-lead semiconductor light. It is a p–n junction diode, which emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light.

Fig No. 5 LED

An LED is often small in area (less than 1 mm^2) and integrated optical components may be used to shape its radiation pattern. Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared light. Infrared LEDs are still frequently used as transmitting elements in remote-control circuits, such as those in remote controls for a wide variety of consumer electronics. The first visible-light LEDs were also of low intensity, and limited to red. Modern LEDs are available across the visible, ultraviolet, and infrared wavelengths, with very high brightness.

3.5 Voltage Regultor

The 78xx (sometimes L78xx, LM78xx, MC78xx...) is a family of self-contained fixed linear voltage regulator integrated circuits. The 78xx family is commonly used in electronic circuits requiring a regulated power supply due to their ease-of-use and low cost. For ICs within the family, the xx is replaced with two digits, indicating the output voltage (for example, the 7805 has a 5-volt output, while the 7812 produces 12 volts). The 78xx line are positive voltage regulators: they produce a voltage that is positive relative to a common ground. There is a related line of 79xx devices which are complementary negative voltage regulators. 78xx and 79xx ICs can be used in combination to provide positive and negative supply voltages in the same circuit.

Fig No. 6 Voltage Regulator

78xx ICs have three terminals and are commonly found in the TO-220 form factor, although they are available in surface-mount, TO-92, and TO-3 packages. These devices support an input voltage anywhere from around 2.5 volts over the intended output voltage up to a maximum of 35 to 40 volts depending on the model, and typically provide 1 or 1.5 amperes of current

3.6 Motor

A DC motor is any of a class of electrical machines that conver ts direct current electrical power into mechanical power. The m ost common types rely on the forces produced by magnetic fiel ds. Nearly all types of DC motors have some internal mechanis m, either electromechanical or electronic, to periodically chang e the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force a nd motion in a straight line

Fig No. 7 Motor

DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

3.7 Sensor

D1 is the voltage reference zener. Tied to this is a string of divider resistors (R2-6) that set the various fixed voltage levels. R7 & 8 form a voltage divider to that reduces the battery voltage by a factor of 3. U1 is an LM339 quad comparator that compares the various voltages from the two dividers. The comparator sections have open collector outputs that simply function as switches to operate the LEDs. D7 protects against reverse battery connection.

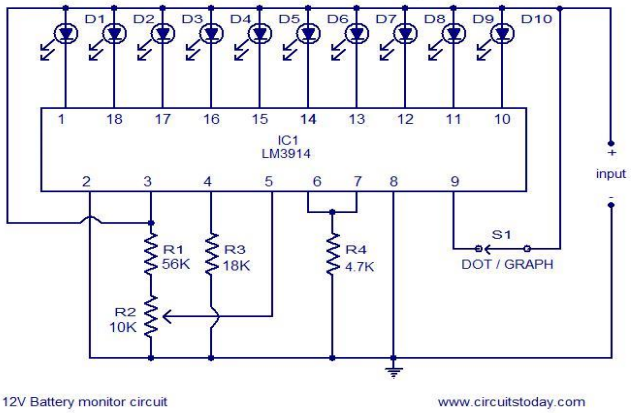

Fig No. 8 Sensor

The LEDs are biased to operate at about 4mA which is quite bright if modern LEDs are used. This current can be adjusted simply by varying the series resistors (R9 through R13).

4. Conclusion

In this paper we have proposed an automated intelligent UPS system. Hence if power fails we will be able to use high priority devises for maximum time like PCs, mobile charger rather than Air conditioner, television etc. In this way we can get optimum use from available charge in the battery.

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