Finger Print Based Electric Load Switching Gear for the Safety of Lineman

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Abstract: *Fingerprint based IOT controlled Electric Protection System is based on a circuit breaker that can only be remotely controlled by the lineman himself, designed to provide security to the maintenance staff and households while repairing the electrical lines. When operated manually we see fatal electrical accidents to the linemen is increasing during the electric line repairing due to lack of communication and coordination between the maintenance staff and electric substation staff. In order to avoid such accidents, the circuit breaker can be designed such that only authorized person can operate it with the help of fingerprint password-based IOT application. By using it operator can control the circuit breaker while he is away from the workstation and fingerprint sensor is used to enter the password to control it when the operator is in the workstation. A relay is used to open or close the circuit breaker. Any wrong attempt to open the breaker an alert will be displayed on the LCD screen through the application and display the status on the HMI. Furthermore, the system will detect faults, maintain a profile of the connection and provide alarms to linemen.*
Keywords: *Arduino UNO (microcontroller), IOT Controlled, Fingerprint Password Based.*

I.   INTRODUCTION

Safety of human life is of a paramount importance. In high current switching system, switch gear protects electrical circuit. ''Security is the prime concern in our day to day life. Everyone needs to be securing as much as possible. The electric line man safety system is designed to control a switch gear by using a fingerprint as password for the safety of electric man. Critical electrical accidents to line men are on the rise during electric line repair due to lack of communication and co-ordination between the maintenance staff and electric substation staff'' [IEEE]. This paper offers a resolution that safeguards safety of maintenance line men. The control to turn on or off the line will be maintained by the line man only because this system has an arrangement such that a fingerprint as password is required to operate the circuit breaker (on/off). The system is fully controlled by a microcontroller from AVR family. A matrix keypad is interfaced to the microcontroller to enter the fingerprint as password. The entered fingerprint as password is compared with the fingerprint as password generated. If the fingerprint as password entered is correct, only then the line can be turned ON/OFF. To repair a particular section of the electric supply line or when the lineman wants to turn off the supply to a line, a request is first put forward to the system, and then the system responds to using the LCD display to enter the fingerprint as password. Then the system generates a fingerprint as password and it will be send to the processor. The fingerprint as password based switch gear can also be implemented in automatic door locking system for providing high security and also can be implemented to control electronic appliances to save the power.

II.   LITERATURE SURVEY

1   **ELECTRIC LINEMAN PROTECTION USING PASSWORD-BASED CIRCUIT BARKER**:

In this method of lineman protection Microcontroller is used which controls all the operations in regarding the password system. For this process, we require components like microcontroller control circuitry, power supply, relay, and keypad. These keypads are used for entering a password for operating different load which is connected to the controller. If suppose password is wrong, then the load will not be switched to the controller and then the controller checks for the precaution instruction which is provided by the developer. This includes operations such as the number of loads to be opened, the number of threshold levels that are crossed. In this process, the controller checks the number of threshold levels that are crossed and according to that the gates are being controlled.

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2   **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 lineman 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[15]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 families. 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 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.

3   **Electric lineman protection using circuit breaker based on an android via Bluetooth:**
        This method provides a password-based circuit breaker system using an android application. Here we connect the circuit with the android application through which we enter the password. There is a substantial increase in the number of fatal accidents involving linemen due to electric shocks resulting from the lack of coordination between maintenance staff and the electric substation staff. This system provides a solution to this problem, to ensure there are no such incidents that endanger the life of linemen. Here the control of the circuit is provided at the substation. The lineman can enter the password to switch OFF the circuit. He may now safely work out the repairs and may return to the substation to switch ON the circuit. He again needs to enter the password in order to switch ON the circuit. Since the control to switch ON/OFF the circuit lies with the lineman himself there is no chance of accidents. The system also provides password storage using EEPROM. This system also makes it possible to change the password as and when needed for security purposes.

4   **Transmission line fault detector in remote areas using wireless technology:**
        Generally Electrical power system consists of three main domains (Generation, Transmission, and Distribution). Between these domains, the maintenance of the transmission and distribution lines is one of the difficult tasks to the EB department. Sometimes the failure of the transmission lines gets unnoticed and the buyer thinks that the power has been shut down. Also, the transmission lines are in far away places in the remote corner of towns, cities and villages. In all these cases it is very difficult to hire an individual to monitor all these transmission lines. In remote areas, people try to rectify the fault in a transmission line on their own, due to which undesirable accidents and safety hazards occurs. To resolve this issue a project is proposed to monitor the transmission lines using wireless technology. In this project WiMAX module (smart electronic monitoring device) is attached to the transmission lines. It monitors different parameters on a transmission line such as current output, overload, short circuit and cut off in a transmission line. If there is any variation in any of this parameter, the WiMAX module immediately broadcast the information to the authorized person (lineman, office powerhouse).

5   **Arduino based underground and overhead cable fault detection:**
        It is very important in the modern-day word to ensure stable operation of transmission lines deliver power without any interrupt. When any fault occurs in the transmission line then it is difficult to locate the fault. In this proposed project to locate the distance of underground and overhead transmission line from fault location to grid station using Arduino . In this project to detect a fault in the transmission line, they use the concept the ohm's law to find the exact position of the fault. Each transmission line has its own resistance based upon the length of the cable. At the feeder end, the low DC voltage is applied through a series resistance. The current would be depending upon the location of the fault in the transmission line. When a short circuit occurs voltage in the series resistor change which is detected by inbuilt ADC of Arduino and display the fault on LCD. In an overhead transmission line, they use the sensing device , relay senses the fault and send the information to Arduino and similarly fault display on LCD connected with Arduino.

III.   REASONS FOR PROJECT IDEA
        In existing system whenever any of the problems occur at distribution lines, lineman have to informs the substation operator to shut down the power of that specific line on which fault has occurred through making a phone call to substation operator or by going by himself to the substation for the maintenance of that distribution line, there is a huge chance of communication gap between the electric lineman and sub-station operator or staff. This communication gap may risk the life of an electric lineman or a transformer or other components, or household appliances.

IV.   BASIC WORKING PRINCIPLE

The microcontroller, which has the capabilities to run twenty-four hours a day, and seven days a week. In this project, it is being used as the brain of the entire system to control the system. The analogue module is an extension block for microcontroller to take in Analogue values and converts it into a readable format for the microcontroller. The Communication Module is another extension block for the microcontroller which enables the to send data via RJ45 jack to a cloud system. The HMI stands for Human Machine Interface, and as the name says it, it displays a programmed graphical interface for the humans to interact with the controller, but also provide run time readable data for the humans to understand the values going in and out of the switching module, and how the microcontroller is regulating the system to normality. The current transformer is kind of a current sensor which uses a coil through which a current carrying wire passes. This causes power to flow in the coil that is proportional to the current. This happens because of the magnetic field produced by flowing current. Inductive sensors are used for AC currents. The sensor has a wire-wound core and a signal conditioner. As the current conductor passes through the core, it becomes magnified by the conductor's magnetic field. Since AC current is constantly changing potential from negative to positive, generally at the rate of 50 to 60 Hz and therefore creating an expanding and collapsing magnetic field, a current is induced in the windings. The secondary current is converted to a voltage and conditioned to output as the input of microcontroller's Analogue Module. The fingerprint is an accessory attached to the Microcontroller for the remote use, as, in very grid station there is a turn off switch for the switching system, which enables it to be operated remotely via HMI, and zero intervention from the centrally linked switching system. The relay is a simple turn on and turns off switch for a line, that is done via an electrical signal
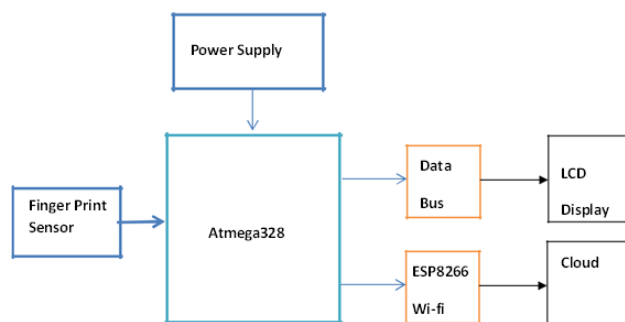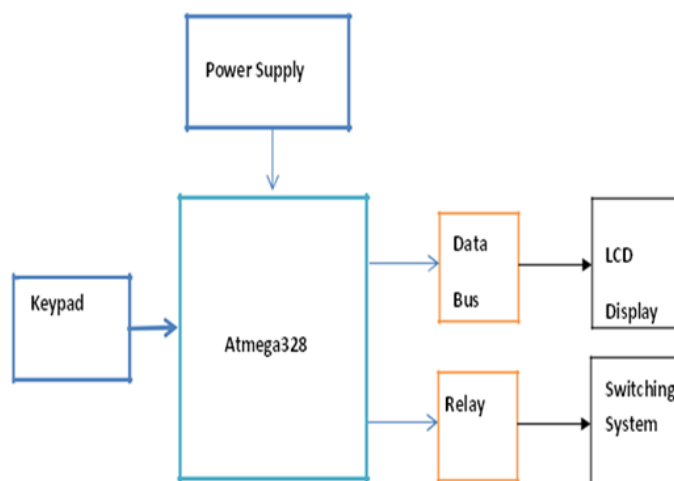

Fig: User Block Diagram

Fig: Substation Block Diagram

V.   BASIC COMPONENTS USED

Hardware Requirement
1.   Arduino UNO- Atmega328
2.   Fingerprint Sensor
3.   ESP8266
4.   Keypad
5.   LCD Display

Software Requirement
1. Arduino IDE
2. Proteus Design Tool

Hardware Description
LCD Display
For case of interaction with user, this system uses an electronic display module. A 16×2 LCD is used. This means in two lines it is possible to display 16 characters per line. A 5×8 pixel matrix is used for display one character. Two registers are associated with an LCD, such as data and command.

Triac
Available in high power packages, the BTA/BTB40-41 series is suitable for the purpose of switching. They can be used as an ON/OFF fan.

Voltage Regulating IC
A voltage regulator, Fig. 3, is designed to 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. 7809 voltage regulating IC is used to provide the voltage 9V d.c.
For the working of the system a power supply is needed. The micro controller needs only 5 Volt DC for its working. Therefore the incoming AC will be rectified, filtered and regulated by 7805 IC,

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. Here in this project we are using it to step down the voltage level.

ESP8266
ESP8266 wifi Module. NodeMCU uses Lua Scripting language and is an open source Internet of Things (IoT) platform. This modules has CH340g USB to TTL IC.
Specification of IoT Module :-
It is based on ESP8266, integates GPIO, PWM, IIC, 1-Wire and ADC all in one board.
Power your developement in the fastest way combination with NodeMCU Firmware.
USB-TTL included, plug and play
10 GPIO, every GPIO can be PWM, I2C, 1-wire

Resistor
The 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 resistances, such as those found in thermistors trimmers, photo resistors and potentiometers. The current through a resistor is in direct proportion the voltage across the resistor's terminals. This relationship is represented by Ohm's law: where *I* is the current through the conductor amperes, Vis the potential difference measured across the conductor in units of volts, and *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 resistor working with voltage.

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. This is especially the case in power-supply filters, where they store charge needed to moderate output voltage and current fluctuations, in rectifier output, and especially in the absence of rechargeable batteries that can provide similar low-frequency current capacity.

Microcontroller

Microcontroller is small computer on a single integrated circuit containing a processor, memory, and programmable input/output peripherals. Program memory in the form of NOR flash or OTP ROM is also often included on chip, as well as a typically small amount of RAM [Byreddy S. & Fazal, 2013]. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications.

Crystal oscillator

Crystal oscillator is an electronic oscillator circuit that uses mechanical resonance of a vibrating crystal of piezoelectric 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.

VI．CONCLUSION

Technology is ruling the world nowadays, but it should erase problems for our development. In this paper, a model for reducing fatal accidents with the help of ARDUINO microcontroller and RFID READER and GSM modem is designed. For repairing the electric lines, the lineman and his safety play a major role. Hence, we have brought forward this concept as a key focusing problem in electrical engineering society. In owing to avoid the fatal accidents for a lineman, a control on service lines via one-time passwords is achieved.

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