Over Voltage, Under Voltage Protection of Electrical Equipment

Sumitha[1], Manjunath Ramesh Ambiger[2]
[1]Assistant Professor, Dept of Computer Science and Engineering
[2]Dept of Computer Science and Engineering
[1, 2] Atria Institute of Technology, Bangalore Karnataka, India

Abstract- *One of the most important components for proper functioning of cities is the mobility. As the paper focuses on transportation, the use of Intelligent Transportation Systems is crucial to enable modern smart cities solutions, both in cargo as well as passenger transport. This paper presents various problems of the typical city with regards to transport and mobility. Some problems are already partlyackled, but there are still open issues for research and development of even better aproaches. Europe's Smart Specialization Strategy suggests that each region specializes in specific solutions, based on existing competences. The presented solutions are part of the Slovenian smart specialization strategy. However, the most important issue for implementation and for improving the real efficiency of the transportation in the smart city is simply the critical mass/acceptance rate of users/citizes.*

Keywords- on-demand transport, traffic, congestion, cargo, optimization

I. INTRODUCTION

Electronic based load increases day by day in household as well as industrial application and they are very sensitive to voltage variation. In this project, focus the protect the equipment in case of over voltage or under voltage and the study of over voltage and under voltage, various power quality issues.Actually sudden fluctuation in voltage is very big and serious problem in industries and home appliances and it causes losses in electrical circuits. These losses causes low power factor in the supply and by much amount of power is going to be wasted. These fluctuations may significantly impact the power quality as well as the reliability of other voltage controlling devices. Therefore due to this fluctuation various costly and precious equipments may get damaged.

When RMS voltage or current drops between 0.1 and 0.9 pu at the power frequency for durations of 0.5 cycles to 1 minute then it is said to be sag condition. The swell condition will occur when RMS voltage or current rise between 1.1 and 1.8 pu at the power frequency for durations of 0.5 to 1 minute. And above the 1.8pu and below 0.9pu is called over voltage and under voltage respectively. Voltage sags and under voltage conditions are caused by abrupt increases in loads such as short circuits and faults or it is caused by abrupt increase in source impendence, abruptly caused by loose connection. Voltage swells and over voltage conditions are almost always caused by an abrupt decrease in load on a circuit with a poor or damaged voltage regulator, although they can also be caused by a damaged or loose neutral connection.

So, the problems occurred due to sag, swell, over and under voltage condition should be removed and it will be detected and protected by this system. In this paper we implement a circuit which helps to detect the voltage below 198 volt which is 0.9 of rated voltage which is 220 volt and it is sag and under voltage condition and in this condition our circuit will remain in open condition so there will on any passage of current. In this condition lower relay of our circuit will remain open. When the voltage rises above 242 voltages which is 1.1 of our rated voltage and it is swell and over voltage condition, in this situation the circuit will remain open because in that time upper relay in the circuit will remain open. Thus we can protect the costly equipment's by passing the supply through this circuit.

II. POWER QUALITY ISSUES

2.1 Overvoltage:

An overvoltage is an increase in the rms value of ac voltage greater than 110 percent or 0.11pu at the power frequency for a duration longer than 1 min. over voltages are usually the result of load switching (e.g., switching off a large load or energizing a capacitor bank). The over voltages result because either the system is too weak for the desired voltage regulation or voltage controls are inadequate. Incorrect tap settings on transformers can also result in system over voltages.

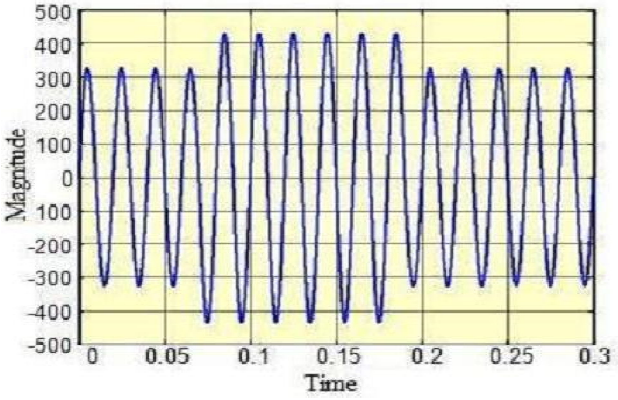


Fig-1: waveform for overvoltage

Causes of over voltages:

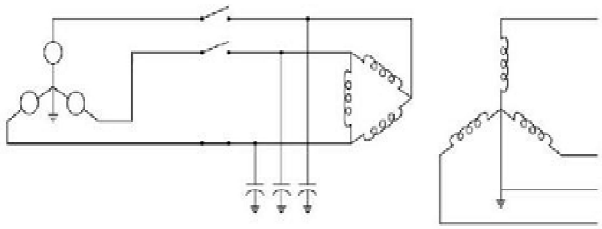
Overvoltage are less common than under voltage but they also arise due to system faults. Overvoltage can occur due to single line to ground fault, which in turn will raise the voltage of the other phases. It can also cause due to disconnection of heavy industrial loads or switching on the capacitor banks. This is generally due to ungrounded or floating ground delta systems, where a change in ground reference would give voltage rise to the ungrounded system. Causes of overvoltage are mainly due to energization of capacitor bank. It can also be generated by sudden load deduction. Due to the disconnection of load there is a sudden reduction of current, which will give rise the voltage, where L is the inductance of the line. The effects of overvoltage are more severe and destructive. It may cause the electrical equipment to fail, due to overheating caused by high voltage. Also electronic and other sensitive equipment are prone to malfunction.

Types of Voltage	Duration	Magnitude
Instantaneous	0.5 – 30 cycles	1.1 – 1.8 pu.
Momentary	30 cycles – 3 sec	1.1 – 1.4 pu.
Temporary	3 sec – 1 min	1.1 – 1.2 pu.

Table-1: Classification of overvoltage

Some more causes of Overvoltage are given below

- Loss of a Secondary Neutral (When the neutral wire is broken by falling branches).
- Ferroresonance (is a special form of series resonance between the magnetizing reactance of a transformer and the system capacitance (charging capacitors).



According to IEEE 1159 Classification of overvoltage

- Accidental Contact to High-Voltage Circuits
- Over voltages Due to Poor Voltage Regulation

2.2 Under voltage:

An under voltage is a decrease in the RMS value ac voltage to less than 90 percent or 0.90pu at the power frequency for a time period longer than 1 min. Under voltages are the result of switching events that are the opposite of the events that cause over voltage

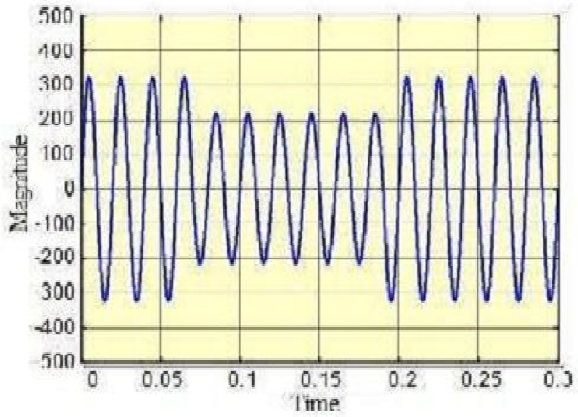


Fig-3: Waveform for under voltage

Under voltages are the most common power disturbance whose effect is quite severe especially in industrial and large commercial customers such as the damage of the sensitivity equipment's and loss of daily productions and finances. The examples of the sensitive equipment's are Programmable Logic Controller (PLC), Adjustable Speed Drive (ASD) and Chiller control. Under voltage at the equipment terminal can be due to a short circuit fault hundreds of kilometers away in the transmission system

2.2.1 Causes of under voltages:

- Closing and Opening of Circuit Breakers
- Due to Fault
- Due to Motor Starting
- Due to Transformer Energizing
- Equipment Failure

- Bad Weather and Pollution (Lightning strikes, Flash over, etc.)
- Construction Activity(damage to underground
- Cables

III. METHOD USED FOR PROTECTION

The aim of our circuit is to protect the load during undervoltage and over current conditions by controlling the relay tripping coil using a LM324 comparator. The comparator will compare the supply voltage with desired preset voltage and will trip the relay coil if the voltage drops below the desired preset value. The relay coil will also trip if the. The under voltage and over current protecting device is shown in the block diagram below

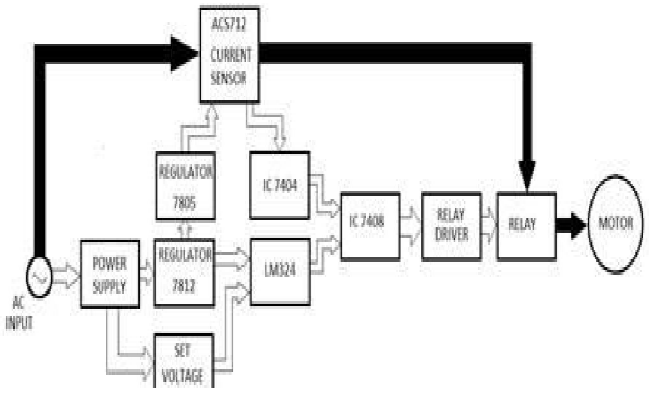


Fig-4:Method Used For Protection

IV. WORKING AND CIRCUIT DIAGRAM

If 220VAC input is applied circuit step-down transformer will reduce voltage to 12volt.Using Bridge rectifier IC 12volt DC output is obtained.

Using IC LM7812 we get regulator DC supply Regulator Input at pin 1 and 2 and from pin 3 and 4 output is taken. IC LM324 serve as heart of protection circuit. It has 4 comparator in it.4th pin is connected to Vcc and 11th pin is grounded. Two zener diode of 6volt and 6.8volt are used.6.8 volt zener diode is connected to 2nd pin of ICLM324 (comparator no.1).6 volt zener diode is connected to 5th pin of ICLM324.

IC2/1 of comparator IC used for overvoltage Protection.IC2/2 of comparator IC used for under voltage protection. When supply voltage raise beyond or fall rated voltage Proportional DC voltage will change and relay driver IC will command to relay driver to relay and relay will get tripped.

V. CONCLUSION

From above discussion it has cleared that of under voltage and overvoltage problem are very common and can create problem for consumer good and industrial application. So system should be protected by certain protection scheme. So here system modeled using comparator and relay to disconnect supply when any overvoltage and under voltage problem occurs.

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