



PASSWORD BASED CIRCUIT BREAKER CONTROL TO ENSURE ELECTRIC LINE MAN'S SAFETY AND LOAD SHARING

M.MOOKAMBIKA, P.PUSHBARANI, Dr.M.MALARVIZHI

PG Student, Gnanamani College of Technology, Namakkal, India

Assistant Professor, Gnanamani College of Technology, Namakkal, India

Professor, Gnanamani College of Technology, Namakkal, India

ABSTRACT

The major problem in the power system is the electrical accidents while repairing the electrical lines due to the lack of communication between the electrical substation and maintenance staff. This project gives a solution to this problem to ensure line man safety. Also the load distribution system has been proposed in which sharing of the load is done between villageside and cityside.

Keywords-circuit breaker, Manual load sharing, Voltage Regulator.

I.INTRODUCTION

Now a days, electrical accidents of the line man are increasing while repairing the electrical lines due to lack of communication between the electrical substation and maintenance staff. This paper gives a solution to this problem to ensure line man safety. In this proposed system the control (ON/OFF) of the electrical lines lies with line man. This paper is arranged in such a way that maintenance staff or line man has to enter the password to ON/OFF the electrical line.

Now if there is any fault in electrical line then line man will switch off the power supply to the line by entering the password and comfortably repair the electrical line, and after coming to the substation line man switch on the supply to the particular line by entering the password. Here, there is also a provision of changing the password. circuit breakers are actually provided as a means of protection to completely isolate the downstream network in the event of a fault.

The demand for electrical energy is ever increasing. Today over 21% (theft apart!!) of the total electrical energy generated in India is lost in transmission (4-6%) and distribution (15-18%). The electrical power deficit in the country is currently about 18%. Electric power is normally generated at 11-25kV in a power station. To transmit over long distances, it is then stepped-up to 400kV, 220kV or 132kV as necessary. The demand for electrical energy is ever increasing, to overcome this problem Load sharing concept is included. This paper focusing on village side and city side based on the load demand and the required voltage is transferred from village side to city side and vice versa.

II. LITERATURE REVIEW

The password-based circuit breaker is a system that requires a specific password to control the circuit, ensuring secure access. Fatal electrical accidents involving linemen have been increasing during power line repairs due to insufficient communication and coordination between maintenance staff and electric substation personnel. To prevent such accidents, the breaker can be designed to allow only authorized individuals to operate it using a password. The system is entirely managed by the Arduino Uno microcontroller.

The embedded systems are electronic devices which are incorporated micro processors within their implementations. The embedded systems designers generally have a significant grasp over hardware technologies. They use specific programming languages and software to develop embedded systems and manipulate the equipment.

Embedded systems often use a slow processor and small memory size to minimize costs. An embedded system is a special purpose system in which the computer is completely encapsulated by or dedicated to the device or system it controls. Unlike a general-purpose computer, such as a

personal computer, an embedded system performs one or a few pre-defined tasks, usually with very specific requirements.

Password based circuit breaker:

A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit. Its basic function is to detect a fault condition and interrupt current flow. Unlike a fuse, which operates once and then must be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation.

In order to avoid such accidents, the breaker can be so designed such that only authorized person can operate it with a password. Here, there is also a provision of changing the password. The system is fully controlled by the 8bit micro controller of 16f 877A family. The password is stored in an EEPROM, interfaced to the microcontroller and the password can be changed anytime unlike affixed one burnt permanently onto the microcontroller. A keypad is used to enter the password and a relay to open or close circuit breaker, which is indicated by a lamp. Any wrong attempt to open the breaker (by entering the wrong password) an alert will be actuated, indicated by another lamp.

III.CONTROLSYSTEM

There are two major divisions in control theory, namely, classical and modern, which have direct implications over the control engineering applications. The scope of classical control theory is limited to single-input and single-output (SISO) system design, except when analyzing for disturbance rejection using a second input. The system analysis is carried out in the time domain using differential equations, in the complex domain with the Laplace transform, or in the frequency domain by transforming from the complex domain. Many systems may be assumed to have a second or demand single variable system response in the time domain. A controller designed using classical theory often requires on site tuning due to incorrect design approximations. Yet, due to the easier physical implementation of classical controller designs as compared to systems designed using modern control theory, these controllers are preferred in most industrial applications.

The Step response characteristics applied in a specification are typically percent to overshoot, settling time, etc. The Open Loop response characteristics applied in a specification are typically Gain and Phase margin and band width. These characteristics may be evaluated through simulation including a dynamic model of the system under control coupled with the compensation model. In contrast, modern control theory is carried out in the state space and can deal with multiple input and multiple output(MIMO) systems.

OPEN-LOOP CONTROL SYSTEMS

In an open-loop control system, the controller independently calculates exact voltage or current needed by the actuator to do the job and sends it. With this approach, however, the controller never actually knows if the actuator did what it was supposed to because there is no feedback. This system absolutely depends on the controller knowing the operating characteristics of actuator.

Open-loop control systems are appropriate in applications where the actions of the actuator on the process are very repeatable and reliable. Relays and stepper motors are devices with reliable characteristics and are usually open-loop operations. Actuators such as motors or flow valves are sometimes used in open-loop operation, but they must be calibrated and adjusted at regular intervals to ensure proper system operation.

CLOSED-LOOP CONTROL SYSTEMS

In a closed-loop control system, the output of the process (controlled variable) is constantly monitored by a sensor; the sensor samples the system output and converts this measurement into an electric signal that it passes back to the controller. Because the controller knows what the system is actually doing, it can make any adjustment necessary to keep the output where it belongs. The signals from the controller to the actuator are the forward path, and the signal from the sensor to the controller is the feed back. The feed back signal is subtracted from the set point at the comparator.

The self-correcting feature of closed-loop control makes it preferable over open- loop control in many applications, despite the additional hardware required. This is because closed-loop system

provides reliable, repeatable performance even when the system components themselves are not absolutely repeatable or precisely known.

CIRCUIT BREAKER

As a matter of fact the power system is necessary to control switch on or off whatever it was at normal condition or abnormal condition at various circuits like (transmission lines, distributors, generating plants). In earlier days switches and fuses were used to control, but there are disadvantages for using them, firstly when a fuse blows out it takes quite sometimes to replace it secondly a fuse cannot interrupt the heavy fault current, we can conclude that the fuses and switches are limited to low voltage and small capacity circuits.

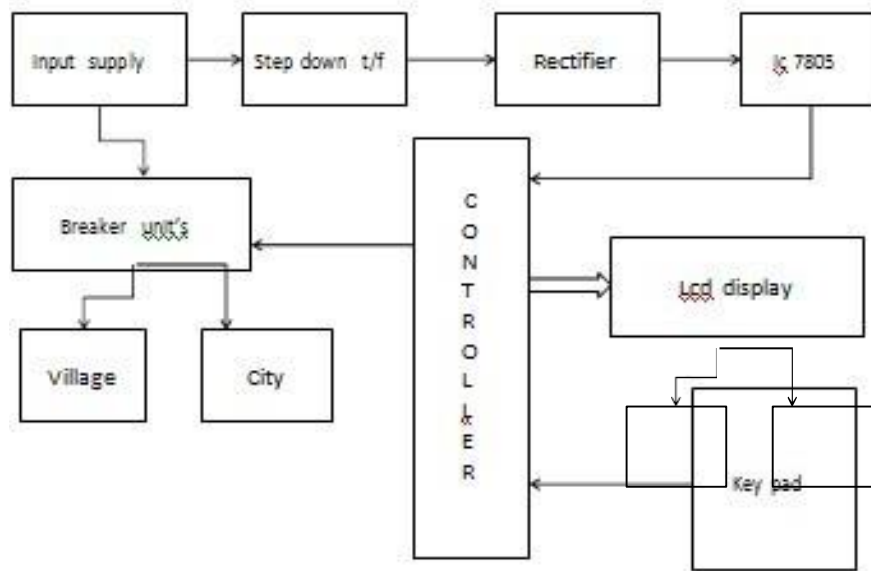
With advancement of power system the lines and equipment operate at very high voltage and carry a large currents this necessity at this time employ a more dependable means of control such as it obtained by use of circuit breakers.

A circuit breaker is a piece of equipment which can make or break the circuit either manually or automatically under all conditions no load, full load, short circuit this made circuit breaker very useful in switching or protection of various parts of the power system.

PROBLEM FORMULATION

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, overload). 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 black out over a large section of the distribution network. As we found that if the power in industries is disconnected for a minute it stops the production. So the power in industries should be continuous. And when a line has to be repaired the line then by unknowingly or wrong intentionally any one can turn ON the circuit breaker and a lineman can be met with a fatal accident.

BLOCK DIAGRAM



RELAY:

A relay is an electrically operated device that uses an electro magnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by allowing complete electrical isolation between control and controlled circuits, or where ever all circuits must be controlled by one signal.

The first relay long distance telegraph circuits a samplers they repeated the signal coming in from one circuit and retransmitted it on another circuit. Relays extensively in telephone exchanges and early computers to perform logical operations. A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching.

Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults in modern electric power systems these functions are performed by digital instruments still called "protective relays".

MICROCONTROLLER:

The AT mega 32 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the AT mega 32 achieves through puts approaching 1MIPS per MHz, allowing the system designer to optimize power consumption versus processing speed.

High-performance, Low-power Atmel AVR8-bit Microcontroller advanced RISC Architecture. Ithave 131 Powerful Instructions, most single- clock cycle execution. It contains 32×8 general purpose working registers.

It is fully static operation. It is upto 16MIPS through put at 16MHz. It is On-chip2-cycle Multiplier. It is high endurance non-volatile memory segments.It contain 32Kbytes of In-system self-programmable flash program.

The memory has 1024 Bytes EEPROM, 2Kbytes Internals RAM, Write / Erase cycles: 10,000 Flash / 100,000 EEPROM, Data retention: 20years at 85°C / 100 years at 25°C. It is a optional boot code section with independent lock bits.

LCD DISPLAY:

The term liquid crystal is used to describe a substance in a state between liquid and solid but which exhibits the properties of both.Molecules in liquid arrange themselves until they all point in the same specific direction. This arrangement of molecules enables the medium to flow as a liquid. Depending on the temperature and particular nature of a exist in one of several distinct phases. Liquid crystals in a nematic phase, in which there is nospatial ordering of the molecules.

KEYPAD:

HEX keypad is a standard device with 16 keys connected in a 4x4 matrix, giving the characters 0-9 A-F. Interfacing of Hex key pad to At mega32 is essential while designing embedded system projects which requires character or numeric input or both. For example projects like digital code lock, numeric calculator etc. Here we are using this to enter numeric password for turn ON/OFF the circuit breaker. This can be easily interface with ant kits Microcontroller Development Board. It is a four pin tactile switch and four mounting holes 3.2mm each.

IC 7805:

A voltage regulator is designed to automatically maintain a constant voltage level. A voltage regulator may use an electromechanical mechanism, or electronic components. Depending on design, it may be used to regulate one or more voltages. 7805 voltage regulating IC is used to provide the voltage 5V dc.

TRANSFORMER:

A transformer is electrical device that transfers the energy between two circuits through electromagnetic induction. A transformer may be used as a safe and efficient voltage converter to change the ac voltage at its input to a higher or lower voltage at its output. Other uses include current conversion, isolation with or without changing voltage and impedance conversion. It can also change the voltage level (lower to higher) and vice versa.

CAPACITOR:

A capacitor is an electrical device that can store energy in the electric field between a pair of closely-spaced conductors (called 'plates'). When voltage is applied to the capacitor, electric charges of equal magnitude, but opposite polarity, build up on each plate.

Capacitors are used in electrical circuits as energy storage devices. They can also be used to differentiate between high-frequency and low-frequency signals and this makes them useful in electronic filters. Capacitors are occasionally referred to as condensers. This is now considered an antiquated term electrolytic capacitor. An electrolytic capacitor is a type of capacitor typically with a larger capacitance per unit volume than other types, making them valuable in relatively high current and low-frequency electrical circuits.

CRYSTAL OSCILLATOR:

Crystal oscillator is an electronic oscillator circuit that uses mechanical resonance of a vibrating crystal of piezo electric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most

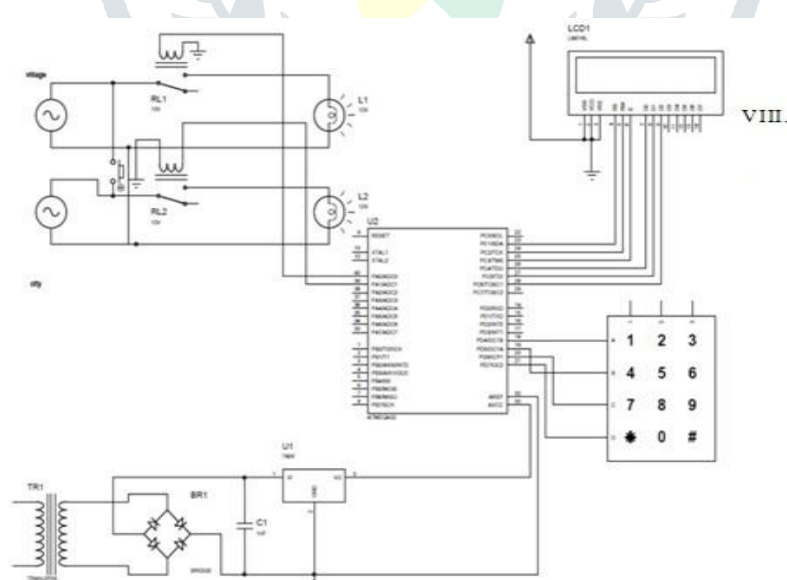
common type of piezo electric resonator used is the quartz crystal, so oscillator circuits incorporating them became known as crystal oscillator.

RESISTOR:

A resistor is a passive component that implements electrical resistance circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits.

Resistors may have fixed resistances or variable resistors. Resistors tend to network terminal electrical as a resistances, such as those found in thermistors trimmers, photoresistors and potentiometers. The current through a resistor is in direct proportion the voltage across the resistor's terminals. R is the resistance of the conductor in units of ohms (symbol: Ω). The ratio of the voltage applied across a resistor's terminals to the intensity of current in the circuit is called its resistance, and this can be assumed to be a constant (independent of the voltage) for ordinary resistors working within their ratings.

CIRCUIT DIAGRAM



IV.WORKING

In this paper, the power is distributed over two sections. First one is supply unit and second one is Breaker unit. Supply unit is converted into 5v and is given to microcontroller. During maintenance maintainer may met with fatal accident. So, for protection of maintainer, relay is operated by password. This is done with the help of microcontroller. First of all the password is preset by programming.

When we entered the password by the keypad if it is matched by preset password then the microcontroller send as signal to trip the password based relay. And again when maintenance is done, password to been ter-and if it matched with preset password, signal is send by microcontroller and relay ON.

Village area and city area run by separate supply voltage. If the demand needed for either village or city area based on the available power is sharing between two area. The load demand is occurred, the maintain reentering the password to operate the switch the load will share, otherwise switch is opened.

V.ADVANTAGES

- Improves Lineman safety
- Electrical accidents can be avoided.
- Easy of operation
- Maintance will be simple.

VI.APPLICATIONS

- It can be used any where in the substation to trip the circuit.
- Most useful to operate in the public areas.

VII.CONCLUSION

It can work on given known password and it gives no scope of password stealing. It ensures the lineman safety and it reduces load demand in the distribution side. There is also a provision of changing the password.

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