

Implementation of Password and GSM Based Lineman Safety System on Power Lines

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Abstract— The electric lineman safety system makes use of a new concept of password and GSM. Due to the lack of communication and co-ordination between the maintenance staff and the electric substation staff linemen are suffering from fatal accidents while repairing lines. Hence to avoid this we are implementing a password and GSM based lineman safety system on power lines. These passwords provide total control to the system to turn on or off the supply to each line. For example, line man has the control to turn ON/OFF the line. If there is a problem in any section of the supply line, then staff wants to turn off that line and repair it. For that the using a matrix keypad he can enter it in the system. Then the system compares the entered password with the generated password. If the passwords are matched, then the supply to that line will be made OFF. He can also control the line using mobile. After completion of his work he can turn on the line by using the password. This ensures security of the worker because no one can turn on the line without his permission. In addition to this to save electrical energy automatic lighting system also included in this project.

Key words: Micro Controller, Communication, Keypad, LDR, GSM

I. INTRODUCTION

One of the more prudent problems faced by the linemen is to operate, maintain and fix the electricity lines to our homes, which have a very high voltage flowing through them. Even a small mistake can cause severe burns or deaths. To counteract this problem this project was designed.

The electric line man safety system is designed to control a circuit breaker by using a password for the safety of electric man[5]. 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 password is required to operate the circuit breaker (on/off). The system is fully controlled by Arduino Microcontroller[1]. A matrix keypad is interfaced to the microcontroller to enter the password. The entered password is compared with the password generated. If the password entered is correct, only then the line can be turned ON/OFF.

All linemen, especially those who deal with live electrical apparatus, use personal protective equipment (PPE) as protection against inadvertent contact. This includes rubber gloves, rubber sleeves, bucket liners and protective blankets.

In addition to this to save electrical energy automatic lighting system also included in this project. Automatic lighting system turns ON and OFF the lights at given time or when the ambient light falls below a specific intensity. Each controller has an LDR which is used to

detect the ambient light. If the ambient light is below a specific value the lights are turned ON. A light dependent sensor is interfaced to the Arduino nano microcontroller it is used to track the sunlight and when the sensors goes dark the led will be made ON and when the sensors found light the led will be made OFF.

II. EXISTING SYSTEM

Power linemen work on electrically energized and de-energized power lines. They may perform a number of tasks associated with power lines, included installation or replacement of distribution equipment such as capacitor banks, distribution transformers on poles, insulators and fuses. These duties include the use of ropes, knots and lifting equipment. These tasks may have to be performed with primitive manual tools where accessibility is limited[1]. Such conditions are common in rural areas.

High voltage transmission lines can worked live with proper setups. The lineman must be isolated from ground. The lineman wears special conductive clothing that is, connected to the line, at which point the line and the lineman are at same potential, allowing the lineman to handle wire[4].

A. Faults in over Head Transmission Lines:

1) Transient Faults:

A transient fault is a fault that is no longer present if power is disconnected for a short time and then restored; or an insulation fault which only temporarily affects a device's dielectric properties which are restored after a short time. Many faults in overhead power lines are transient in nature. When a fault occurs, equipment used for power system protection to isolate the area of the fault. A transient fault will then clear and the power-line can be returned to service[4].

2) Persistent Faults:

A persistent fault does not disappear when power is disconnected [4]. Faults in underground power cables are most often persistent due to mechanical damage to the cable, but are sometimes transient in nature due to lightning. A persistent fault does not disappear when power is disconnected.

3) Symmetrical Faults:

A symmetric or balanced fault affects each of the three phases equally [4]. In transmission line faults, roughly 5% are symmetric. This is in contrast to an asymmetrical fault, where the three phases are not affected equally.

4) Asymmetric Faults:

An asymmetric or unbalanced fault does not affect each of the three phases equally [4]. Common types of asymmetric faults, and their causes:

- 1) Line-to-line - a short circuit between lines, caused by ionization of air, or when lines come into physical contact, for example due to a broken insulator. In transmission line faults, roughly 5% - 10% are asymmetric line-to-line faults.
- 2) Line-to-ground - a short circuit between one line and ground, very often caused by physical contact, for example due to lightning or other storm damage[4]. In transmission line faults, roughly 65% - 70% are asymmetric line-to-ground faults.
- 3) Double line-to-ground - two lines come into contact with the ground (and each other), also commonly due to storm damage. In transmission line faults, roughly 15% - 20% are asymmetric double line-to-ground.

Where I_f = fault current

TYPE OF FAULT	SEVERITY	OCCURRENCE
3-Phase L-L-L, L-L-L-G	Severe	5%
Phase to phase L-L-G	Severe	10%
Phase to phase L-L	Less severe	15%
Single line to ground	Very less	70%

Table 1: Severity and occurrence of different types of faults.

Generally when a fault occurs in transmission line, unless it is severe it is unseen. But gradually these minor faults can lead to damage of transformer and can turn havoc to human life. It may also initiate fire[4]. Present day in India, we do not have a system in hand that would let us know in real time once a fault occurs. Matter of concern is that since we do not have a real time system, this leads to damage of the underlying equipment connected and turns out to be a threat to human around. In order to avoid such incidents to the maximum extent, maintenance or checking of the transmission lines are generally carried out on a frequent basis. This leads to increased manpower requirement. To overcome the faults of existing system, we are proposing a GSM based transmission line fault detection System.

B. Existing Street Lightning System:

Now-a-days the manually operated street lights are not switched off properly even the sunlight comes and also not switched on earlier before sunset[8]. In sunny and rainy days, ON time and OFF time differ significantly which is one of the major disadvantage of using timer circuits or manual[8]. This project exploits the working of a transistor in saturation region and cut-off region to switch ON and switch OFF and this project also reduces the power consumption by using LDR(Light Dependant Resistor).

III. PROPOSED CONCEPT

A. Working of GSM:

A GSM modem is a wireless modem that works with GSM wireless networks. A wireless modem is similar to a dial-up modem[1]. The main difference is that a wireless modem transmits data through a wireless network whereas a dial-up modem transmits data through a copper telephone line. Most mobile phones can be used as a wireless modem. To send SMS messages, first place a valid SIM card into a GSM modem, which is then connected to microcontroller by RS

232 cable[1]. After connecting a GSM modem to a microcontroller, you can control the GSM modem by sending instructions to it.



Fig. 3.1 A: GSM Modem

B. Advantages:

- 1) Remote monitoring of UPS system is possible.
- 2) Easy to detect the faults.
- 3) Reliable system.
- 4) Easy to maintain the battery and other system.
- 5) More frequent faults are avoided.
- 6) It reduces the labour charge and transportation as well.

C. Working of LDR (Light Dependent Resistor):

A Photo Resistor (LDR) is a light-controlled Variable resistor . The resistance of a photo resistor decreases with increasing incident light intensity, in other words, it exhibits conductivity.



Fig. 3.3 A: LDR SENSOR

Circuit of a compact and true solid-state automatic lawn light is described here. The circuit can be used to switch on incandescent garden light bulbs at dusk and switch off them at dawn[8]. A 10 mm encapsulated light dependent resistor (LDR) here works as the twilight detector.

If you wish to operate the, light bulb(s) on a little reduced power, just replace the TRIAC T2 with a suitable silicon controlled rectifier (SCR). This may give a long life to the incandescent load[8]. Finally, the LDR should not be mounted to receive direct sunlight. It may be mounted at the top of the enclosure, pointing to the sky say southwards[8].

Automatic lightening system can be observed in this application, if the surrounding lightening conditions are dark, then it is sensed by the LDR and it sends signal to turn on the bulbs. Similarly, if the lightening conditions are bright, then LDR sends a signal to turn OFF the bulbs[7]. The above operation can be seen in the following figure.

If a fault arises in any pole in the system then the LDR senses the fault and the information is send to the registered mobile number from the GSM module.

A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor, Extrinsic devices have impurities, also called dopants, added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons are sufficient to trigger the device.

IV. RESULTS

Case1: 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 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 password. Since it has the provision of changing the password, person can give any password of his will and have his work done .



Fig. 4.1 A: when two bulbs are on



Fig. 4.2 B: when one bulb is turned off using password.

Case 2: For the operation of the bulbs they are named as 'A' and 'B' respectively and 0 and 1 are used for turning OFF and ON respectively. They are 4 possible ways for operating them, they are as follows.

MESSAGE	BULB--A	BULB--B
#a0b0	OFF	OFF
#a1b0	ON	OFF
#a0b1	OFF	ON
#a1b1	ON	ON

Table 2 GSM based bulbs operation:

Case 3: In this application, if a fault arises in any pole in the system then the LDR senses the fault and the information is sent to the registered mobile number from the GSM module. This application can be observed in below figure.

Case 4: Automatic lightening system can be observed in this application, if the surrounding lightening conditions are dark, then it is sensed by the LDR and it sends signal to turn on the bulbs. Similarly, if the lightening conditions are bright, then LDR sends a signal to turn OFF the bulbs.



Fig. 4.4 A: Operation of LDR in dark condition



Fig. 4.4 B: Operation of LDR in bright condition

V. CONCLUSION

The project titled 'IMPLEMENTATION OF PASSWORD AND GSM BASED LINEMAN SAFETY SYSTEM ON POWER LINES' gave the following conclusions.

- It can work on a single given known password.
- The password to operate can be changed and system can be operated efficiently with the changed password.
- It gives no scope of password stealing.
- It is effective in providing safety to the working staff.
- It is economical.
- It can be easily installed.

VI. FUTURE SCOPE

Due to time constraints and limited resources we are capable of using only password and GSM for the protection purpose and this leads to some security concerns involving GSM and password secrecy which may cause many disorders in the power lines.

If this project is implemented by using IOT(Internet of Things) it leads to improved security of the safety system on power lines that give better results.

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