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Digital Autotransformer

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Abstract:
Now-a-days in many industries, line varying condition is handled by adjusting the rheostat knob of the autotransformer. This method has limitation i.e. human error while varying the potentiometer and Parallax error while taking the readings .The method is also time consuming. The scope of this project is to design a variable power supply using microcontroller and the power supply which is used in various applications. Thus the problem can be eliminated using automatically controlled autotransformer using dc servomotor i.e. 'digital autotransformer''.Automatic control will be achieved using digital feedback through a microcontroller and DC Motor. The direction of rotation of the DC-Motor is controlled by signals provided by the microcontroller.This technique of auto transformation by using digital feedback can be used as variable ac power supply and also to test the machines in the industry. The design of the system is simple and easy to implement. Through this work, we are expecting to get stable voltage at the output.

1. Introduction

The conventional method of controlling a variable power supply involves the meticulous task of adjusting a rheostat that is a knob on the instrument. This method has a lot of limitations such as human errors while varying the potentiometer, parallax error while taking readings, it is time consuming, and requires continuous monitoring in case of line voltage fluctuations. In order to get rid of these limitations, the demand was to design a system that is accurate as well as highly efficient which eliminates the human errors. A peek is taken into the world of computer-aided process. The present work is an implementation of micro-controller interfaced with servo motor mechanism where in the use of digital technology has improved the system's efficiency immensely that is quite widely used in industries and is now very important to industries where time is an important factor as regards to testing of electrical devices

2. Scope of the Project

The scope of the project is to design a Variable power supply using micro-controller. The power Supplydesigned can be used in various application areas such as:It can be used for testing of electrical devices having various ratings.It can be used for electronic appliances requiring DC voltage and hence an adapter or eliminator.It can be used in applications where the Voltage Values vary over a wide range and at each value of voltage the value has to be accurate.The motor interfaced with the micro-controller can also be used for several other purposes.

3. Block Diagram

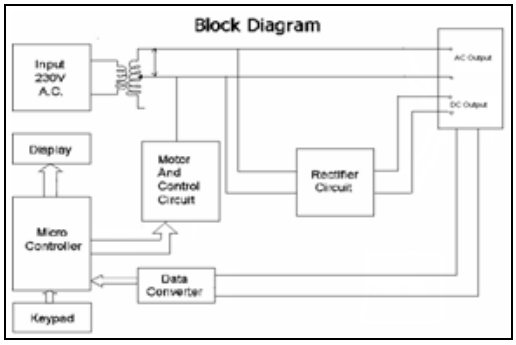

Figure 1

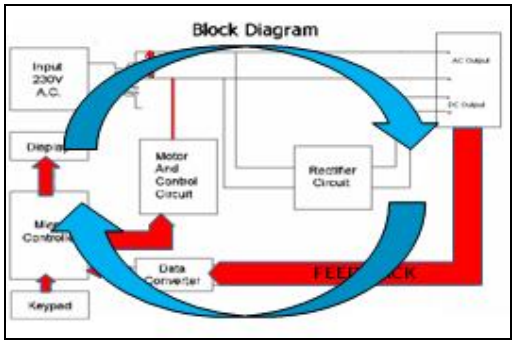

Figure 2

The system is entirely micro-controller controlled and starts functioning on being given an input through the keypad. On switching on the power the user has to type in the value of voltage required. This value is stored in the micro-controller in binary format. The typed value can be seen on the LCD. Then when the input is thus typed in the START key must be pressed. This begins the operation of the system.

The micro-controller now gives a start signal. The clock to the microcontroller is provided by IC 7414. The motor starts running and accordingly increases the variac output.

The voltage obtained at the output may not be exactly equal to the desired voltage; hence a feedback path is incorporated to the errors. The feedback path consists of a rectifier circuit followed by a data converter. The rectifier rectifies the AC output.

If the stored value is found to be less than observed value, then micro-controller sends a reverse signal to the MCC. The motor begins to run in the opposite direction and the above process is repeated. [15]

If stored value is more than received value then motor continues to run in forward direction and the feedback is again provided. This process continues till the observed value is equal to the keyed in value.

Thus, with the help of micro-controller an error free output voltage can be obtained effortlessly.

4. Algorithm

- Start.
- Initialize the microcontroller.
- Read the keypad inputs.
- Store the required voltage in microcontroller memory.
- Read the voltage at the output of ADC.
- Move the current output voltage into another memory location.
- Calculate the difference between required voltage and current voltage values stored in memory locations.
- If difference in voltage is POSITIVE (> 0) ,
  Rotate the motor in FORWARD Direction, Goto Step 5
- If difference in voltage is NEGATIVE (< 0) ,
  Rotate the motor in REVERSE Direction, Goto Step 5
- If difference in voltage is ZERO (= 0) ,
  STOP the motor.
- Display the current output on LCD.
- Go to step 5.

5. Advantages

- The system is not dependent on load, so it can be used for various other applications.
- The error detecting circuit can be used for detecting sudden fluctuations or dangerous increase in line current.
- No continuous monitoring is required.
- Parallax Errors and Human Errors are totally removed.The project aims at replacing a Person by an automated type of system, thereby replacing a skilled professional by an unskilled one

6. Limitations

- Speed of operation is a less.
- Power is consumed during the operation as compared to manual control

7. Applications

- The project was designed basically for testing electrical devices having various ratings. The testing of the electrical devices was done with the help of a manually adjusted power supply. This project enables one to test electrical devices having high voltage rating in a short time. When testing a batch of such devices, a substantial amount of time is saved.

- Can be used as a DC Power Supply after Rectification thus finding applications in various Laboratories and Industries.

8. Future Scope

- The motor interfaced with microcontroller can be modified to be used for various purposes such as solar tracking system, Telescope Range Monitering System, opening and closing of shutters or curtains, water level control by controlling valves, robotic appliances, etc.
- We were trying to display the input values by the LED display & in for future modification we want to provide touch sensitive keypad but as it lead to the complex circuit for the construction of display we decided to carry on with the LCD display and regular buttons

9. Conclusion

The Manually Controlled Autotransformer in which there are most of the time human error, parallax error occurs as well as continuous monitoring is required in case of line voltage fluctuation is replaced by Automatically Controlled Autotransformer in which no such error or continuous monitoring is required & system is thus highly efficient.

The design of the system is simple and easy to implement. The voltage obtained at the output is stable and accurate. The system is encased in a single compact assembly. Thus, the system is portable and occupies less space. The system needs only to be plugged in to a single phase AC supply. The various parts in the system requiring constant voltage are provided through the line voltage itself by means of rectifiers, adapters, transformers, etc.

The system is easy to use and extremely user–friendly due to the well programmed keypad and display. As components used are relatively less expensive and weight is placed on comprehensive programming, the system cost as well as complexity is reduced.

10. References

1. Bimal K Bose “Recent Advances in Power Electronics,IEEE Transactions On Power Electronics”, Vol7 No1, Jan 2010
2. Nang Kaythi Hlaing & Lwin Lwin Oo “Microcontroller-Based Single-Phase Automatic Voltage Regulator”. Department Computer University (PangLong) Myanma .
3. Mandeep Singh Walia ‘’Stepper Motor Control using 89C51’’,October 2004.
4. Moazzim, S. Rahaman, M A Martin,”Microcontroller based closed-loop automatic speed control of DC motor using PWM” Dept. of Electrical Engineering and ComputerScience, North South University.
5. Ahmed M. A. Haidar, ”Software Interfacing of Servo Motor withMicrocontroller” University of Wollongong, NSW, Australia J. Electrical Systems 9-1 (2013): 84-99 ..
6. Hanqing Xing, Hanjun Jiang ,” A Fully Digital-Compatible BIST Strategy for ADC Linearity Testing” Department of Electrical and Computer Engineering, Iowa.
7. Neil Rasmussen,“The Role o f Isolation Transformers in Data Center UPS Systems” Schneider Electric’s Data Center Science Center.
8. Modern Digital Electronics, Tata McGraw Hill – R.P.Jain
9. Microcontroller 8051, Pearson – Mazidi Mazidi