International Journal of Engineering and Technical Research (IJETR)
ISSN: 2321-0869, Volume-2, Issue-12, December 2014

Variable Power Supply Using Microcontroller

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***Abstract*— The advent of industry, hospitals, retail outlets and computers and computer controlled equipment entering the rural domain of India has necessitated the requirement of variable power supply for variety of equipment. For meeting this requirement a multipurpose supply source is envisaged. Until now, the digital supply has carried a variety of meanings: one whose parameters or functions are set digitally by external logic signals; or a power supply for a "digital system," like a cell phone; or a power supply providing a digital readout. The greater functionality and new monitoring features of today's power supply requires more sophisticated control and communications. In addition, requirements for lower costs, smaller form factors and compressed development cycles continue to escalate, pressing power supply designers as never before. The digital power supplies are proving to be a better and futuristic option over the analog power. The architecture of the microcontroller is out of the preview of this paper. A variable power supply is one where you can continuously adjust the output voltage to your requirements.**

The conventional controlling method of variable power supply that uses manual interference (using a rheostat) has been replaced by a servo motor which is controlled by a micro-controller. This in turn reduces the pain of adjusting the rheostat manually and also increases the efficiency of the system. Varying the output of the power supply is the re-commended way to test a project after having double checked parts placement against circuit drawings and the parts placement guide. Aimed at solving the practical problems envisaged in the power supply to the rural areas of India .It is a practical application of software for the controlled power supply from a single platform to a varied variety of equipment expected to be used in hospitals, BPOs etc. The software programming has been incorporate d using C language and has been kept out of the purview of this presentation as the program itself is a subject of independent presentation. The design has been made incorporating user friendly features and easy usage for the operators.

***Index Terms*— ADC, Digital System, Embedded C, LCD, Microcontroller, Robotics, VPS.**

I. 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 imple-mentation of micro-controller [2] interfaced with servo motor mechanism is the heart of the system wherein 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 important factor as regards to testing of electrical devices. This small report on Variable power supply is made to help even a novice understand how variable voltages are generated and what impact they have on testing and functioning of the industrial motors [2].

We prefer a digital power supply control over a range of the power supply. Analog one for the following reasons. Programming flexibility is the key advantage of digital over analog control [1]. The following design features have been incorporated for Programmability enables manufacturers to use single academic interest of this paper. Control platform in a wide range of power supply products. The digital power supply covers a range of -30 to +30 Enhanced control and monitoring capabilities. Volts, a resolution of 0.1 volts with dual output. Systems in development can be tuned quickly using the power supply is capable of sourcing 10 Amps of software based calibrations. Current. Programmability enables power supply redesigns with the model has an LCD display for voltage generated more efficient topologies that take advantage of and current drawn.

II. LITERATURE SURVEY

The different blocks of the variable power supply were studied. Based on this the projected scope, the market availability, the
Cost–effectiveness and the components required were designed appropriately.

A. MARKET AVAILABILITY

The market is the ultimate destination of any project. If it is not commercially viable, any venture is not worth its salt. Thus market knowledge effects in being the absolute pre-requisite. The project is a variable supply [2]. This is a rarity, especially required on a large scale for industrial use. Companies like Siemens use it for contact measuring. Contact measuring refers to ability of the instrument to measure the correctness of the performance of the device under test which requires a constant input voltage. The available module is bulky and too expensive to be of commercial interest. The portability pointer is also on the wrong side of consumer convenience. Our venture is an effort to untie this Gordian knot.

Manuscript received December 05, 2014.

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B. *ESTIMATED PRICE TAG*

The price tag of the auto transformer in the market ranges from Rs. 1,800 to Rs. 2,200. This is the resultant of the increasing price of the copper wires, the other side of the coin of consumer electronics. The motor used is the servomotor. The cost for etching a sq. cm. is Rs. 10. The Cost price of the final product, considering the above, is roughly estimated to be hovering around the Rs. 4,500 mark. Though, mass production would lower the rate to a reasonable Rs. 1,500 mark. An analogy could be found in the case of mobile phones produced in China with features like touch-screen made reasonably cheap.

C. *COMPONENTS USED IN MARKET*

Different types of power supplies are already available in the market. Manual control is superseded by highly accurate voltage readings. The motor used is ac servomotor, which after a lot of comparison with its counterparts was found to be the outright winner in terms of power and efficiency. Here micro controllers like 89S51 and 89C51 are used which operate at 5 and 15 V respectively. Though micro-processors being cost efficient and easily programmable, it is an outdated technology dating from the 1940s. Uses of micro controllers [2] were preferred over micro-processors taking into consideration the demand of the future industry domain, which has already switched over to PICs. Also micro controllers have flexibility ungratified by the latter. Programming codes can be Assembly language or Embedded C, of which the latter swas found to be of industrial favoring due to its supple coding patterns. This is a venture to produce an extremely fast and an accurate power supply at an efficient, thus removing the manual tuning prevalent in the commercial power supplies available in the market.

III. PROPOSED METHOD

In order to have a system that is highly efficient a design was developed wherein the micro-controller is interfaced with a servo-motor with the help of a controlling logic that is in the form of a high level language programming [1]. The basic logic is that a user will feed the voltage required in the number-pad which could be observed in the display unit. Now the micro-controller will give the start signal and the motor will start running based on the supply given to the motor. The micro-controller will monitor the running of the motor and as soon as the motor crosses the respective voltage a stop signal is given by the micro-controller to the motor. In this way the required output voltage is obtained. A feedback circuit is also designed in case to avoid the possibility of any error in the system. A simple and highly efficient bridge rectifier circuit is used which helps in the conversion of ac to dc voltages.

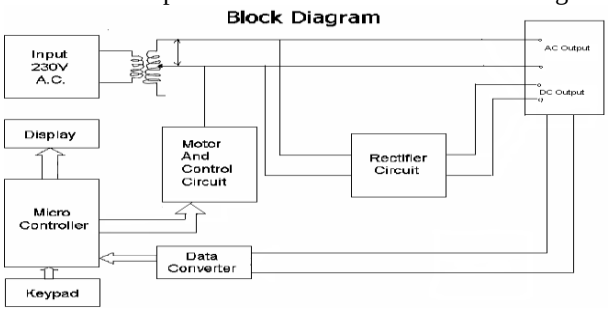

Fig.1 block diagram of variable power supply by using microcontroller

IV. DESIGN AND IMPLEMENTATION

The design of the AC Variable power supply can be better understood with the circuit diagram. It can be broadly divided into the following sections:

1. Input Section
2. Micro-controller
3. Rectifier Section
4. Data Conversion Section
5. Output Section

The sections can be described in detail as follows:

1. Input section

The input section consists of a keypad interfaced to the micro-controller. The keypad consists of number keys from 0 to 9 and clear and confirm keys.

2. Micro-controller

The micro-controller [1] used is 89S51 chip. ADC 0808 is also interfaced with the port 2 of the micro-controller. The port 3 and four pins of port 1 of are connected with the Keypad. The pin number P0 and P1 of port 0 are connected with the motor control circuit. The LCD is interfaced with the port 0.

The micro-controller [4] is the heart of this system. It controls the various processes and makes the system efficient as well as hassle free.

3. Rectifier Section

The rectifier circuit is a full wave bridge rectifier. The diodes used in this system are IN Series diodes which can handle voltages up to 250V. A capacitor is connected across the rectifier to filter the pulsating dc voltage obtained at the output.

4. Data Conversion Section

The input voltage is given to a rectifier and filter circuit in order to get the DC voltage. As the ADC cannot take such large input voltages the input voltage is stepped down to 3V by a step down transformer and an equivalent voltage is given to the ADC [1]. Thus the analog voltage is digitized by the ADC and that value gets stored in the memory of the micro-controller.

5. Output Section

A 16character * 2line LCD is also interfaced to the micro-controller. It shows the typed in voltage and real time value of the voltage.

V. WORKING

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

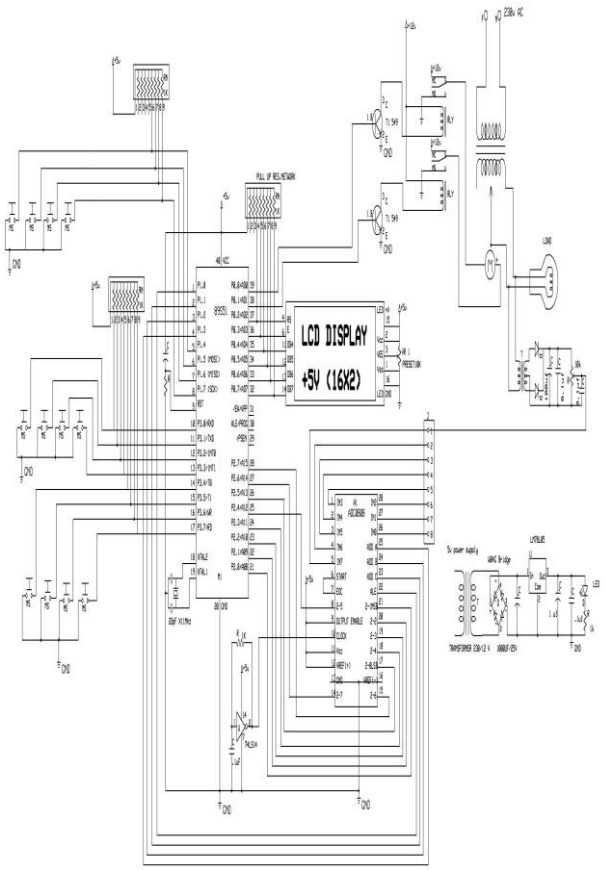

Fig.2 final circuit diagram of variable power supply by using micro-controller.

The system. Then the micro-controller gives start signal. The clock to the microcontroller is provided by Oscillator [1]. 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. 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.

VI. FLOW CHART

The entire functionality of this power supply lies in the software programming of the microcontroller. The strengths of the design lie in the fact that the hardware functionality has been replaced by the software.

Software Algorithm

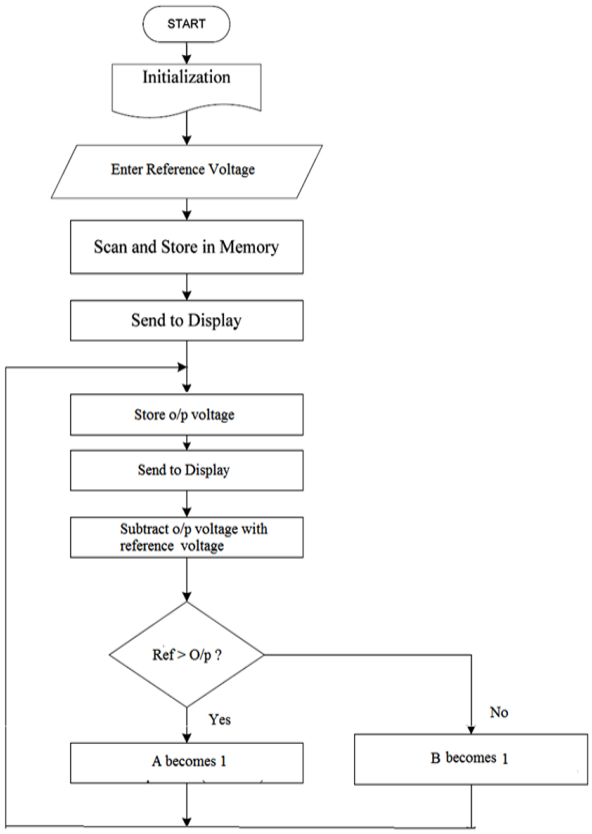

Fig.3 Flow chart for the variable power supply working

VII. 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.

The system is not dependent on load, so besides the original purpose for designing it can be used for various other applications. In an electrical or electronic industry, this will act as a quick, easy and accurate power supply. With no manual adjustment or monitoring required, this system will be welcomed in any industry requiring a wide range of voltages for different purposes [2].

VIII. FUTURE SCOPE

The motor interfaced with microprocessor can be used for various purposes such as solar tracking system, opening and closing of shutters or curtains, water level control by controlling valves, robotic appliances, etc.

The error detecting circuit can be used for detecting sudden fluctuations or dangerous increase in line current. The microprocessor may then provide proper signals for atonement of these fluctuations or for cutting off the supply. The range of the output voltage can be varied by selecting the servo-motor mechanism with a suitable rating.

IX. CONCLUSION

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. The software programming has been incorporated using C language and has been kept out of the purview of this presentation as the program itself is a subject of independent presentation. The design has been, Made incorporating user friendly features and easy usage for the operators.

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