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Password based circuit breaker operation for the safety of lineman duringmaintenance work

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ABSTRACT
Nowadays, accidental death of lineman is a commonly occurring tragedy. so, it is compulsory for us to guarantee the safety of linemen by adapting a new method of operation. A new system should be adapted to regulate and manage the control panel which consists of all the electrical components and circuit breakers. These accidents are on the rise throughout the country, main reason being miscommunicationbetween the maintenance workers and sub-station workers. The planned system gives a solution for this problem and reduces the risk for linemen. The control to activating/ deactivatingthe control panel is in the hands of the linemen only. In this new method of operation, a "Passcode or Password" is needed to access the control panel and further to operate the circuit breaker (ON/OFF). An encrypted Passcode/Password is sent form the substation to the circuit breaker operators(linemen), for the purpose executing maintenance works. The password is registered and forwarded to the lineman's mobile and also to the management panel by the help of GSM module. The received passcode/password is typed in through the matrix keyboard which acts as the input device and also it is interfaced to the microcontroller present inside the panel. The password entered by the lineman is compared with the encrypted passcode received from the substation through the GSM module. Only when both the passwords match, the lineman will be able to access the control panel and to operate the circuit breaker, so he can proceed to do the repair works and maintenance works. If any third party enters a wrong password, he/she will not be able to access or operate the control panel and hence the system will be completely secured.
Keywords: Security,lineman,password,control panel

I. INTRODUCTION

In present times, casualties of line-workers due to accidents occurring during maintenance works is on the rise. Until now, to execute maintenance works, Line clearance method is used to shut down the electrical line in which the work is to be done. There are lots of short-comings to this method, like accidental charging of the line due to mistake of the operators at station, which can lead to serious injuries, and in some unfortunate cases, even deaths of line-workers.The employment of microcontrollers can be a solution to this issue. The employment of communication networks will increase the potency of the pilotless devices. This new method with the help of GSM module, reduces the risk of physical contact with the high voltage electrical lines, and enables us to control the circuit breakers automatically. so,we decided to implement GSM based circuit to control the operation of the electrical lines.

A circuit breaker is a protective device which acts as a switch designed to safeguard an electrical circuit from damage caused by short circuit. When operated manually there is a chance of fatalaccidents occurring to the line-workers such as linemen andoccurrence of these accidents are steadily increasing during the electric line repair due to the lack of communication and coordination between the maintenance staff and the electric substation staff[1].Circuit breakers are an important necessity for an electrical system as they play a vital role in protecting the electrical components. And their malfunctioning can cause damageto the electrical equipment and could result in unstable operating conditions. When doing repair works on electrical lines there is a probability of miscommunication between the linemen and substation workers. This miscommunication could result in an accident and result in the death of theline-workers.

There are many major disadvantages to the existing system of Circuit Breaker operation, for example: During maintenance or repair works, the entire line is turned off which is a major

inconvenience for the consumers, and sometimes,miscommunication between line-workers and substation workers may result in fatal accidents.

So as a solution to this outdated method of operation and to increase the safety of the linemen, we propose a new system of operation which doesn't require manual operation of the Circuit breaker. Here's how our system will work; The Passcode entered by the lineman will be displayed in the LCD display. This passcodewill be comparedwith the password which was received through the GSM module.Our system uses a microcontroller which is embedded in Arduino. If a particular line needs repair or maintenance, the substation workers will send an encrypted password to the lineman and also to the Arduino through the GSM module.The lineman will then enter the received passcode in the keypad present in the panel. This Passcode will be compared with the password in the Arduino. If both these passwords match, the control panel door will be opened.A relay gives the control signal to the panel and the circuit breaker for the required operation. As soon as the repair work is done, lineman should enter the same passcodeto switch ON the circuit breaker, and hence the electrical line will be active again.Hence, the control of the circuit breakers and the ability to access the control panel will be in the hands of linemen and substation workers only[3].

In this proposed method, there are numerous advantages, starting from increase in the safety of Linemen, User friendly operation of main line, the proposed system is easy to install and operate, this method of operation is very Cost-effective, and most importantly it is easy to maintain and repair.

The primary objectives of our systemis to decrease the physical work required while switching ON/OFF the CB's, and also to increase the safety of Line-men during maintenance works.

II. METHODOLOGY:

- We referred all the previous researches done in this domain.
- Literature review on Operations of Arduino based protection.
- Searched about a different type of controlling circuit systems, Relays and other components.
- Designed the block diagram
- Designed a Model Circuit with all the components.
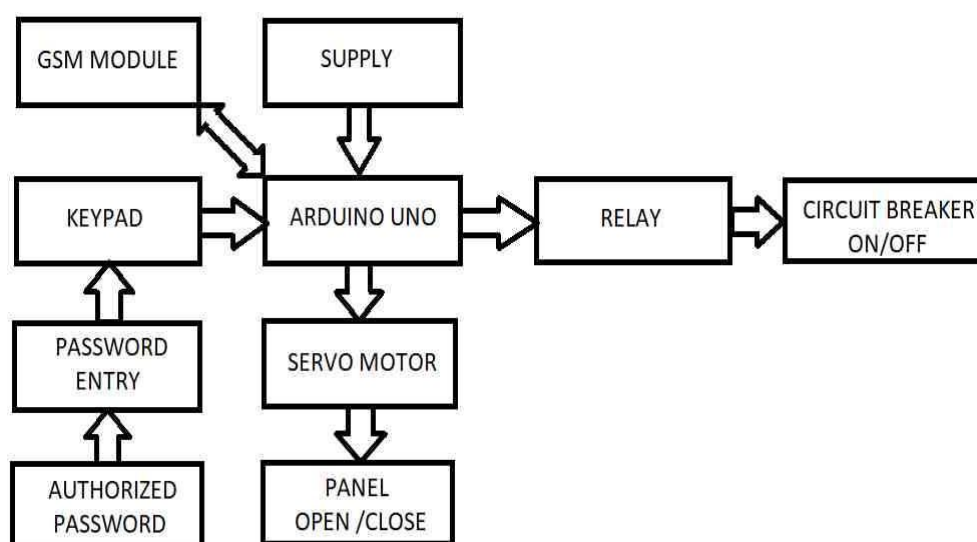
III. BLOCK DIAGRAM

Fig 1

IV. COMPONENTS

- Matrix keypad
- GSM module
- Arduino
- Relay
- LCD
- Servo motor

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Component specification

Component Name	Type	Operating Voltage/Current	Quantity
Matrix Keypad	4X4	30mA(max)	1
GSM module	SIM900A	5V	1
Arduino	UNO R3	5V	1
Relay	SPDT	5V	1
LCD	16X2	5V	1
Servomotor	SG90	5V	2
Connecting wires			As required

4.1 Matrix keypad:
The matrix keypad acts as the input device. It has 12(3x3) or 16(4x4) keys in total, which means that it has unique value for each key and hence the password can be entered through this. The entered password or the button clicked will be displayed in the LCD.

Fig 2

4.2 GSM module:
A GSM module is a wireless modem that operates as a wireless network. The key difference between the dial-up modem and GSM modem is that the dial-up modem transmits and receives data through a telephone line cables whereas a wireless modem transmits and receives data through radio waves signal. In order of the radio waves, it requires a SIM card for this to operate.The Global System for Mobile Communication is used for sending and receiving information to the Arduino interfaced with it and to the control room. Generally, it acts as the mobile phone which can communicate with the other mobiles when it is interfaced with the Arduino.

Fig 3

4.3 Arduino ATMEGA 328:
Arduino board compromises of various microprocessors where ATMEGA 328 is the microprocessor used here. It is a low power CMOS which gives highly efficient performance with 8-bit microcontrollerbased on AVR enhanced RISC architecture. AT stands for ATMEL, MEGA which represents Frequency in Megahertz. Here 328 represents 32Kbyte Flash Memory. It consists of 14 digital pins where it can be act as both input and output in which 6 can be used as PWM outputs. The Arduino can be programmed to do a specific task based on different projects. Simply is acts as the heart of the system.
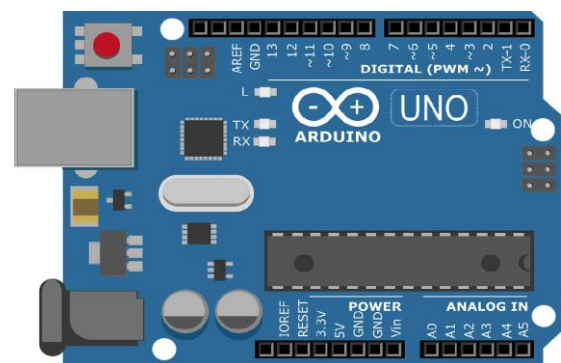

Fig 4

Features
• High-performance.
• Low-power Consumption.
• Fully Static Operation.
• 32Kbytes Flash program memory

4.4 Relay:
A circuit used to switch on and off a light bulb or any other load connected to main supply. It works on the principle of electromagnetic operation where magnetic field is created to operate the lever to control the flow of current in specific direction to turn on/off the load. Here the load given is LED to specify the on/off conditions of relay.
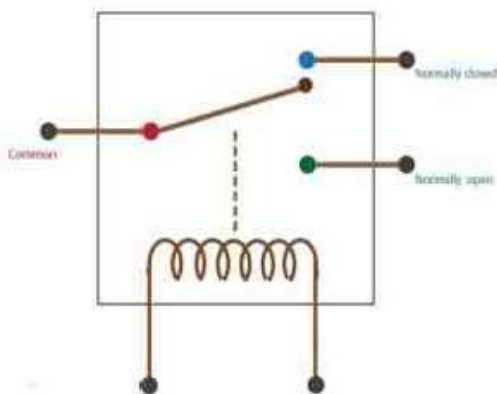
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Fig 5

Fig 6

4.5   LCD:

Liquid crystal display(LCD) is also called as flat panel display which works on the principle of blocking light. It is used for displaying numeric and alphanumeric characters in dot matrix and segmental way. The entered password will be processed by the Arduino and will displayed by the LCD. It consists of 16 rows and 2 columns to display the numeric and alphanumeric contents

Fig 7

4.6   Servo Motor:

There are different types of motor among which, the servo motor is named for its great precision. Commonly servo motor can rotate with perfect position because it consists of a control circuit that provides feedback on the current position of the motor shaft allows it to rotate with great precision andaccuracy.

Fig 8

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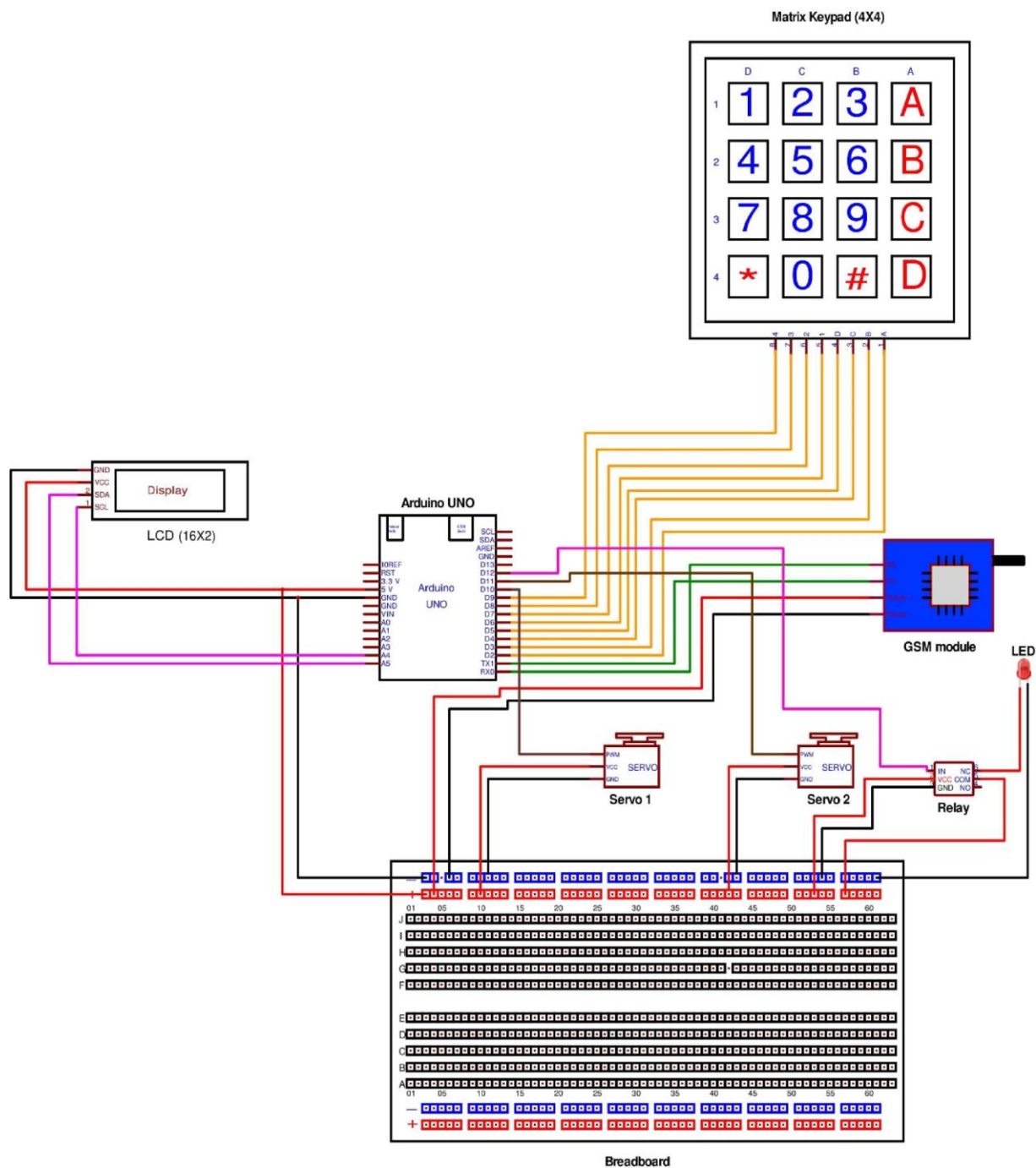
V.   CIRCUIT DIAGRAM

Fig 9

VI.   WORKING

1. The secure Password must be sent to the Arduino through GSM module by the substation worker.
2. The Password must be entered in the Matrix Keypad by the lineman.
3. The passcode entered by the lineman is compared with the password given by substation worker.
4. If both the passwords match, the control panel and the relay are opened.
5. If the passwords do not match, "incorrect password" message is displayed.

VII. OUTCOME

- The proposed model will perform switching of CB's with minimal manual work.
- The proposed model will significantly improve safety of Line-men.
- The proposed model will make operation of CB's easy, efficient and encrypted.

VIII. CONCLUSION

This proposed system ensures safety of lineman. As there is no physical contact between the lineman and the line, the life of the lineman is on no risk. It can work immediately once the password is given. The password to operate can be changed simultaneously and system can be operated efficiently with the changed password. No intruder can access the breaker once the password is changed successfully. It gives no option of password hacking and hence effective in providing safety to the working staff. It is cost-effective and can be easily installed.

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