RFID Based Circuit Breaker for Electrical Line Man Safety

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Abstract: *The project is designed to control a circuit breaker with help of a password only a keypad is connected to the project to enter the password. 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. This proposed system provides a solution, which can ensure the safety of the maintenance staff e.g. line man. The control to turn ON/OFF the line lies with the line man only. This system has an arrangement such that RFID reader and password entering keypad is required to operate the circuit breaker (ON/OFF).by entering the correct password. The system is fully controlled by a microcontroller from pic family. a matrix keypad is inter faced to the microcontroller to enter the password. The entered password is compared with the password stored in the ROM of the microcontroller. If the password entered is correct, then only the line can be turned ON/OFF activation deactivation of the circuit breaker is indicator by a lamp (ON/OFF)*

Keywords: RFID tag Reader, Microcontroller, Circuit Breaker, 3 Phase Sensing

I. INTRODUCTION

A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by excess current from an overload or short circuit. Its basic function is to interrupt current flow after a fault is detected. 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 Circuit breakers are made in varying sizes, from small devices that protect low-current circuits or individual household appliance, up to large switchgear designed to protect high voltage circuits feeding an entire city. The generic function of a circuit breaker, or fuse, as an automatic means of removing power from a faulty system is often abbreviated as OCPD (Over Current Protection Device). All circuit breaker systems have common features in their operation, but details vary substantially depending on the voltage class, current rating and type of the circuit breaker. The circuit breaker must first detect a fault condition. In small mains and low voltage circuit breakers, this is usually done within the device itself. Typically, the heating or magnetic effects of electric current are employed. Circuit breakers for large currents or high voltages are usually arranged with protective relay pilot devices to sense a fault condition and to operate the opening mechanism. These typically require a separate power source, such as a battery, although some high-voltage circuit breakers are self-contained with current transformers, protective relays, and an internal control power source A lot more research are going on developing new topologies and control strategies for the safety system. Electricity is now become a part of our daily life, they play the many roles in their field. The main objective of this project is to save line man by making such a protective system controlled through fingerprint scanner, in this proposed system if there is any fault in line, the line man senses his finger and he reads the RFID tag due to which main line is switched off. The finger print based electric line man safety system is designed to control a circuit breaker by using a RFID and Fingerprint sensor for the safety of electric man. . This project gives a solution to this problem to ensure electric line man safety. It very simple to maintain so it is very useful for the line man. The parts which are required for our model are easily available in the market. The main concept of our project is to save the life of line man.

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II. LITERATURE SURVEY

In past few years many theories were proposed about the circuit breaker system.

Mane Kirti [1] proposed a system that access only specified password to control the circuit breaker by authorized person only. It is fully controlled by the microcontroller which has an 8KB of ROM and matrix keypad was used to to enter the password and relay driver to switch ON/ OFF loads through relays.

BhagwanKharat[2] proposes a system that presents the architecture of an online monitoring and diagnosis System of an electrical equipment which has role to acquire, transfer and process information about monitored equipment. An interface is designed on top of which different local as well as system applications can be recorded. Controller will continuously transmit parameters of circuit breaker to control room and also displayed on Monitor of computer as well as after C.B trip SMS get sent to the registered mobile number. Once message is received, the operator or any authorized person will give command to set or reset the breaker. It minimizes the fault clearing time and improves maintenance method which increases life time and reliability of the circuit breaker.

Abhijit Das [3] proposed a system that develops monitoring & control scheme of a typical circuit breaker using Arduino Mega 2560 embedded microcontroller along with Ethernet Shield for integration of IOT. The system facilitates diagnose of the electrical and mechanical health of circuit breaker in real time. It uses Open-source platform which eliminates the concern regarding reliability & security of the safety/safety related/strategic application as complete source code implementation is open & fully accessible to the user.

Lakshmi Devdas [4] proposed an idea that put forwards a more secured operating 8 condition for the line man and ensures unauthorized access and that a switching of the line does not occurs. This is implemented using a password verification method. With the help of matrix keypad user can enter password which is compared with a pre-set password. If it matches, the line man 11 can operate the line according the requirement. Parameters like voltage and current with ON/OFF status are accessed on a webpage, connected via an IOT.

Nair Athira [5] , have proposed a system that focuses on the safety of the lineman while working so they do not feel the sudden electric shock. With proper coordination among lineman and substation, lot of accidents can be avoided. The project aimed to provide the solution that ensures the safety of maintenance staff. The lineman detects the fault in the electric line, SMS get sent to the substation staff, which switch off the line and turn it on when the fault is resolved.
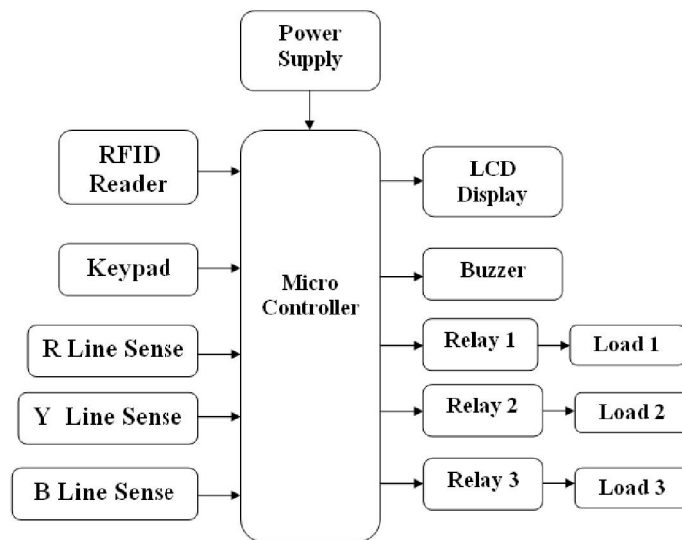
Method of disease detection

Fig. 1. Block Diagram

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. When operated manually we see fatal electrical accidents to the line man are increasing during the electric line repair due to the lack of communication and coordination between the maintenance staff and the electric substation staff. 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 Arduino controller family. The password is stored in an, interfaced to the controller and the password can be changed any time unlike a fixed one burnt permanently on to the controller. 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. Index terms:, controller, LCD, Transformer, RFID Reader, Load, Relay, Relay Driver. Nowadays, electric injuries to the line man are growing, while repairing the electrical lines because of the dearth of communiqué between the electric substation and renovation staff. This task gives a technique to this trouble to ensure line man protection. In this proposed device the control (ON/OFF) of the electrical strains lies with line man. This undertaking is organized in this sort of way that renovation workforce or line guy has to enter the password to ON/OFF the electric line. Now if there is any fault in electric line then line man will transfer off the power deliver to the line via entering password and without difficulty repair the electrical line, and after coming to the substation line guy switch on the deliver to the specific line with the aid of entering the password.

PIC18f4520 Microcontroller

The PIC18F4520 is a 28/40/44-Pin, High-Performance, Enhanced Flash, USB Microcontrollers with nanoWatt Technology. It is an 8-bit enhanced flash PIC microcontroller that comes with nano Watt technology and is based on RISC architecture. Many electronic applications house this controller and cover wide areas ranging from home appliances, industrial automation, security system and end-user products. This microcontroller has made a renowned place in the market and becomes a major concern for university students for designing their projects, setting them free from the use of a plethora of components for a specific purpose, as this controller comes with inbuilt peripheral with the ability to perform multiple functions on a single chip.

The PIC18F4520 contains 256 bytes of EEPROM data memory, 1536 bytes of RAM, and program memory of 32K.

It also incorporates 2 Comparators,10-bit Analog-to-Digital (A/D) converter with 13 channels, and houses decent memory endurance around 1,000,000 for EEPROM and 100,000 for program memory.

The Enhanced Universal Asynchronous Receiver Transmitter (EUSART) feature is useful for developing the serial communication with other devices.
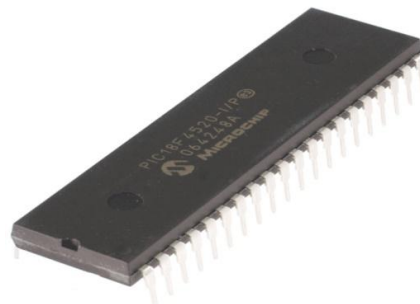

Fig. 2. PIC 18f4520

LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD

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each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD
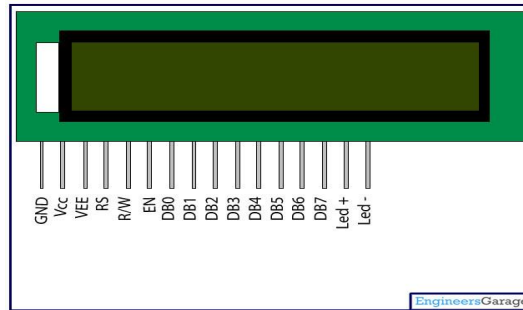

Fig. 3. LCD Display

RFID Tag Reader

RF ID is Radio Frequency Identification which is used to make track of every physical object. The frequency of operation widely used at present are **LF –Low Frequency 125 KHz & UHF (Mifare) 13.5MHz.** In this post our focus is on 125KHz RF ID.The main components of the RF ID system are: 1) The **RF ID Reader – EM-18 type** of RFID reader is used for demo in this post.2**) RF ID tag** – The Tag contains an Integrated circuit for memory & an Antenna coil. There are 2 types of Tags – Passive & Active. We make use of Passive tags here .As the name implies these tags do not have a power source .When the passive Tag is near a RF ID reader, the energy is induced by electromagnetic waves. The tag "wakes up" & responds by sending the data stored in its memory. **The RANGE of passive tag access is below 10 cm.**

Active tags have their own battery source & offer a long range of access. Active tags are costlier than the passive ones.

Fig. 4.RFID Tag Reader

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 allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

Fig. 5.Relay

GSM SIM 800

Voltage Sensor is a precise low cost sensor for measuring voltage. It is based on principle of resistive voltage divider design. It can make the red terminal connector input voltage to 5 times smaller. Arduino analog input voltages up to 5V, the voltage detection module input voltage not greater than 5Vx5=25V (if using 3.3V systems, input voltage not greater than 3.3Vx5=16.5V).

Arduino AVR chips have 10-bit AD, so this module simulates a resolution of 0.00489V (5V/1023), so the minimum voltage of input voltage detection module is 0.00489Vx5=0.02445V.

Fig. 6.Voltage Sensor

III. CONCLUSION

It can work on given known password and it gives no scope of password stealing. It ensures the line man safety and it reduces load demand in the distribution side. There is also a provision of changing the password. The electric lineman safety system is designed to control a circuit breaker with help of a password and RFID. RFID is the main attraction of this project. It provides a new approach to the security of the lineman and completely eliminates the accidents to the lineman due to electric shock during the electric line repair. This system can also implement in many other public areas also. It has been developed by integrated features of all the hardware components used. It provides a new approach to the security of the lineman and it completely eliminates the electrical accidents to the lineman during the electric line repair.

IV. ACKNOWLEDGMENT

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