ADVANCED AUTOMATIC VOLTAGE STABILIZER SYSTEM

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Abstract-----**This paper describes the potential applications of power electronics for the stabilization of voltage. This is the advanced design for present substation design. This design is used to automatically connect or disconnect Capacitor bank and a new design for voltage control using Step-up auto transformer instead of using of transformer with tapping. Thus by making this project we can help electricity consumers for a better service so that their electrical equipments don't get damaged.**

INTRODUCTION

Voltage stabilization refers to the ability of a power system to maintain steady voltages at all buses in the system after being subjected to a disturbance from a given initial operating condition. It depends on the ability to maintain/restore equilibrium between load demand and load supply from the power system.

LITERATURE SURVEY

[1] Title of paper: "Single Phase Automatic Voltage RegulatorDesign for Synchronous Generator"
Date of Publication: October 2011
Author(s): M. Rabiul Alam, Rajib Baran Roy, S.M. Jahangir Alam , Dewan Juel Rahman
Journal: International Journal of Electrical & Computer Sciences
Pages: 35-40 (IJECS-IJENS Vol: 11 No: 05)

This paper is information about voltage stabilizer as an electronic device able to deliver relatively constant output voltage while input voltage and load current changes over time . In the simplest case emitter follower is used, the base of the regulating transistor is directly connected to the voltage reference. The stabilizer uses the power source, having voltage Uin that may vary over time. It delivers the relatively constant voltage Uout. The output load RL can also vary over time. For such a device to work properly, the input voltage must be larger than the output voltage and voltage drop must not exceed the limits of the transistor used. The voltage stabilizer is used to condition the fluctuating of AC power supply. There are two major types of voltage stabilizer: Solid state electronic (static) voltage stabilizer and Servo controlled (electro-mechanical) voltage stabilizer.

[2] Title of paper: "P-V, Q-V Curve – A Novel Approach for Voltage Stability Analysis"
Date of Publication: 2013
Author(s): SnehalB. Bhaladhare, A. S. Telang and Prashant P. Bedekar
Journal: International Journal of Computer Applications
Pages : 31-35

This paper gives idea about Voltage stability concerned with the ability of a power system to maintain acceptable voltages at all buses in the system under normal conditions and after being subjected to a disturbance. A power system at a given operating state is voltage stable if, following the disturbances; voltages near loads are identical or close to the predisturbance values. A power system is said to have entered a state of voltage instability when a disturbance results in a progressive and uncontrollable decline in voltage. Following voltage instability, a power system may undergo voltage collapse, if the post disturbance equilibrium voltages near loads are below acceptable limits. Voltage collapse is also defined as a process by which voltage instability leads to very low voltage profile in a significant part of the system. Voltage collapse may be total (blackout) or partial. The main cause of voltage collapse may be due to the inability of the power system to supply the reactive power or an excessive absorption of the reactive power by the system itself.

[3] Title of paper: "Design and Implementation of an Automatic Voltage Regulator with a Great Precision and Proper Hysteresis"
Date of Publication: 2015
Author(s): Mohammad Shah Alamgir and Sumit Dev
Page(s): 21-32 (Vol.75 (2015))
Journal: International Journal of Advanced Science and Technology

This paper gives us information about the voltage regulator may be manually or automatically controlled. The voltage can be regulated manually by tap-changing switches, a variable auto transformer, and an induction regulator. In manual control, the output voltage is sensed with a voltmeter connected at the output; the decision and correcting operation is made by a human being. The manual control may not always be feasible due to various factors and the accuracy, which can be obtained, depending on the degree of instrument and giving much better performance so far as stability . In modern large interconnected system, manual regulation is not feasible and therefore automatic voltage regulation equipment is installed on each generator.

VOLTAGE STABILITY

Voltage Stability is defined as the ability of power system to maintain steady voltages at all buses in the system after being subjected to a disturbance from a given initial operating condition. Voltage stability is a problem in power networks, which are heavily load, faulted, or with insufficient reactive power supply. Although voltage instability is essentially a local phenomenon, the problem of voltage stability concerns whole power system, and is essential for its operation and control. The main reason for voltage instability is the increased of load, for that reason, voltage stability is also called load stability problem. Voltage collapse is the process by which the sequence of events accompanying voltage instability leads to a blackout or abnormally low voltages in a significant part of the power system. Most of problem found in power system realizes voltage collapse as a static phenomenon. Static study is appropriate for the bulk power system study, which involves enormous number of buses and generators. Static voltage instability is mainly associated with reactive power imbalance. Slowly developing changes in the power system occur that eventually lead to a shortage of reactive power and declining voltage. This phenomenon can be seen from the plot of the voltage at receiving end versus the power transferred. The plots are popularly referred to as P-V curve or "Nose" curve.

As the power transfer increases, the voltage at the receiving end decreases. Eventually, the critical (nose) point, the point at which the system reactive power is out of use, is reached where any further increase in active power transfer will lead to very rapid decrease in voltage magnitude. Before reaching the critical point, the large voltage drop due to heavy reactive power losses can be observed. The only way to save the system from voltage collapse is to reduce the reactive power load or add addition reactive power prior to reaching the point of voltage collapse.

FACTORS AFFECTING VOLTAGE STABILITY

1. The voltage collapse occurs invariably following a large disturbance or large load increase in a heavily stressed power system.
2. This results in an increased reactive power consumption and voltage drop.
3. The voltage drop causes initial load reduction triggering control mechanisms for load restoration. It is the dynamics of these controls that often lead to voltage instability and collapse.
4. Induction motors supplying loads with constant torques draw constant power independent of applied voltage.

METHODS FOR VOLTAGE STABILIZATION

1. Application of reactive power compensating devices.
2. Control of network voltage and generator reactive o/p.
3. Control of transformer tap changers.
4. Stability margin.
5. Operators' action.
6. Install/Operate Shunt Capacitor Banks.
7. Add Series Compensation on transmission lines in the problem area Implement under-voltage load shed (UVLS) program.

DAIGRAM

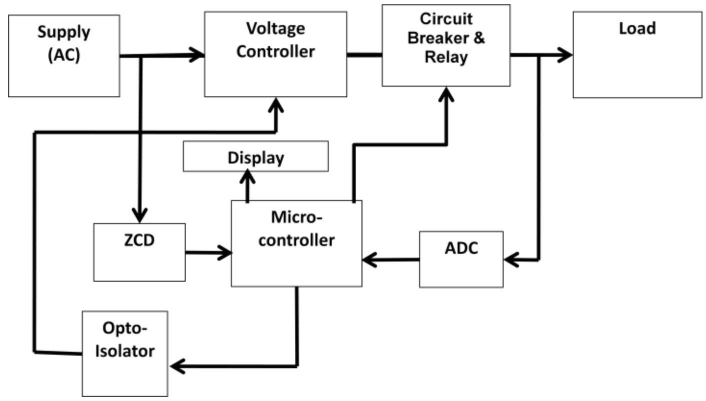

Figure 1: Block diagram

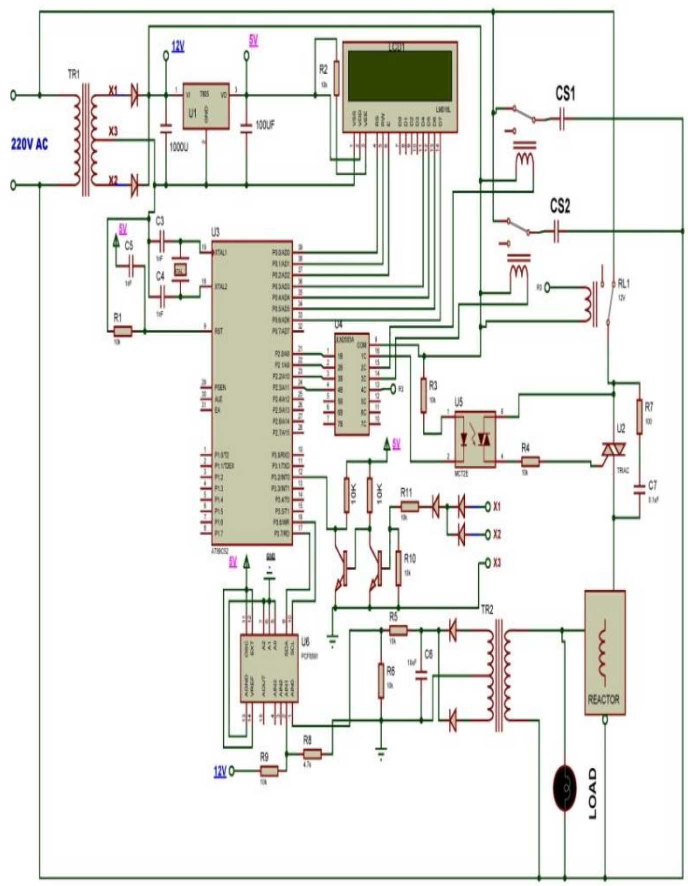

Figure 2: Circuit diagram

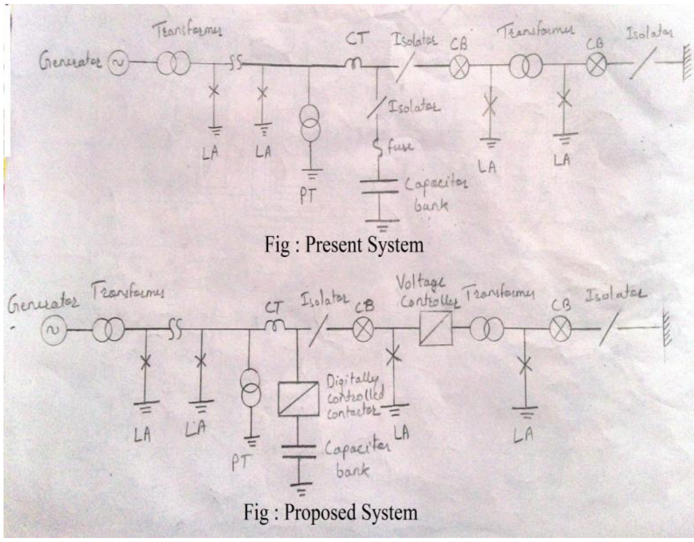

Figure 3: Present and Proposed System

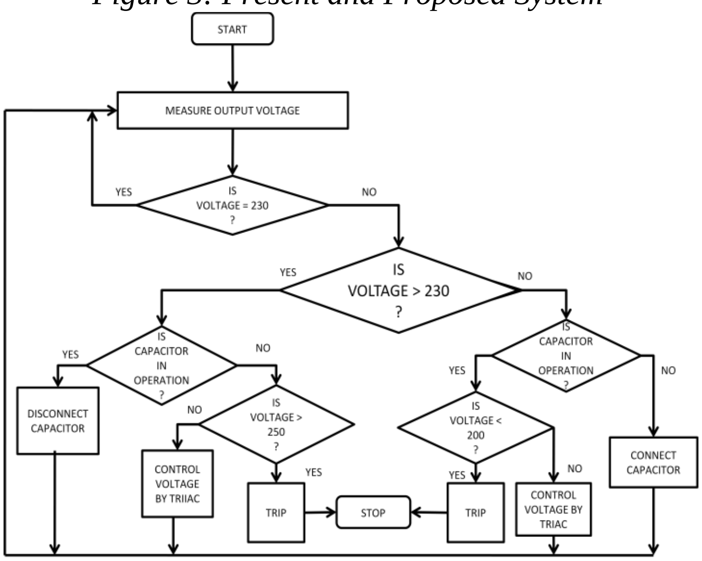

Figure 4: Flow chart for working of system

OPERATION

- Under normal load conditions the system works properly and voltage is also constant.
- For abnormal or heavy load condition, there is change in voltage, resulting in fluctuation in voltage.
- A closed feedback loop is used to analyze the voltage and then to control the fluctuation to fixed voltage level.
- For controlling we are using reactors and capacitors, which will come in operation automatically by the help of microcontroller.
- The input to microcontroller is given from a feedback path via analog to digital converter (ADC). This gives information to microcontroller for present voltage level.
- Also one input is give by zero crossing detector; this gives pulses when sine wave amplitude touches zero level.
- The control signal from microcontroller is given via opto isolator to control thyristor firing angle.
- In this system instead of using transformer with tapping we are using step-up autotransformer.
- Also for beyond controllable voltage fluctuation, to avoid generator tripping there is provision of emergency line/load cut off.

TESTING

For this hardware we are basically performing two tests :-

- Sudden Rise in Load Demand :-

  When sudden load demand is raised on Power system then the bus voltages drops, and there is chance of losing of synchronism, Drop in frequency, or emergency tripping of Generator. This hardware helps the system to automatically boost the voltage with the help of capacitor banks. The Capacitor bank comes in Operation Automatically as per set control logic set Microcontroller.

- Sudden Loss of Load Demand :-

  When there is sudden loss of Load then, there is rise in bus voltages, there is rise in frequency, due to which there is chance of losing synchronism. This hardware automatically disconnects the Capacitor bank and even after that the Voltage is above desired voltage, then with the help of TRAIC the amplitude of voltage is controlled with the help of Microcontroller.

RESULT

The TRAIC is used for clipping of amplitude of input voltage. A part of output voltage is Fed back to Micro-controller, via step-down transformer and ADC (Analog to Digital Converter). The output of ADC is serial pulses representing the Load side Voltage. Then this signal is compared with Pre-set Values of 190V, and thus Micro-controller makes necessary operations for Clipping or Boosting of Output Voltage.

For both load conditions: Sudden Rise in Load Demand and Sudden loss in Load Demand, the Hardware made works automatically and controls the Output Voltage Level to Set voltage of 190 Volts with 4.5% output accuracy for any deviation of input supply voltage within 180V to 250V.

APLICATIONS

- Can be used for industrial application.
- Can be used for Voltage stabilization of Specific Area.

CONCLUSION

The work has been focused on the issues related to distribution systems voltage stability. The impacts of adverse power quality issues on industrial loads have been presented and different methods to classify the stability margin of an area EPS have been illustrated with some simple examples. The Various methods for Stabilization of Voltage have been explained. A new method for voltage stabilization has been explained with the help of prototype, which uses the Shunt capacitor bank and a TRAIC in series for amplitude control of voltage. This Shunt capacitor bank and TRAIC are controlled automatically with the help microcontroller.

FUTURE SCOPE

- This system can be further developed for Automatic Power factor Correction.
- It will be interesting to develop this system for Automatic Power Stabilization.
- It will be interesting to investigate the interaction between the slow acting mechanical devices of the synchronous generator and the fast acting devices of the power electronics controllers when the system has to simultaneously respond to disturbances occurring at more than one location.
- Simultaneous operation for more than two Advanced Automatic Voltage Stabilizer System at various stages of power distribution system connected for same line.

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