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Automatic Load Shedding With Microcontroller

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Abstract:
Load Shedding is very challenging problem in power system relaying. The load connected to transformer must also be protected from overloading and fault current must be minimized. Protection employs different relaying methods to protect against various methods like over-current protection, over voltage and under voltage protection and Earth Fault Relay protect the loads against overloads and external applied conditions. The digital system comprises of a microcontroller MSP430F5419A which monitors the load on real-time basis and if a change in system parameters arises in the connected load, it is sensed by the ct and pt And microcontroller triggers the relay and the load is switched by the controller based on the priority of the load requirement as a result some of the loads will cut off and hence, the load reduces on the system. In this project, we are going to implement the design of microcontroller based load shedding system for required load is the major emphasis of this work is the description of hardware and software development of project.

Keywords: microcontroller-load shedding-transformer-power system-protection-relay-earth fault.

I. INTRODUCTION

Power system stability is critical to the system operation and quality of supply. Any power system imbalance, which can be caused by load variations Manual disconnecting load to assist the grid largely depends on with power system operators' experiences and judgments as well as the quickness which may lead to mal-operations, whereas automatic disconnecting predetermined loads may provide a fast response for load shedding schemes but requires a deliberately designed control strategies and robust control systems. Some of the interruptions were caused by slow removal of system faults, causing system instability. Such trouble could have been avoided by the use of adequate protective equipment, including fast primary relaying, backup protection, adequate circuit breakers properly maintained, and in some cases high-speed reclosing. Some other major load interruptions occurred in spite of high-speed fault clearing. When a particular system, or a component part thereof, does not have sufficient reserve generation (either generating units or transmission connection s), separation may cause distress regardless of the speed of fault clearing Load shedding may then be mandatory. It is likely that such situations will become more serious with the increase in size of generating units and with a tendency to give preferential consideration in the scheduling of load to the newer and larger units. Some interruptions may not have involved system faults at all, but in any case, if the excess load had been promptly removed, the system would have carried the remaining load, permitting more prompt restoration of service to the entire load.

II. WHAT IS LOAD SHEDDING

Load shedding (load shedding) is a way to distribute demand for electrical power across multiple power sources. Load shedding is used to relieve stress on a primary energy source when demand for electricity is greater than the primary power source can supply. Most buildings, including data centers, purchase electrical power from a utility provider. To reduce the cost of power, while also ensuring continuous operation, a building operator may negotiate an agreement with the power provider to voluntarily load shed on a pre-scheduled or on-demand basis. During load shedding events, the building draws power from its secondary source(s) rather than from the utility. A typical secondary source is on-site diesel generators, or on-site or contracted solar photo voltaic or wind-based renewable power. Many utilities load management programs offer cost incentives for building operators to voluntarily load shed during peak usage periods. Load management programs are a good option for energy-intensive building operations that also have high-quality power distribution control and secondary power sources, such as a data center. To prevent disruption to the systems in the building, the operator can rely on uninterruptible power supply systems and power distribution units that moderate the flow of electricity to sensitive equipment. Environmental protection bodies define and regulate load shedding as non-emergency use of non-primary power in developed countries. Power customers may experience involuntary load shedding when a utility electrical provider lowers or stops electricity distribution across the coverage area for a short period of time; this type of load shedding is commonly referred to as a rolling blackout. Brownouts, another type of involuntary load shedding, are caused by the power supplier lowering voltage distribution during peak usage times to balance supply and demand.

III. COMPONENTS DISCRIPTION

A) Microcontroller:

The MSP430F5419A provides a set of standard features:

128k bytes of Flash,16KB RAM, 86 I/O lines, 16 bit timer and counters, 12bit ADC,14 external channel and 2 internal channels. The TI MSP430 family of ultra-low-power microcontrollers consists of several devices featuring different sets of peripherals targeted for various applications. The architecture, combined with extensive low-power modes, is optimized to achieve extended battery life in portable measurement applications. The device features a powerful 16-

bit RISC CPU, 16-bit registers. The digitally controlled oscillator (DCO) allows the device to wake up from low-power modes to active mode in 3.5 µs (typical).

B) Relay:

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available. For further information about switch contacts and the terms used to describe them please see the page on switches.

C) R485 Cable:

RS-485, also known as TIA-485(-A), EIA-485, is a standard defining the electrical characteristics of drivers and receivers for use in serial communications systems. Electrical signaling is balanced, and multipoint systems are supported. Digital communications networks implementing the standard can be used effectively over long distances and in electrically noisy environments. Multiple receivers may be connected to such a network in a linear, multi drop bus. These characteristics make RS-485 useful in industrial communication systems.

D) Instrument transformers:

A current transformer (CT) is a type of transformer that is used to measure alternating current (AC). It produces a current in its secondary which is proportional to the current in its primary. Current transformers, along with voltage or potential transformers are instrument transformers. Instrument Trans formers scale the large values of voltage or current to small, standardized values that are easy to handle for instruments and protective relays. The instrument transformers isolate measurement or protection circuits from the high voltage of the primary system. A current transformer provides a secondary current that is accurately proportional to the current flowing in its primary. The current transformer presents a negligible load to the primary circuit.

E) Led display:

Light emitting diode (LED) is a solid state device that converts electrical energy into single color light. It is basically a specialized type of PN junction diode that emits either visible light, infrared or laser light at different wavelengths, made from a thin layer of heavily doped semiconductor material. LED produces 'cold' generation light resulting in high efficiency. Unlike LEDs, normal incandescent lamps and bulbs generate large amounts of heat radiating away energy within the visible spectrum Being a solid state device, LEDs are more durable, small and provide much longer life than normal light sources. A light emitting diode (LED) is a type of semiconductor diode that emits light when a current flows from anode to cathode across the PN junction of the device. Hence, an LED requires a direct current supply to forward bias the junction with a positive voltage for normal operation. The voltage to current relationship of LED is non-linear, so the LED turns on at a lower voltage and will rapidly draw much higher current as the voltage increases.

IV. PROJECT OUTLINE

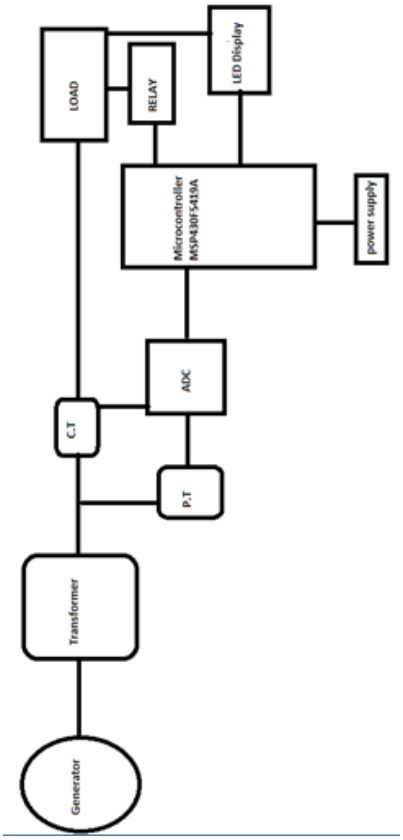

Figure.1. Project outline

V. PROJECT EXPLANATION

We have implemented this project in our institution. The initial values of load current are taken and the value is set in the program of microcontroller and the trip command is on before connecting it to supply. The values of load current are continuously read by the microcontroller. If there is any change in the load current above the preset value then the microcontroller sends the trip command to the particular load on the basis of the priority of the load. Hence a un wanted part of load is getting disconnected. After a regular use we can also set the current trip limits based on the connected load. The trip action is very fast as the relay is operated within milli seconds.

VI. PROJECT CALCULATIONS

The total load of the institution is 210KW.
We know that,
P=210kw
V=440v
Power factor=0.8
The total maximum load current is =344-45Amp.
Hence the trip condition is set for 330Amps; if the load exceeds this value the relay is operated.

VII. CONCLUSION

In present days the procedure for disconnecting the loads is done manually.as manual load shedding has become inefficient practice to maintain efficient transfer of power to loads.as it gave rise to transient switching losses which pose a threat to Connected loads and also power system. In order to

reduce these losses in this project it controls load based on limit prescribed by load connected i.e. as per load. Hence the fluctuation can be stabilized within limits. Hence reduces the transient losses in the system at the Load side. We have implemented this project in our institution and by implementing this there is a reduction in electricity bill without bearing penalty by maintaining power factor within the prescribed limits. This may add up the cost to the loads but it will helps the users in reducing the penalty.so, it will be better to Employ this automatic load shedding in domestic purposes also. so, that we can conserve energy for future. The future application of this project can be implemented with low cost and can be implemented with various devices like protection relays and temperature sensors. This project can be integrated into smart meters for domestic use. This helps the Consumer to reduce their electricity bill by using load shedding system on daily basis and it also monitors the power and reduces the load consumption during peak Periods. This scheme of load shedding helps to maintain the power continuity at load without any damage to load. Hence in future this project will be applicable from the lower ratings to higher ratings.

VIII. REFERENCES

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