

IoT Based Distribution System Protection Scheme

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Abstract— Today's scenario many of the power system accident are caused because of the improper design and excessive load on the system. The project protects load to switch from surges it also protects from quick changeover. This is an inexpensive auto cut-off system, which is fabricated using relay and other discrete components. Overvoltage and under voltage are quality problems, they happen due to many reasons. The effect of overvoltage and under voltage are severe, the overvoltage can cause failure of insulation and under voltage can cause burning of motor coil. To solve problem the tripping mechanism is designed so that load is disconnected if it is subjected to overvoltage, under voltage or imbalance operation in case of three phase equipments. The design is first simulated on a virtual environment by use of simulation program and then next step is design of hardware according to simulated circuit. Two designs are made single phase and three phases, only the single phase is designed as hardware. The circuit responses are effective for voltage variation then let it be overvoltage or under voltage in case of single phase circuit and it also responds effectively for phase failure. The circuit can be stand alone circuit between supply mains and load. The overvoltage and under voltage cutoff also provides various protection 1) Transients. 2) Under voltage. 3) Overvoltage. There are various types of security provided by the system: Assured for overvoltage/under voltage, insurance against homeless people and so on. For this project we have also integrated IOT based system so that it give real time data and alert regarding any fault. The project also gives a focus on password based circuit

breaker. As also keypad is provided for project so that password can be entered. Fatal electrical accidents are happening and it is subject of prime concern it is due to lack of communication between line men who is to repair fault and maintenance staff at substation. So a solution is provided and it ensures safety as well. So by this ON/Off control of the line remain in hands of line man. The arrangement is made such i.e. password is entered to operate CB (ON/OFF). So by doing this lineman is able to turn off supply for time being and able to repair fault comfortably and after repair is complete he has to enter password and so line will be turned on

I. INTRODUCTION

The sudden change in voltage is huge issue in enterprises and in home machines and it causes misfortunes in electrical circuits. The on-time postpone circuit shields the heap from exchanging floods as well as from speedy changeover [off and on] impact. Here is an economical auto cut-off circuit. It very well may be utilized to secure loads, for example, T.V, Refrigerator and so forth, from unwanted over and under line voltages. Voltage swells and over voltage conditions are about caused by a sudden reduction in load or any fault. Right when RMS voltage or current drops in the region of 0.1 and 0.9 pu at the power recurrence for the ranges of 0.5 cycles to 1 minute then it is said to be hang condition. The swell condition will happen when RMS voltage or current climbs in the region of 1.1 and 1.8 pu at the power repeat for lengths of 0.5 to 1 minute. In this project we execute a circuit which recognizes the voltage underneath 198 volts which is 0.9

of assessed voltage i.e. 220 volts then it is called list or under voltage condition. In this condition our circuit will remain in open condition so there will not any section of current and lower hand-off of our circuit will remain open. Right when the voltage rises above 242 voltages which is 1.1 of our assessed voltage then it is brought swell and over voltage condition, in this situation the circuit will remain open in light of the fact that in that time upper move in the circuit will remain open. In this way we protect the system also the all real time data of the system will send to operator on his mobile with the help IOT system. The present work focuses on the regular practice and flaws of line clearance (LC) for the repair request and closing of LC after the repair is done. The draw backs of current LC system are charging of the line by accidental or by mistake of the operators at substation may be due to lack of information or criticality has evidenced injuries or even death of working linemen on the line. The proposed low cost Arduino controlled based

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secured password operated control panel and circuit breaker ON/OFF is the best suited mechanism in preventing the injuries or death of working men on the line by any accidental charging of line unknowingly. The unauthorized access of the secured systems is prevented by authorization password or login for the security purpose. The lack of communication and co-ordination between the maintenance staff and the electric substation staff can be minimized. This system provides a solution to ensure the safety of the maintenance staff

II. PROBLEM STATEMENT: -

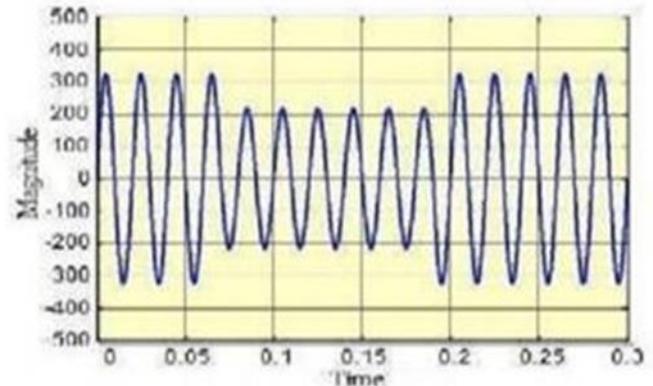
The effects of overvoltage and under voltage to electric equipments in general and can't be ignored. Overheating and insulation failure might happen when electric equipments are subjected to under or over voltage conditions. Moreover the condition maybe hazardous, Depending on its duration, it is more serious in the case of domestic appliances like fridges and air conditioners. If a fridge is operated on low voltage this heats up and gets damaged.

Fatal electrical accidents to the line man are increasing during the electric line repair due to the lack of communication and co-ordination between the maintenance staff and the electric substation staff.

Literature Survey: - Under voltage: -

Sag or under-voltage is a temporary decrease in power lasting up to over a minute. Sag or an under- voltage typically happens whenever heavy machinery is turned on. A great amount of power is used by the heavy machinery during start-up, leaving a small amount or power available for other equipment to use. Voltage sags also happen when the main source of power is affected by natural events like lightning strikes, strong winds and power lines getting hit by falling tree branches. Voltage sags can arrive from the utility; however, in most cases, the majority of sags are generated inside a building. For example, in residential wiring, the most common cause of voltage sags is the starting current drawn by refrigerator and air conditioning motors. Sags do not generally disturb incandescent or fluorescent lighting Motors or heaters; however some electronic equipment lacks sufficient internal energy storage and, therefore, cannot ride through sags in the supply voltage. Equipment may be able to ride through very brief, deep sags, or it may be able to ride through longer but shallower sags.

Figure: Typical voltage sag.



Waveform for under voltage

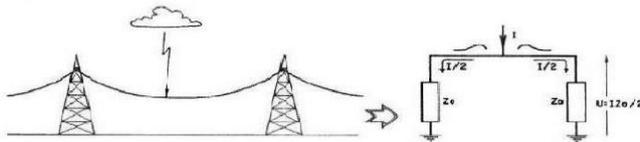
Overvoltage: -

The main causes due to which over-voltages are produced in the power systems can be generally classified into two categories as follows:

- Internal over-voltages this is classified to
- Switching over-voltages.
 - Insulation failure.
 - Arcing ground: can be prevented by earthing the neutral.
 - Resonance.
- External over-voltages: due to lightning
- switching over-voltages: There is a great variety of events that would initiate a switching surge in a power network. The switching operations of greatest relevance to insulation design can be classified as follows:
 - Energization of transmission lines and cables. The following specific switching operations are some of the most common in this category:
 - Energization of a line that is open circuited at the far end.
 - Energization of a line that is terminated by an unloaded transformer.
 - Energization of a line through the low-voltage side of a transformer.
 - Reenergization of a line. This means the energization of a transmission line carrying charges trapped by previous line interruptions when high-speed reclosures are used.
 - Load rejection. This is affected by a circuit breaker opening at the far end of the line. This may also be followed by opening the line at the sending end in what is called a line dropping operation.
 - Switching on and off of equipment. All switching operations involving an element of the transmission network will produce a switching surge. Of particular importance, however, are the following operations:
 - Switching of high-voltage reactors.
 - Switching of transformers that are loaded by a reactor on their tertiary winding.
 - Switching of a transformer at no load.
 - Fault initiation and clearing.

Lightning over-voltages:-

An electric discharge between cloud and earth, between clouds or between the charges centers of the same cloud is known as lightning. Lightning is a huge spark and Takes place when clouds are charged to such a high potential (+ve or -ve) with respect to earth or a neighboring cloud that the dielectric strength of neighboring medium (air) is destroyed. The most severe lightning stroke is that which strikes a phase conductor On the transmission line as it produces the highest overvoltage for a given stroke current. The lightning stroke injects its current into a termination impedance Z , which in this case is half the line surge impedance since the current will flowing both directions as shown in Figure



In practice, however, the shapes and magnitudes of lightning surge waves get modified by their reflections at points of discontinuity as they travel along transmission lines Lightning strokes represent true danger to life, structures, power systems, and communication networks. Lightning is always a major source of damage to power systems where equipment insulation may break down under the resulting overvoltage and the subsequent high emery discharge

Problem for lineman while working: -

In the absence of switches at different points in the distribution network, it is not possible to isolate certain loads when required. However, the circuit breakers are actually provided as a means of protection to completely isolate the downstream network in the event of a fault (short circuit, over load). Using this as a tool for load management is not desirable, as it disconnects the power supply to a very large segment of consumers and blackout over a large section of the distribution network. As we found that if the power in industries is disconnect for a minute is stops the production. So the power in industries should be continues. And when a line man goes to repair the line then by unknowingly or wrong intentionally any one can ON the circuit breaker and line man can be met with fatal accident

Effects of voltage fluctuation: -

Appliances like luminaries (bulbs, tube lights and CFLs) and heaters (like room heaters and water heaters) do not need voltage stabilizers. When the voltage is less, less current will flow through them. When voltage is more, more current will flow through them. So when voltage is

less, the output of these appliances will be less or the bulb will give less light, room heater will heat less, water heater will heat slowly. And as the bulb will give lesser light the power consumption of the bulb will be less. In fact many municipalities reduce the voltage of street lights at times when the light requirement is less to reduce the power consumption of the bulbs. However when the Voltage is higher than normal; more current will flow through these appliances. And if the high voltage is consistent, it may result in burning of the bulb or the appliance

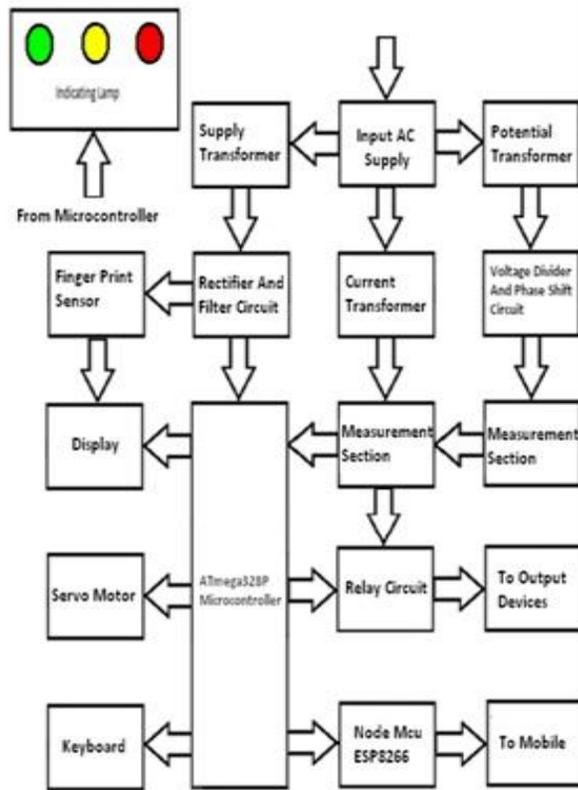
Method used for protection: -

The method used is the one in which if there is any fault over voltage or under voltage the person gets notification on his mobile via IoT based module then the relay gets operated and the equipment connected to the system gets isolated so that it does not get damaged. Now to solve another problem a password based circuit breaker is also implemented so that the line man safety can also be taken into consideration. It works if fault occurs on the line then the lineman will have to enter the password if it matches with the preset password then the circuit breaker operates and the lineman can work comfortably after the completion of work he has to enter the password again and after it is confirmed the circuit breaker operates and line comes back to normal.

Mode of Operation: -

The system is designed for protection of the distribution system from any fault. the distribution supply first come to box and the given to the load when supply comes to in the box then different parameter of the supply can be check when the values are in the normal then only the supply given to the load if in between any fault occurs then the it automatically isolate the system with a fraction of second and protect from any damage. Also then it rebuild the system when the parameters are come to normal rang after fault clear. Also the system consist of the inbuilt IoT system which is transfer the system real time data to the operator mobile so that it can monitor and control system from any location .In any emergency condition system can be control from operator mobile

Block diagram: -



III. RESULT:

When we connect the above system to the distribution system then, The voltage between 198V to 242V should be a normal voltage indication by green lamp, when the voltage is below 198 volts which is 0.9 of assessed voltage the is under voltage indication by the yellow lamp and the when voltage is above the 242 voltages which is 1.1 of our assessed voltage then the red lamp glow indicate that over voltage in the system

IV. CURRENT RESEARCH:

A Major area of research is to develop a system more reliable. For that power quality play important role to improve power quality further we develop this system and in future we can add harmonic monitoring and elimination technique for better operation of system. Also we connect the system with the storage devices and the cloud for past data storage so that on that data we can easily monitored and analyse for system performance improvement

V. CONCLUSION

Security is prime concern in our day-to-day life. Everyone wants to be as much as secure as to be possible. The

circuit can be tripped without any fail and load can also be controlled when fault in the system. This system provides a new approach to secure the life of a lineman.

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