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NODE MCU BASED PASSWORD CIRCUIT BREAKER

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ABSTRACT

Statistics suggests that majority of electrical accidents occurs during electrical line maintenance work and are caused due to miss communication between electric substation staff and maintenance staff. To prevent this, we are implementing automated circuit breaker with a better interfacing. Internet of things is at the forefront in areas of real time monitoring, situational awareness and intelligence, control and cyber security which makes the system efficient secure reliable resilient and sustainable. This project gives maintenance complete control for turning ON/OFF the line. The proposed idea put forward a more secured operating condition for the line man and ensures unauthorized access and that a switching of the line does not occurs. This is realized using a password verification method. The password is entered using a matrix keypad which is compared with a pre-set password. If it matches, the line man can operate the line according the requirement.

Keywords: ESP8266, Circuit Breaker, .

I. INTRODUCTION

Nowadays, electrical accidents to the line man are increasing, 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. In this proposed system the control (ON/OFF) of the electrical lines lies with line man. This project 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 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. The password based circuit is to ensure the security purpose. To block unauthorized entry. In India, the number of death due to electrical accidents has reached about 1400 in the last 3 years alone. Of these, majority of the victims are electrical line man who lost their life during maintenance work. The main reason behind these

upsetting figures is due to the improper charging and discharging of electrical lines occurring due to miscommunication and lack of coordination between maintenance staff and engineers at the substation.1 Another cause is the unauthorized operating of line. In the event of power outage due to fault or other abnormalities the lines are sometimes charged without proper communication from the concerned authority. In rural area there are even incidents where civilians themselves operate the line, reason. In order to avoid this, we have designed a system that checks the authenticity of the user. The password based circuit breaker accomplishes this by using a password verification method.

Problem Statement:

Provide confidence to protect engineers during maintenance work on high voltage installations. It is found that 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.

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II. LITERATURE SURVEY

Electric lineman protection using user changeable 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. 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 8 bit microcontroller of 8051 family. The password is stored in an EEPROM, interfaced to the microcontroller and the password can be changed any time unlike a fixed one burnt permanently on to 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. 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. 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 8 bit microcontroller of 16f877A family. The password is stored in an EEPROM, interfaced to the microcontroller and the password can be changed any time unlike a fixed one burnt permanently on to 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. Index terms: Resistors, Capacitors, Diodes, Transistors, Voltage regulator, Rectifier, Microcontroller, EEPROM, Relay, Relay Driver



III. BLOCK DIAGRAM

Fig. Block Diagram

Description:

The best safety precaution that can be taken to prevent loss of lives of linemen and people, due to electrical accident caused by lack of communication and break down of distribution line, is to isolate the fault as soon as possible with secured methods like password based circuit breaker. Fault detection and isolation is much difficult when it comes to distribution sector, as a large area has to be completely monitored. The current technique of using fuse unit to disconnect supply before maintenance work is also a major threat to the life of linemen. Password based circuit breaker replace the older system of fuse unit for disconnection and connection of distribution lines. This circuit breaker module provides a safer working environment for the lineman during maintenance or extension work. This unit makes the entire control of operating circuit breaker within the hands of the authority. The circuit breaker unit works on a pre-set password, which is already stored in the memory of microcontroller. An external keypad is provided for the entering of password by the authority, both the passwords are compared by the microcontroller and if they match, the relay can be operated for connection and disconnection of supply. The same process can be achieved through mobile application called "BYLNK". This facility allows the operation of password based circuit breaker by entering the password through a mobile application synchronised to the system, the same comparison takes place here and the authority can operate the device without coming to the spot and thus its useful in emergency situations. Password based circuit breaker, when connected with a fault detection unit placed along with each consumer's energy meter, can be effectively used for the faster detection and isolation of fault occurred by breakdown of distribution line. When the signal from the detector is received by the WiFi module integrated to the NODEMCU microcontroller, connected to the password based circuit breaker. The NODEMCU compares the pre-set conditions and takes the necessary action to isolate the fault with relay unit. Providing instant alert to the

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authority is important for faster isolation of fault. The alert system placed in the section office are controlled using NODEMCU microcontroller. The signal from the detector consist of the consumer id, which is helpful in displaying of the exact address of the fault. For that an LCD display unit is placed along with LED alert

Components Description

Arduino Uno:

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button. The 14 digital input/output pins can be used as input or output pins by using pin Mode(), digital Read() and digital Write () functions in ardiuno programming. Each pin operate at 5V and can provide or receive a maximum of 40mA current, and has an internal pull-up resistor of 20-500 KOhms which are disconnected by default.



Fig 2. Arduino Uno

ESP8266 Module:

There are so many methods and IDEs available to with ESP modules, but the most commonly used on is the Arduino IDE. So let us discuss only about that further below. The ESP8266 module works with 3.3V only, anything more than 3.7V would kill the module hence be cautions with your circuits. The best way to program an ESP-01 is by using the FTDI board that supports 3.3V programming. If you don't have one it is recommended to buy one or for time being you can also use an Arduino board. One commonly problem that every one faces with ESP-01 is the powering up problem. The module is a bit power hungry while programming and hence you can power it with a 3.3V pin on Arduino or just use a potential divider. So it is important to make a small voltage regulator for 3.31v that could supply a minimum of 500mA. One recommended regulator is the LM317 which could handle the job easily.



Fig 3. ESP8266

LCD display:

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode ray tube (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than CRT and plasma displays, with LCD screens available in sizes ranging from tiny digital watches to huge, big-screen television sets. Since LCD screens do not use phosphors, they do not suffer image burn-in when a static image is displayed on a screen for a long time (e.g., the table frame for an aircraft schedule on an indoor sign). LCDs are, however, susceptible to image persistence. The LCD screen is more energy-efficient and can be disposed of more safely than a CRT can. Its low electrical power consumption enables it to be used in battery-powered electronic equipment more efficiently than CRTs can be. By 2008, annual sales of televisions with LCD screens exceeded sales of CRT units worldwide, and the CRT became obsolete for most purposes.





Battery:



An electric battery is a device consisting of one or more electrochemical cell swith external connections provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved additionally to include devices composed of a single cell. Primary (single-use or "disposable") batteries are used once and discarded; the electrode materials are irreversibly changed during discharge. Common examples are the alkaline battery used for flashlights and a multitude of portable electronic devices. Secondary (rechargeable) batteries can be discharged and recharged multiple times using an applied electric current; the original composition of the electrodes can be restored by reverse current. Examples include the leadacid batteries used in vehicles and lithium-ion batteries used for portable electronics such as laptops and smartphones. Batteries come in many shapes and sizes, from miniature cells used to power hearing aids and wristwatches to small, thin cells used in smartphones, to large lead acid batteries used in cars and trucks, and at the largest extreme, huge battery banks the size of rooms that provide standby or emergency power for telephone exchanges and computer data centers.

Relay:

Relays are most commonly used switching device in electronics. Let us learn how to use one in our circuits based on the requirement of our project. Before we proceed with the circuit to drive the relay we have to consider two important parameter of the relay. Once is the Trigger Voltage, this is the voltage required to turn on the relay that is to change the contact from Common->NC to Common->NO. Our relay here has 5V trigger voltage, but you can

also find relays of values 3V, 6V and even 12V so select one based on the available voltage in your project. The other parameter is your Load Voltage & Current, this is the amount of voltage or current that the NC,NO or Common terminal of the relay could withstand, in our case for DC it is maximum of 30V and 10A. Make sure the load you are using falls into this range. The above circuit shows a bareminimum concept for a relay to operate. Since the relay has 5V trigger voltage we have used a +5V DC supply to one end of the coil and the other end to ground through a switch. This switch can be anything from a small transistor to a microcontroller or a microprocessor which can perform switching operating. You can also notice a diode connected across the coil of the relay, this diode is called the Fly back Diode. The purpose of the diode is to protect the switch from high voltage spike that can produced by the relay coil. As shown one end of the load can be connected to the Common pin and the other end is either connected to NO or NC. If connected to NO the load remains disconnected before trigger and if connected to NC the load remains connected before trigger.



Fig 5. relay

Keypad:

A keypad is a set of buttons arranged in a block or pad which bear digits, symbols or alphabetical letters. Pads mostly containing numbers and used with computers are numeric keypads. Keypads are found on devices which require mainly numeric input such as calculators, television remotes, push-button telephones, vending machines, ATMs, Point of Sale devices, combination locks, and digital door locks. Many devices follow the E.161 standard for their arrangement. A computer keyboard usually has a small numeric keypad on the side, in addition to the other number keys on the top, but with a calculator style arrangement of buttons that allow more efficient entry of numerical data. This number pad (commonly abbreviated to numpad) is usually positioned on the right side of the keyboard because most people are right-handed. Many laptop computers have special function keys that turn part of the alphabetical keyboard into a numerical keypad as there is insufficient space to allow a separate keypad to be built into the laptop's chassis. Separate external plug-in keypads can be purchased. Keypads for the entry of PINs and for product selection

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appear on many devices including ATMs, vending machines, Point of Sale payment devices, time clocks, combination locks and digital door locks.



IV. CONCLUSION

This system provides a solution, which can improve the safety of the project. It is designed to control a circuit breaker with the help of a password. The maintenance staff e.g. Line man's for control to turn ON/OFF. The line works with the line man only this system is arrangement such that a password is required to operate the circuit breaker (ON/OFF). Line man can turn off the supply and comfortably repair it, and return to the substation, then turn on the line by entering the correct or same password. The system fully controlled by a Arduino UNO. If the password entered is correct, then the line can be turned (ON/OFF). Security is prime concern in our day-to-day life. Everyone wants to be more secure as to be possible. This system provides a new approach to a lineman security for their life. The circuit can be used without any fail of a lineman. The circuit can be used without any load can also be controlled when required.

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