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Smart Power Monitoring and Control System in Servo Stabilizer

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ABSTRACT

Servo stabilizers save the life of costly appliances by correcting the voltage fluctuations in the incoming AC voltage. Though it using voltage sensing relay to check the fluctuations, it cause damage to expensive electronic devices used in home and industries. To surmount this complexity, the bidirectional device TRIAC is used which makes safety switching between high and low levels of current. TRIAC will also prevent the coil from burning during high voltages and switches off the load instantly. The controller PIC16F883 is used to drive the TRIAC through isolator circuit over cutoff point and for showcasing values of voltage and current in LCD display. In addition to this MYDAQ module is enclosed in this project to monitor voltage fluctuations.

Keywords : Servo Mechanism; Automatic Voltage Regulator (AVR); PIC Microcontroller; Autotransformer; Phase Control; Triac.

I. INTRODUCTION

Nowadays we are using number of gadgets and home appliances in our day to day life. One of the basic requirements of those appliances is electricity. We enjoy those appliances when they are in good working condition ,but if there is any mis-behaviour happens we may not think much we will suddenly replace those appliances with new one.No one is ready to analyse the reason behind that. A research says that many of the device failures is caused due to fluctuations in voltages. This project aims at reducing those fluctuations by providing stable input through servo stabilizers.An additional feature called voltage performance monitoring is done to repeatedly to check out the performance by analysing the resulted output through graphical representation in web pages by using IOT.

II. METHODS AND MATERIAL

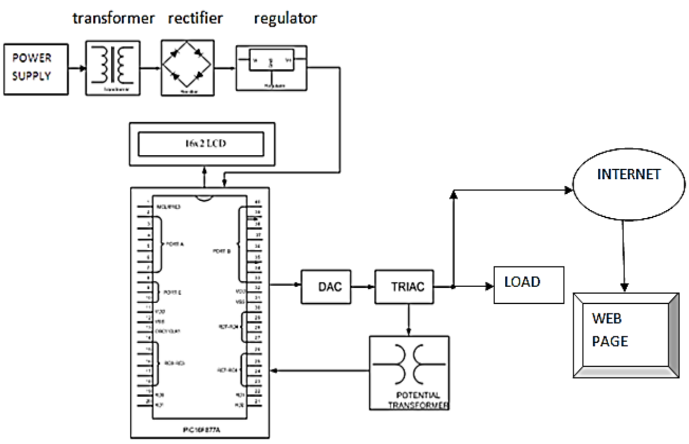
A. Existing Methods

Stabilizers are now manufactured by using Relay, though it has several advantages it has some draw backs such as its switching time[ON and OFF] is greater that too in several milli seconds. This is not suitable for quicker response. If there is any minute delay in switching the device which may results in causing huge damage to the appliances.

B. Proposed Methods

In order to obtain quicker response we are replacing Relay with TRIAC, whose switching time is smaller when compared to relay. The switching time of TRIAC is in the range of few micro seconds. Monitoring circuitry helps to identify when there is any lag in voltage performance.

C. Block Diagram



D. Bridge Rectifier

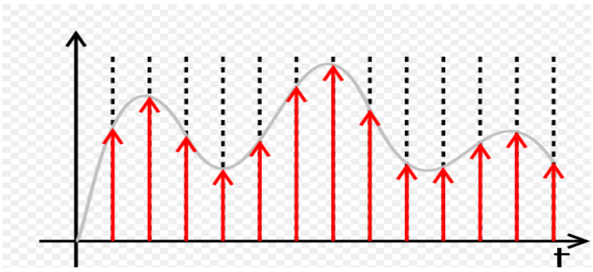
When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners. Let us assume that the transformer is working properly and there is a positive potential, at point A and a negative potential at point B. the positive potential at point A will forward bias D3 and reverse bias D4. The negative potential at point B will forward bias D1 and reverse D2. At this time D3 and D1 are forward biased and will allow current flow to pass through them; D4 and D2 are reverse biased and will block current flow. The path for current flow is from point B through D1, up through RL, through D3, through the secondary of the transformer back to point B. this path is indicated by the solid arrows. Waveforms (1) and (2) can be observed across D1 and D3. One-half cycle later the polarity across the secondary of the transformer reverse, forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow will now be from point A through D4, up through RL, through D2, through the secondary of T1, and back to point A. Since current flows through the load (RL) during both half cycles of the applied voltage, this bridge rectifier is a full-wave rectifier.

E. Digital to Analog Conversion

In electronics, a **digital-to-analog converter** (**DAC** or **D-to-A**) is a device for converting a digital (usually binary) code to an analog signal (current, voltage or electric charge).

An analog-to-digital converter (ADC) performs the reverse operation.

Basic ideal Operation :

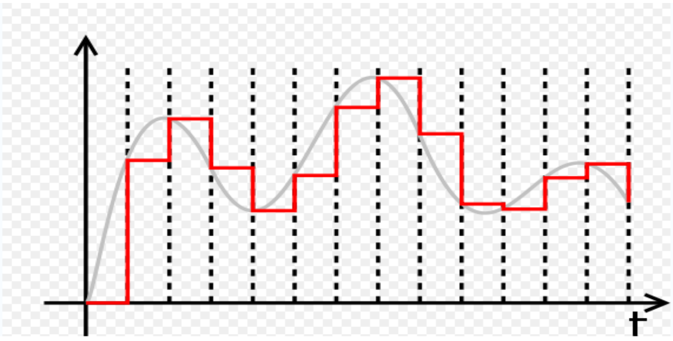


Waveform (1)

X axis-clock pulse Y axis-sequence value

A typical DAC converts the abstract numbers into a concrete sequence of impulses that are then processed by a reconstruction filter using some form of interpolation to fill in data between the impulses. Other DAC methods (e.g., methods based on Delta-sigma modulation) produce a pulse-density modulated signal that can then be filtered in a similar way to produce a smoothly-varying signal. By the Nyquist–Shannon sampling theorem, sampled data can be reconstructed perfectly provided that its bandwidth meets certain requirements (e.g., a base band signal with bandwidth less than the Nyquist frequency). However, even with an ideal reconstruction filter, digital sampling introduces quantization error that makes perfect reconstruction practically impossible. Increasing the digital resolution (i.e., increasing the number of bits used in each sample) or introducing sampling dither can reduce this error.

F. Practical Operation



Waveform(2)

X axis-clock pulse,Y axis-sequence value Instead of impulses, usually the sequence of numbers update the analogue voltage at uniform sampling intervals.

These numbers are written to the DAC, typically with a clock signal that causes each number to be latched in sequence, at which time the DAC output voltage changes rapidly from the previous value to the value represented by the currently latched number. The effect of this is that the output voltage is *held* in time at the current value until the next input number is latched resulting in a piecewise constant or 'staircase' shaped output. This is equivalent to a zero-order hold operation and has an effect on the frequency response of the reconstructed signal.

Piecewise constant signal typical of a zero-order (non-interpolating) DAC output.

The fact that practical DACs output a sequence of piecewise constant values or rectangular pulses would cause multiple harmonics above the nyquist frequency. These are typically removed with a low pass filter acting as a reconstruction filter.

G. Applications

Audio

Most modern audio signals are stored in digital form (for example MP3s and CDs) and in order to be heard through speakers they must be converted into an analog signal. DACs are therefore found in CD players, digital music players, and PC sound cards.

Specialist stand-alone DACs can also be found in high-end hi-fi systems. These normally take the digital output of a CD player (or dedicated transport) and convert the signal into a line-level output that can then be fed into a pre-amplifier stage.

Similar digital-to-analog converters can be found in digital speakers such as USB speakers, and in sound cards

Video

Video signals from a digital source, such as a computer, must be converted to analog form if they are to be displayed on an analog monitor. As of 2007, analog inputs are more commonly used than digital, but this may change as flat panel displays with DVI and/or HDMI connections become more widespread. A video DAC is, however, incorporated in any Digital Video Player with analog outputs. The DAC is usually integrated with some memory (RAM), which contains conversion tables for gamma correction, contrast and brightness, to make a device called a RAMDAC.

A device that is distantly related to the DAC is the digitally controlled potentiometer, used to control an analog signal digitally.

DAC performance

DACs are at the beginning of the analog signal chain, which makes them very important to system performance. The most important characteristics of these devices are:

- **Resolution**: This is the number of possible output levels the DAC is designed to reproduce. This is usually stated as the number of bits it uses, which is the base two logarithm of the number of levels. For instance a 1 bit DAC is designed to reproduce 2 (2^1) levels while an 8 bit DAC is designed for 256 (2^8) levels. Resolution is related to the **effective number of bits** (ENOB) which is a measurement of the actual resolution attained by the DAC.
- **Maximum sampling frequency**: This is a measurement of the maximum speed at which the DACs circuitry can operate and still produce the correct output. As stated in the Nyquist–Shannon sampling theorem, a signal must be sampled at over twice the frequency of the desired signal. For instance, to reproduce signals in all the audible spectrum, which includes frequencies of up to 20 kHz, it is necessary to use DACs that operate at over 40 kHz. The CD standard samples audio at 44.1 kHz, thus DACs of this frequency are often used. A common frequency in cheap computer sound cards is 48 kHz—many work at only this frequency, offering the use of other sample rates only through (often poor) internal resampling.

Other measurements, such as phase distortion and sampling period instability, can also be very important for some applications.

H. Pic Microcontroller

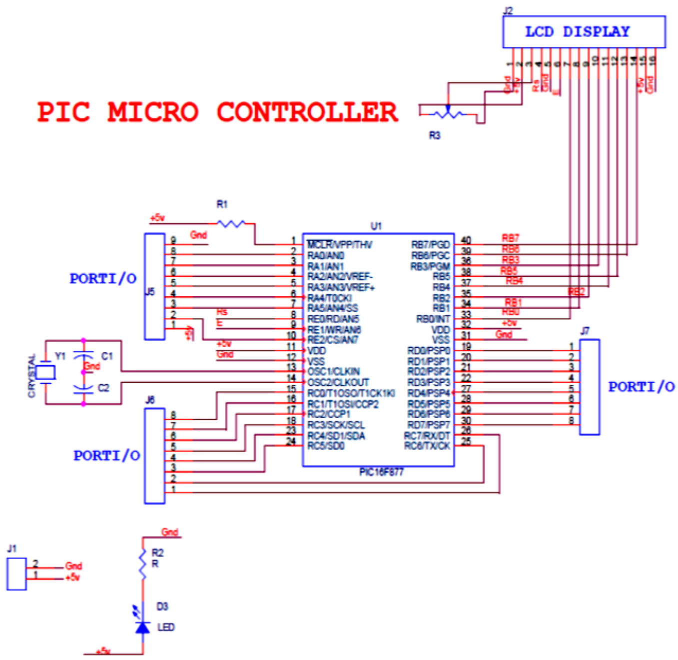
Scope

PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques.

PIC (16F877):

Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

I. Block Diagram of Microcontroller



Operation

The power supply is given to the controller is +5v ,it will operated in +5v only. Here we are interfacing LCD display with the controller. It is 40 pin controller. It consists of 5ports namely port A, port B, port C, port D and port E.
Each port have different number of pins.
Port A have 6pins(RA0-RA5)
Port B have 8pins(RB0-RB7)
Port C have 8pins(RC0-RC7)
Port D have 8pins(RD0-RD7)
Port E have 3pins(RE0-RE2)

VDD is for Power Supply

VCC for to ground. For clock input and output for 2pin is used (CLK IN/OUT). For LCD interfacing, LCD data line is taken from the port B (0-7), for data line given to LCD. Here we are using trimpot variable resistor. This resistor is used for adjustment of LCD brightness.Crystal oscillator is used for producing clock pulse. There are different type of oscillators like RC,LC etc,. Some of the oscillator produce clock pulse which is vary with voltage, temperature fluctuations. Only crystal oscillator produce stable clock pulse, it does not vary with the voltage fluctuations. We never get accurate operation of controller if clock pulse is not stable. Then the port A, port C is used for input/output purpose. Input/output is taken from the this port. Data are given to the controller through input ports. Port RE(0-1) is for read and write. RD(0-7)is also for input.

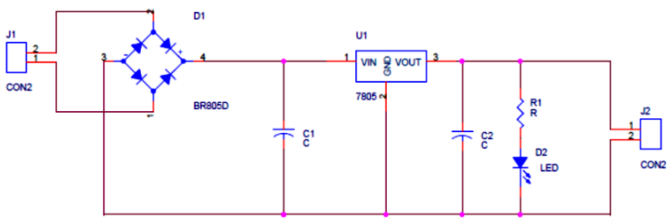
Power Supply

Scope

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

This typically involves converting 240 volt AC supplied by a utility company to a well-regulated lower voltage (+5V) DC for electronic devices.

Diagram:



III. RESULTS AND DISCUSSION

Explanation

1. Potential transformer

2. Rectifier
3. Filter
4. Regulator

All electronic circuits need DC power supply either from battery or power packs units. It may not be economical and convenient to depend upon battery power supply. Hence, much electronic equipment contains circuit which converts AC supply voltage into DC voltage at the required level. Transformer involves converting 240 volt AC supply into step downed required AC voltage. Rectifier is defined as an electronic device used for converting AC voltage into unidirectional voltage. A rectifier utilizes unidirectional conduction device like a vacuum diode or PN junction diode. It also consists of filter to remove the pulsating AC component.
Then it will feed into regulator. The regulation of power supplies is done by incorporating circuitry to tightly control the output voltage and/or current of the power supply to a specific value. The specific value is closely maintained despite variations in the load presented to the power supply's output, or any reasonable voltage variation at the power supply's input. We can add more than one regulator according to our needed voltage to get the different output voltages. From this, we can get the regulated +5V and +/-12V DC supply.

Advantage

Small size and less weight.
Less expensive
High reliable and versatile
Reduced man power

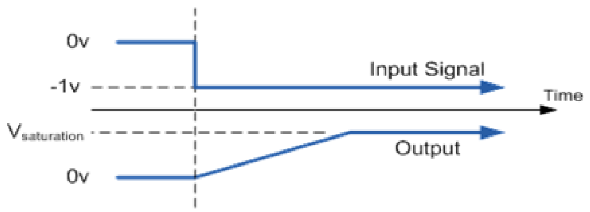
Application

It is typically used in electronic devices such as switched-mode power supply, linear regulator, rectifier and inverter (electrical).

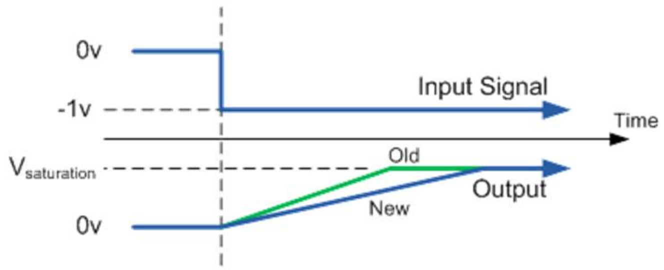
Integrator Amplifier Circuit

As its name implies, the **Integrator Amplifier** is an operational amplifier circuit that performs the mathematical operation of **Integration** that is we can cause the output to respond to changes in the input voltage over time and the integrator amplifier produces a voltage output which is proportional to that of its input voltage with respect to time. In other words the magnitude of the output signal is determined by the length of time a voltage is present at its input as the current through the feedback loop charges or discharges the capacitor.

When a voltage, Vin is firstly applied to the input of an integrating amplifier, the uncharged capacitor C has very little resistance and acts a bit like a short circuit (voltage follower circuit) giving an overall gain of less than 1, thus resulting in zero output. As the feedback capacitor C begins to charge up, its reactance Xc decreases and the ratio of Zf/Rin increases producing an output voltage that continues to increase until the capacitor is fully charged. At this point the ratio of feedback capacitor to input resistor (Zf/Rin) is infinite resulting in infinite gain and the output of the amplifier goes into saturation as shown below. (Saturation is when the output voltage of the amplifier swings heavily to one voltage supply rail or the other with no control in between).



The rate at which the output voltage increases (the rate of change) is determined by the value of the resistor and the capacitor, "RC time constant". By changing this RC time constant value, either by changing the value of the Capacitor, C or the Resistor, R, the time in which it takes the output voltage to reach saturation can also be changed for example.



If we apply a constantly changing input signal such as a square wave to the input of an **Integrator Amplifier** then the capacitor will charge and discharge in response to changes in the input signal. This results in the output signal being that of a saw tooth waveform whose frequency is dependant upon the RC time constant of the resistor/capacitor combination. This type of circuit is also known as a **Ramp Generator** and the transfer function is given below.

IV. CONCLUSION

This project aims at reducing device failures by avoiding unwanted voltage fluctuations through TRIAC performance using servo stabilizers. In addition to this circuitry prevention circuit is added for continuous monitoring of device Performance.

V. REFERENCES

[1] Ms. A. Ahmed, Power Electronics for Technology, Prentice-Hall International, 1999.
[2] J. B. Peatmann, Design with PIC Microcontrollers, Prentice-Hall, 1998.
[3] J. M. Jacob, Power Electronics: Principles and Applications, Vikas Publishing House, 2002.
[4] M. C. Sharma, Voltage Stabilizers and Automatic Cutouts, 1987.
[5] P. C. Sen, Power Electronics, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1987.
[6] R. A. Penfold, An Introduction to PIC Microcontrollers, Bernard Babani Publishing, 1997.
[7] Sollatek (UK), Automatic Voltage Regulator. www.sollatek.com.