UNINTERRUPTIBLE POWER SUPPLY MONITORING SYSTEM WITH VISUAL BASIC

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ABSTRACT

In industrial process today, reliability of equipment is very important. Power supply must be able to cater the need of industrial process. In case of power failure, backup power supply system must be able to support the main process plant. This is to ensure smooth operation and product quality. In order to do this, uninterruptible power supply (UPS) system can be used as to ensure the reliability, stability and consistency of the entire system. These UPS system must be monitored in order to enable them to react accordingly in response to a fault or power failure.

In this project, UPS monitoring system using visual basic is designed to provide a safe and constant 12VDC supply in the case of power disruption. The main power supply, 240VAC is converted to 12VDC as output voltage and a battery will be used as part of the backup system. This system will be able to control the source of power which offers power from LIVE line or power from BATTERY line. The main output voltage is 12VDC and the battery level will be monitored using GUI software created using visual basic.

INTRODUCTION

Power back-up system is essential and has been used by industries all over the world to ensure their machines or equipments operation running smoothly without having the effect of power disruption. Therefore, the power back-up system is very important to make sure the system work properly. There are often cases that the power back-up system do not work properly when needed and this failure caused losses in term of time and money to industries. A system that be able to monitor this power back-up system can detect any abnormal activities occurred to the system. In addition, the system can prevent any fault that may affect the whole operations.

Uninterruptible power supply (UPS) systems have enabled the improvement of power source quality, providing clean and uninterruptible power to critical loads such as industrial process controls, computers, medical equipment, data communication systems and protection against power supply disturbances or interruptions [1-3]. UPS provides stable supply to the system in the present/absence of the input supply [4]. It is important for the UPS system to be able to take over immediately that full load in power outage or out-of-tolerance situation to avoid any data loss, uncontrolled system shut-down or malfunctioning of the device [5]. Commonly, the UPS topology can be classified as off-line UPS, line interactive UPS and on-line UPS. There three topologies were discussed details in [2-6].

This paper presented on-line UPS monitoring system with visual basic. The on-line consists of a rectifier, charger, battery and static transfer switch. Under normal line conditions, the load is directly supplied from the live line as shown in Figure 1. After power failure, a battery continues supplying power to the load. Batteries are charged, as necessary when line power is available. The monitoring system using Microsoft Visual Basic is designed to monitor the constant 12VDC supply from live line and from the battery when power failure is occurred. The prototype of on-line UPS is designed and output voltage is monitored using Graphical User Interface (GUI) software in order to monitor the overall system.

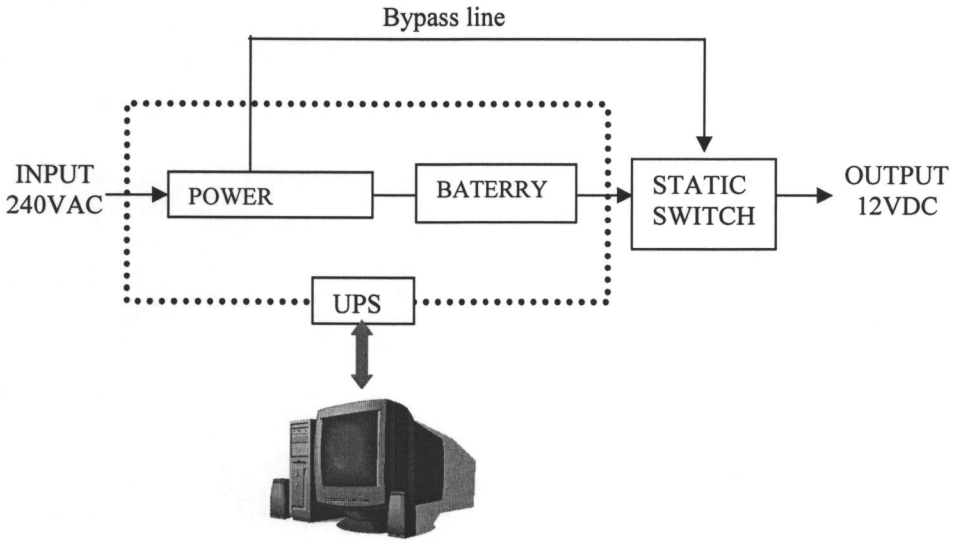


Figure 1. Block diagram of on-line UPS

DESIGN METHOD

A simple UPS is designed by using transformer, 1N4001 diodes, capacitors and 7812 regulator to produce 12VDC voltage. The output voltage is supplied to battery as backup and to the live line output. The 12VDC is then connected to 7805 regulator to produce 5VDC voltage. This voltage will be used by microcontroller and others components that required 5VDC voltage. The 5V circuit consisted of 7805 regulator that regulates the 12V voltage from the main circuit to 5V voltage level.

The AT89C51 8-bit microcontroller with 4K bytes flash is used to control overall system. This device is manufactured using Atmel's high density nonvolatile memory technology and allows the program memory to be reprogrammed in system. The DC-to-DC converter that maintains ± 12VDC output with the input range between 9VDC to 18VDC is designed using TRACOPOWER TEN8-1222. The output voltage is then supplied to A/D converter AD574JN that operates in unipolar operation. The AD574JN conversion process is controlled by microcontroller.

The microcontroller consists of Port 0, Port 1, Port 2 and Port 3. Port 0 is connected to AD574JN to control the converter and also connected to relays to control the line switching. Port 1 and Port 2 is connected to AD574JN as an input to convert data by A-to-D converter. At Port 3, only pin 10 and pin 11 were used to transmit and received data. Furthermore, the microcontroller is connected to computer by using RS-232 interface. The RS-232 interface circuit consisted of a MAX232 and DB9 female connector. The relays are connected to battery line and live line to perform as a line switching during the interrupt occurred. The hardware is then will communicate with visual basic software to monitor and control UPS system as shown in Figure 2.

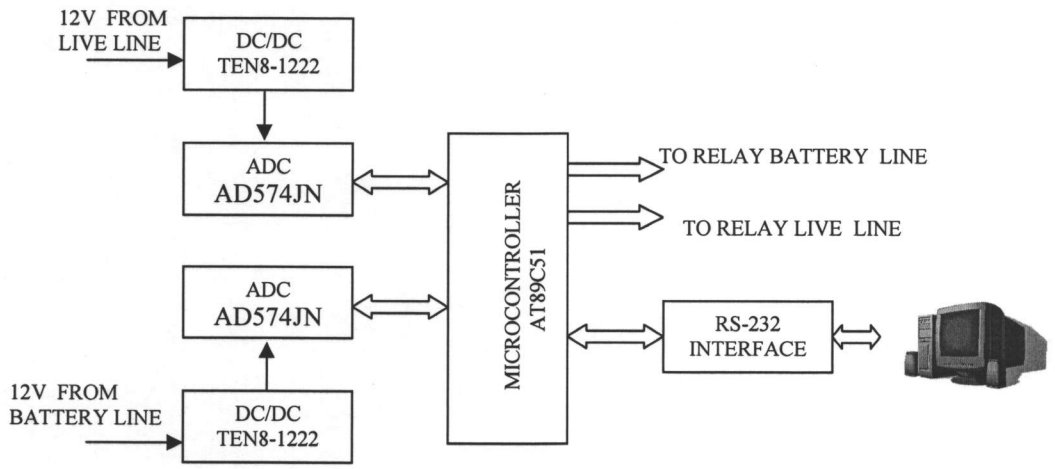


Figure 2. Block diagram for monitoring system

RESULT AND DISCUSSION

The hardware of the system consists of four main components which are power supply circuit, microcontroller circuit, relays circuit and converters circuit as shown in Figure 3. The components were constructed separately to make the circuit easy to troubleshoot. The power supply circuit is connected to main source 240VAC to produce 12VDC voltage. The GUI for the system which is UPS Workbench V1.0 was created using visual basic will communicate with the microcontroller and monitor the result as shown in Figure 4(a). The UPS interface indicated 12VDC from the live line. Furthermore, the power disruption was created by disconnecting the power line, the system monitor the output voltage at battery line which is 9VDC as shown in Figure 4(b). For the testing purpose, the 9VDC battery is used. When there is an error occurred, for example both lines have no power, the ERROR and FAULT indicator will appear as shown in Figure 4(c).

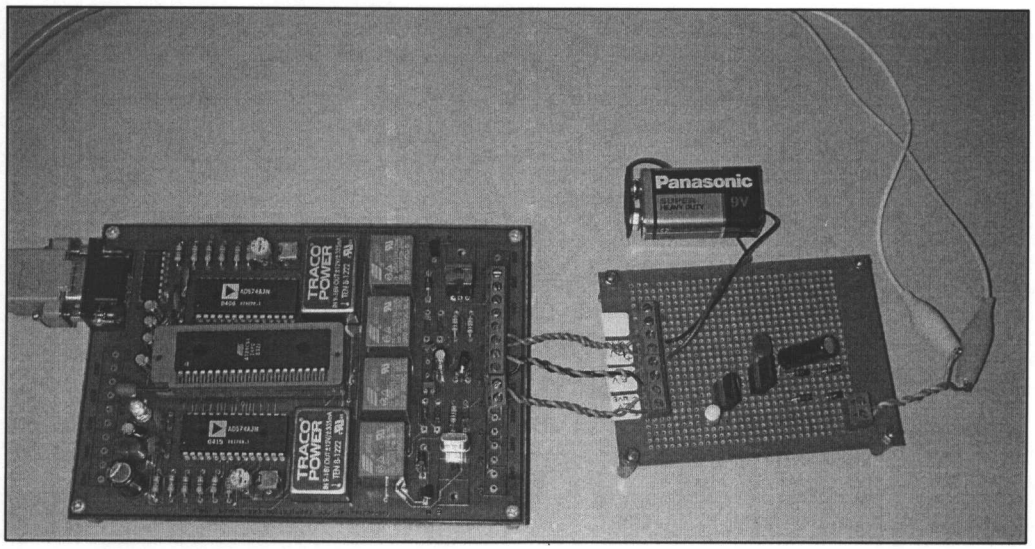
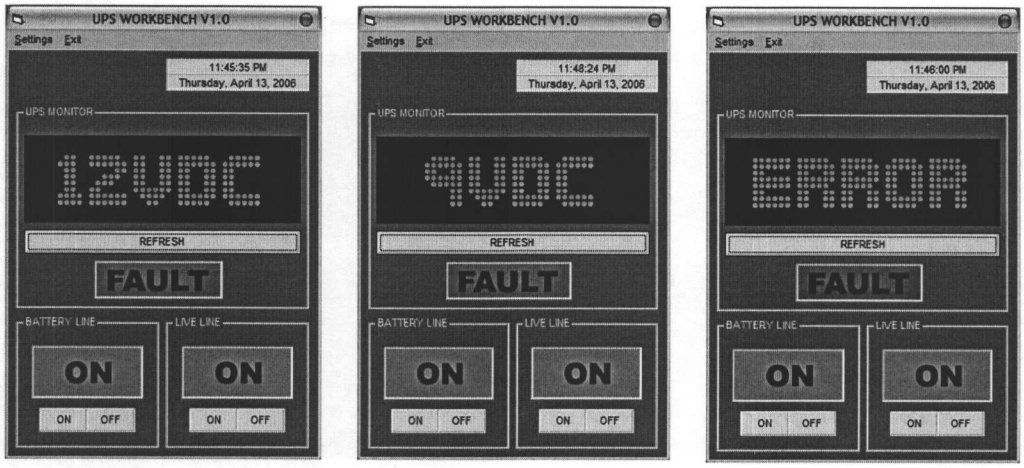


Figure 3: Hardware



(a) (b) (c)

Figure 4: Output voltage monitoring result. (a) From live line. (b) From battery line.(c) Power failure for both lines

CONCLUSION

It has shown that the UPS system can be monitored using visual basic. The 12VDC voltage from live line is indicated on the main interface on the screen. When the failure occurred on the live line, the voltage level form the battery is appeared on the screen. Furthermore, when there is an error occurred on the system, the ERROR and FAULT indicator will appear on the screen. Therefore, the on-line UPS power form live line or battery line and the overall system being able to monitor with visual basic is presented.

ACKNOWLEDGEMENT

The author wish to express his appreciation to the support and contributions of all those who assist in this research especially Northern University College of Engineering for sponsoring this research.

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