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Intelligent Railway Controlling And Monitoring By Using PLC.

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ABSTRACT
There appears frequently natural phenomena such as collapse, landslide along the railway line & fire hazards which badly threaten the transport safety of the railway. This system adopts the method of auto-monitoring, and the monitoring content is the earth's surface deformation. At the front, through high-accuracy infrared sensor, the deformation signals of the dangerous mountains can be acquired, the real-time monitoring and pre-alarm for fire & Earthquake can be achieved. This method is simple, convenient and penetrating, with lower-cost and higher -accuracy. The system is Eco Friendly System. This system is mainly designed to identify the Smoke for fire protection, earthquake, flood detection for protection & conservation of electrical energy. So the Damage happens due to Those will be avoid. The working of project is very simple, but very useful this system will help to avoid the harm caused due to earthquake.

Keywords
GIC PLC, LDR module, MQ2 smoke sensor, IR sensor module, Flood detection sensor, Motion sensor, Electromagnetic Relay.

1.INTRODUCTION
Our country is one of the greatest countries in the world which have most serious geological disaster. Day by day the geological disaster gets worse, and endangers people's lives and property directly, affects the sustainable development of our society's economy. There appears frequently some natural phenomena such as the mountain collapse, mountain slide and so on along the line of railway, which badly threaten the traffic and transport safety of the railway. The slide and collapse can destroy the line, prevent the train from running, endanger the station, smash the station house up; destroy the railroad bridge and other facilities, cut off the tunnel, destroy the bright cave, and bring about the traffic accidents with turning over the train and people's death.

Railroad is one of projects which suffer the most serious and frequent collapse and slide.

As our Railway network become more crowded, the used tunnels & under passes is expanding, both to improve traffic flow, to protect local environment from increase traffic exposure. Within tunnel where maintenance access can be limited and where corrosive atmospheric condition are common,, reliable performance of the lighting system is critical, as is the need for the absolute minimum of the operational maintenance requirements.

A smoke detector is a device that senses smoke, typically as an indicator of fire. Commercial security devices issue a signal to a fire alarm control panel as part of a fire alarm system, while household smoke detectors, also known as smoke alarms, generally issue a local audible or visual alarm from the detector itself. Smoke detectors are housed in plastic enclosures, typically shaped like a disk about 150 millimeters (6 in) in diameter and 25 millimeters (1 in) thick, but shape and size varies. Smoke can be detected either optically (photoelectric) or by physical process (ionization), detectors may use either, or both, methods. Sensitive alarms can be used to detect, and thus deter, smoking in areas where it is banned. Smoke detectors in large commercial, industrial, and residential buildings are usually powered by a central fire alarm system, which is powered by the building power with a battery backup. Domestic smoke detectors range from individual battery-powered units, to several interlinked mains-powered units with battery backup; if any unit detects smoke, all trigger even in the absence of electricity. A Flood detector is an electronic device that is designed to detect the presence of water and provide an alert in time to allow the prevention of Accident from flood.

2. OVERVIEW OF PLC

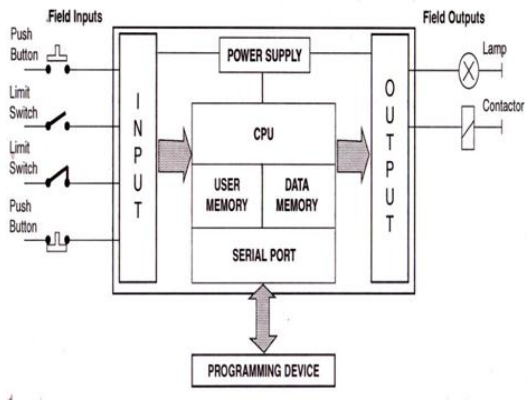

Fig 1: Block Diagram of PLC

2.1 History of Programmable Logic Controller (PLC)

According to Bolton (2004), in the 1960 and 1970s, electromechanical relay, timers, counters and sequencers were standard. Many control panels contained hundreds of these electromechanically devices. The primary negativity aspect of mechanical control was that the reliability was low thus keeping these panel operating were extremely high. The PLC was invented in response to the needs of the American automotive industry. Before the PLC, control, sequencing, and safety interlock logic for manufacturing automobiles was accomplished using relays, timers and dedicated closed-loop controllers. The auto industries complained that the cost of purchasing and changing a single relay is highly cost. The second factor involved time, expenses and labour required when a change of control needs to be done by modifying the control panel itself. In 1968 GM Hydromantic (the automatic transmission division of General Motors) issued a request for proposal for an electronic replacement for hard-wired relay systems. The winning proposal came from Bedford Associates that designated the 084 product called Modicom , which stood for Modular Digital Controller. One of the people who worked on that project was Dick Morley, who is considered to be the "father" of the PLC. The unit was retired after nearly twenty years of uninterrupted service. According to Jansen (1996) PLCs are used in many different industries and achiness such as packaging and semiconductor machines. Well known PLC brands are Siemens, Allen-Bradley, ABB, Mitsubishi, Omron, Schneider Electric and General Electric. High speed manufacturing such as automotive industry requires reliable control devices that were smaller, consumed less power, featured fast switching and were quickly and easily changeable. It also must withstand the harsh industrial environment [9].

2.2 How Does A PLC Operate?

There are four basic steps in the operation of all PLCs; Input Scan, Program Scan, Output Scan, and Housekeeping. These steps continually take place in a repeating loop.

a) Input Scan: Detects the state of all input devices that are connected to the PLC
b) Program Scan: Executes the user created program logic
c) Output Scan: Energizes or de-energize all output devices that are connected to the PLC.
d) Housekeeping
This step includes communications with programming terminals, Internal diagnostics, etc…These steps are continually processed in a loop.

A PLC is a digitally operated electronic system, designed for use in an industrial environment .It uses programmable memory for internal storage for user oriented instructions for implementing specific functions such as logic, sequencing, timing, arithmetic and control through digital or analog inputs of various machines or processes .In simple terms PLC is a solid state, digital, industrial computer. A PLC is a device invented to replace sequential relay circuits for machine control .The PLC works by looking at its inputs and depending upon their state turning ON/OFF its outputs. The user enters a program via software, that give desired results. PLC used in many real world applications which involves machining, packaging, material handling, automated assembly.

3. SYSTEM DEVELOPMENT

3.1 Programmable Logic Controller

In this project we have used GIC PLC (model NO. G7DDT10).Which is the heart of the project. This controls all the functions of project. It performs the operation as per the program given to it. PLC takes the I/P form different sensor & gives output to control no. of thing as follows

a) Tunnel light
b) To control the station light fan as per motion sensor output.
c) TO OFF the fan when fire hazard happen.
d) To change the signal from Red to Green as per moisture sensor & LDR sensor output.
e) Turn ON/OFF the buzzer.

3.2 Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays.

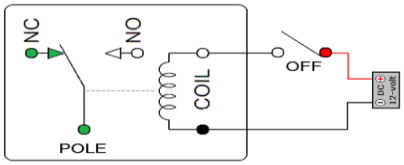

Fig 2: Relay

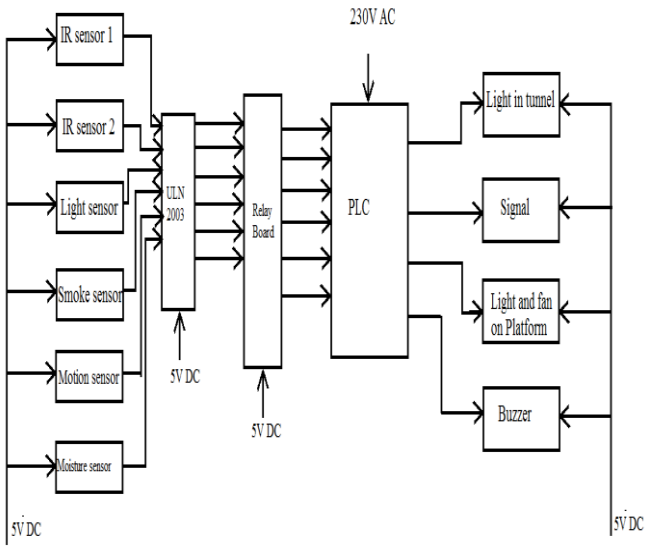

Fig 3: Block Diagram of System

3.3 Smoke sensor (MQ2 Gas sensor)

Fig 4: MQ2 Gas Sensor

The MQ series of gas sensors use a small heater inside with an electro-chemical sensor. They are sensitive for a range of gasses and are used indoors at room temperature. The output is an analog signal and can be read with an analog input of the PLC. The MQ-2 Gas Sensor module is useful for gas leakage detecting in home and industry. It can detect LPG, i-butane, propane, methane, alcohol, hydrogen and smoke. Some modules have a built-in variable resistor to adjust the sensitivity of the sensor.

3.4 Flood Water Sensor

a) Instant warning about leaks or flood conditions.
b) Used where there is a risk of leakage from water installation.
c) As soon as detector comes in contact with water, it signals an alarm.
d) Same size as a large jam jar lid.

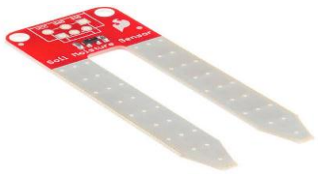

Fig 5: Flood Water Sensor

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity.

3.5 Earthquake Detector (IR Sensor module)

Fig 6: Earthquake Detector

An infrared sensor circuit is one of the basic and popular sensor module in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real time. This circuit comprises of the following components.

a) LM358 IC 2 IR transmitter and receiver pair
b) Resistors of the range of kilo ohms.
c) Variable resistors.
d) LED (Light Emitting Diode).

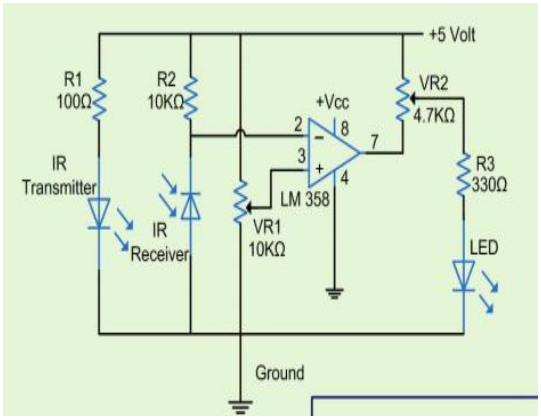

Fig 7: circuit diagram of earthquake detector

In this project, the transmitter section includes an IR sensor, which transmits continuous IR rays to be received by an IR receiver module. An IR output terminal of the receiver varies depending upon its receiving of IR rays. Since this variation cannot be analyzed as such, therefore this output can be fed to a comparator circuit. Here an operational amplifier (op-amp) of LM 339 is used as comparator circuit. When the IR receiver does not receive a signal, the potential at the inverting input goes higher than that non-inverting input of the comparator IC (LM339). Thus the output of the comparator goes low, but the LED does not glow. When the IR receiver module receive signal to the potential at the inverting input goes low. Thus the output of the comparator (LM 339) goes high and the LED starts glowing. Resistor R1 (100), R2 (10k) and R3 (330) are used to ensure that minimum 10 mA current passes through the IR LED Devices like Photodiode and normal LEDs respectively. Resistor VR2 (preset=5k) is used to adjust the output terminals. Resistor VR1 (preset=10k) is used to set the sensitivity of the circuit Diagram.

3.6 LDR (Light dependent resistor)

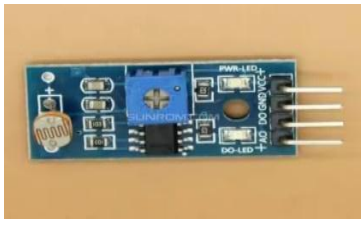

Fig 8: LDR Module

A light dependent resistor works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in

which the materials conductivity is increased when light is absorbed by the material. When light falls i.e. when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. These photons in the incident light should have energy greater than the band gap of the semiconductor material to make the electrons jump from the valence band to the conduction band. Hence when light having enough energy strikes on the device, more and more electrons are excited to the conduction band which results in large number of charge carriers. The result of this process is more and more current starts flowing through the device when the circuit is closed and hence it is said that the resistance of the device has been decreased. This is the most common working principle of LDR.

3.7 Motion sensor

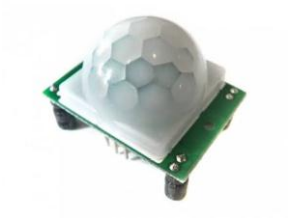

Fig 9: Motion Sensor

A motion detector is a device that detects moving objects, particularly people. A motion detector is often integrated as a component of a system that automatically performs a task or alerts a user of motion in an area. Motion detectors form a vital component of security, automated lighting control, home control, energy efficiency, and other useful systems. An electronic motion detector contains an optical, microwave, or acoustic sensor, and in many cases a transmitter for illumination. However, a *passive* sensor only senses a signal emitted by the moving object itself. Changes in the optical, microwave, or acoustic field in the device's proximity are interpreted by the electronics based on one of the technologies listed below. Most inexpensive motion detectors can detect up to distances of at least 15 feet (5 meters). Specialized systems are more expensive but have much longer ranges. Tomographic motion detection systems can cover much larger areas because the radio waves are at frequencies which penetrate most walls and obstructions, and are detected in multiple locations, not just at the location of the transmitter. Motion detectors have found wide use in domestic and commercial applications. One common application is activation of automatic door openers in businesses and public buildings. Motion sensors are also widely used in lieu of a true occupancy sensor in activating street lights or indoor lights in walkways (such as lobbies and staircases). In such "Smart Lighting" systems, energy is conserved by only powering the lights for the duration of a timer, after which the person has presumably left the area. A motion detector may be among the sensors of a burglar alarm that is used to alert the home owner or security service when it detects the motion of a possible intruder. Such a detector may also trigger a security camera in order to record the possible intrusion.

4. SOFTWARE DEVELOPMENT

The G-Soft software is used with all of the Genie-NX central units. This software runs under Windows and free disk spaces are required for the installation. Execute the setup.exe for an automatic installation. The software allows you to create, send, test, recover and print user programs as well as initializing, starting and stopping the central unit. While Ladder Logic is the most commonly used PLC programming language, it is not the only one. The following table lists of some of languages that are used to program a PLC.

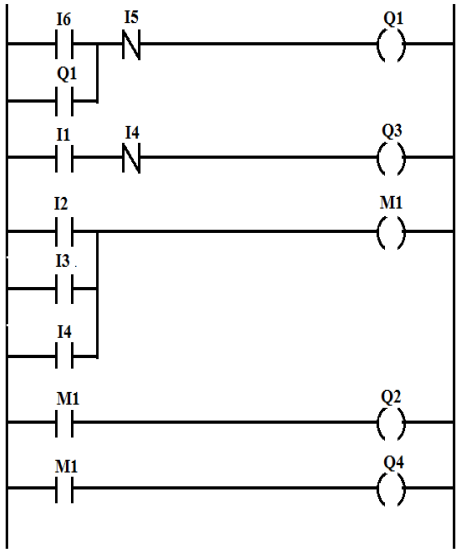

Fig 10: System Ladder Diagram

I1-Motion sensor	I6-IR1 (Infrared sensor 1)
I2-Flood sensor	Q1-Tunnel light
I3-LDR sensor	Q2-Buzzer
I4-Smoke detector	Q3-Station light & Fan
I5-IR2(Infrared sensor 2)	Q4-Railway signal

5. ADVANTAGES AND FUTURE SCOPE

5.1 Advantages :-

a) This System sense earthquake and automatically turn on Hooter.
b) After sense earthquake it will change the signal to red to stop the train.
c) Also in case of flood the signal changes from Green to Red of track after detecting water on track.
d) Strong-degree of automation.
e) High-accuracy of monitoring.
f) Precautions from fire hazards.

5.2. Future Scope

In coming days we will be able to implement this system wireless over internet. Also we can achieve this goal using GSM module in future. This will lead to an totally automated integrated for protection system with an high efficiency for precautions against natural hazards.

6. CONCLUCTION

As our Railway network become more crowded, the used tunnels & under passes is expanding, both to improve traffic flow, to protect local environment from increase traffic exposure. Within tunnel where maintenance access can be limited and where corrosive atmospheric condition are common,, reliable performance of the lighting system is critical, as is the need for the absolute minimum of the operational maintenance requirements.

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