PLC BASED FAULT DETECTION IN RAILWAY TRACKS AND GATES

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ABSTRACT

In today's real time, commuters use a wide variety of modes of transportation, but most of our population prefers to travel by train. relatively low travel costs. Although the Indian railways have executed lots of safety measures to make travelers free from danger, it is still possible to observe railroad accidents resulting in the loss of people and valuables.

Some of the main causes of rail accidents are track faults and unmanned railroad crossing. Currently our railways use \physical technique for error detection by labor checkers. This is a pursuit to build a PLC-based automatic fault detection technology for the rail track and railway gates to triumph over the mentioned problems. The designed system uses an ultrasonic sensor to detect railway track faults and limit switches to monitor the working condition of unmanned railroad crossing. Hardware devices and communication devices used for automatic fault detection are PIC Microcontroller, PLC and GSM module.

INTRODUCTION

Railways were the most important infrastructure development in India from 1850 to 1947. Railways play an important role in transportation. There are 12,617 trains that carry over 23 million passengers daily. The enormous growth of population transportation in huge quantities is crucial. We have the second largest railway network in Asia. But about the emergency protocol during accidents we stay at last. The Data collected from the Nation Crime Record Bureau says that there were 3196 level crossing accidents in India for the past two years. Elimination of these kinds of minor accidents is very essential. After a more in-depth analysis of the factors behind these train accidents, the latest statistics show that around 90% are due to cracks on the track or natural causes current work focuses on reducing the accident rate through automatic detection of track faults and monitoring unmanned railroad crossing.

LITERATURE SURVEY

As part of this study, a literature search was carried out to select the problems of the railway network. Limited work has been done to determine damage to railway tracks, which is the cause of accidents that result in loss of life and property. The aim of this article is to suggest solutions to reduce the occurrence of tragic accidents.

Raghupathy et.al [1] in their work have designed a system supported supersonic waves which might forestall the train accidents thanks to mishap of tracks, pilotless railway crossing and head on collision.

Stefan et al, [2] have used the Eddy current sensors to search out the fault in track. The sensors are mounted 100mm on prime of the rail head of the train bogie. This detector monitors the railway track and detects the breakage/s inside the track.

Ramesh et al, [3] have urged the detection of cracks and derailments in rails which can be done by supersonic waves or sensors.

COMPONENTS

Ultrasonic sensor

Ultrasonic sensors send out short, high-frequency sound pulses at regular intervals that travel through the air at the speed of sound and, when they hit an object, are reflected as echo signals to the sensor, which itself calculates the distance to the target within the range of the time between the transmitted signal and receiving an echo. As the distance to an object is determined by measuring the time of flight rather than the intensity of the sound to test the material Ultrasonic sensors are used to detect the cracks , Air bubbles and other product defects, object detection, position detection, ultrasonic mouse, etc.

Figure 1: ultrasonic sensor

IndraControl L20 PLC

IndraControl L20 is a modular and scalable controller that combines the advantages of a small and compact controller with a standardized I / O system based on terminal technology. It is a hardware platform that can be used in PLC applications. Offers built-in interfaces and fast inputs and outputs (8 each) and communication interfaces such as Ethernet, PROFIBUS and RS232 The locally available I / O modules can be expanded with the Rexroth online I / O system by simply installing the components next to one another. The application programs, including the runtime, are fully archived on standardized and easily accessible Compact Flash media.

The controls and interfaces are on the front. On the left side of the device there is an eight-digit display with four control buttons, a reset button with LED, an RS232 interface and a Compact Flash card slot. Further interfaces (Ethernet, PROFIBUS DP) are located in the middle of the device. The digital input and output connectors (eight each) and the power supply connectors are located on the right side of the device.

Figure 2: PLC KIT

Advantages of PLC

- Compared to connecting relay control panels programming in PLC is much easier.
- At any time controler can modify the program.
- The PLC requires smaller space than relay controller panels.
- Compared to an electromechanical relay, the PLC has very few hardware errors.

Limit Switch

Lever limit switches are used in heavy lifting equipment to prevent excessive displacement of the lifting movement in the power supply and control circuit up to 500 V and 40 A DC. The limit switch normally remains closed and cuts off the power supply to stop the crane motor.

Figure 3 : Limit Switch

Figure 5 : GSM Module

Arduino Uno

Arduino Uno is a microcontroller card based on the ATmega328P (datasheet). It has 14 digital I / O pins 6 of which can be used as PWM outputs, 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB port, a socket, an ICSP Connector and a reset button.

Figure 4 : Arduino Uno

GSM Module

SIM800L is a miniature cellular module that can be used to send GPRS, send and receive SMS messages, and make and receive voice calls. Due to its low cost, small footprint and support for four frequency bands, this module is the perfect solution for any project that requires remote connections.

BLOCK DIAGRAM

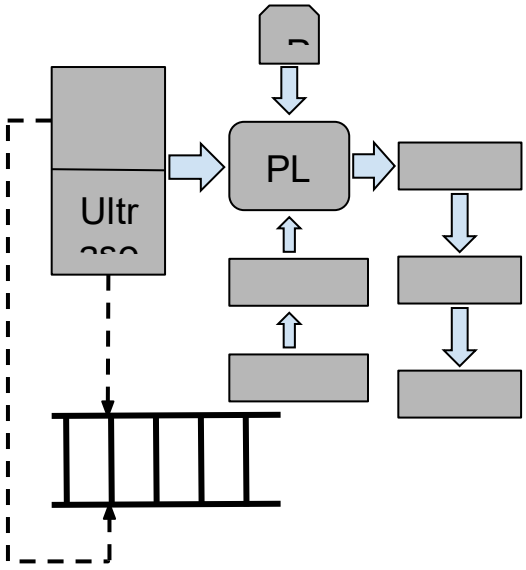

Figure 6 : Block Diagram

WORKING

From the above diagram, we represent our project titled as automatic fault detection in railway tracks and gates. In our project we uses two distance measurable sensors i.e (ultrasonic sensor) to detect the fault in our railway system, and uses a limit switch to monitor the operating conditions of the level crossing. The ultrasonic sensors are fixed at the front and rear of the railway bed, the limit switch is located at one end of the level crossing.Two ultrasonic sensors and limit switches is connected as input in plc and the microcontroller is connected as output in plc and also connected to the GSM module.

Two ultrasonic sensors detect the derailment and failure of the fish track plate. By installing these two ultrasonic sensors on both sides of the railway, the distance between them and the left and right rails can be adjusted to 4 cm. The sensor is connected to the PLC input port. When a derailment occurs, the gap between the sensor and the rail will change the specified 4 cm distance or vary in the railway track, the ultrasonic sensor sends the error signal as output to the programmable logic controller and the plc turn on the led light and also send the information about the detected error signal to the microcontroller. Then, the GSM module receives the information from the microcontroller and also sends the information to the next nearest station via email or sms.

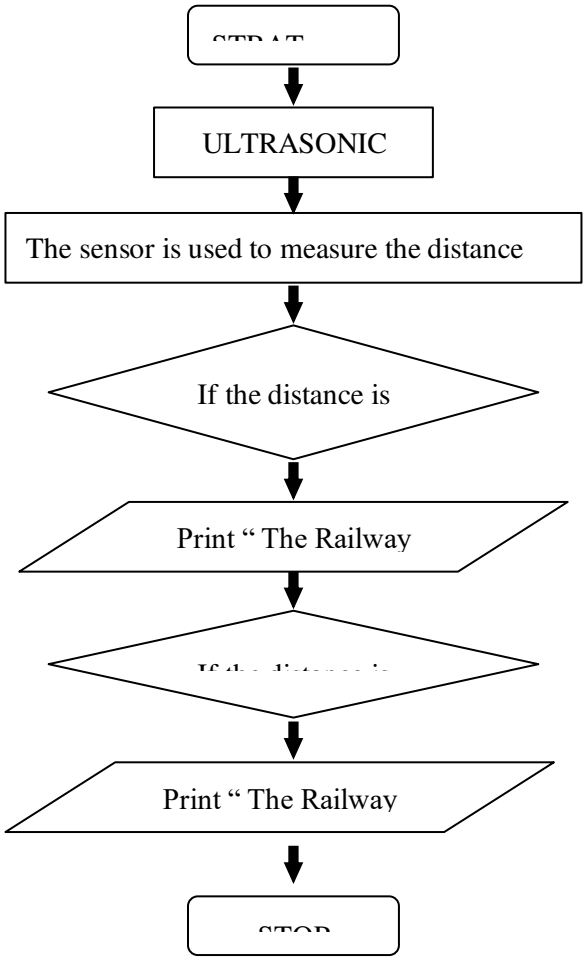

Figure 7 : Flow Chart

Two limit switches S1 & S2 attached near railway gate elbow. Switch S1 is placed in the upper limit and switch S2 is placed in the lower limit. When the gate is opened (control room), S1 will be triggered. When the gate is closed, S2 will be triggered. When the gate is opened, the system waits for 10 seconds. If S1 is not triggered yet, the system is programmed to send an alert via GSM Module stating "Gate is not opened yet - Malfunction". Similarly when the gate is closed, the system waits for 10 seconds. If S2 is not triggered yet, the system is programmed to send an alert stating "Gate is not closed yet - Malfunction". Both the switches S1 and S2 are placed in such a way to attain maximum precision.

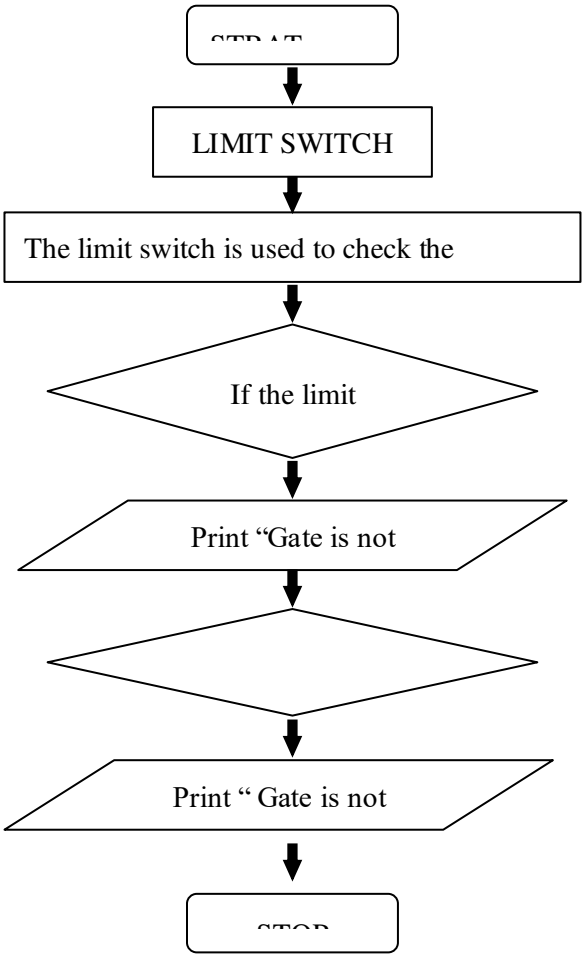

Figure 8 : Flow Chart

Ladder Diagram

Usually the PLC program is coded on a system, in a particular app, and then directed to the PLC via a straight-through cable or network. Generally, thousands of relay controls can be put back by a single PLC.

Ladder diagram is a programming language that uses graphic diagrams based on schematic diagrams of relay logic devices. It is mainly used for the software development of programmable logic controllers (PLC) in industrial control applications. The name is based on the observation that the program in this language is similar to a staircase, with two vertical rails and a series of horizontal steps in the middle.

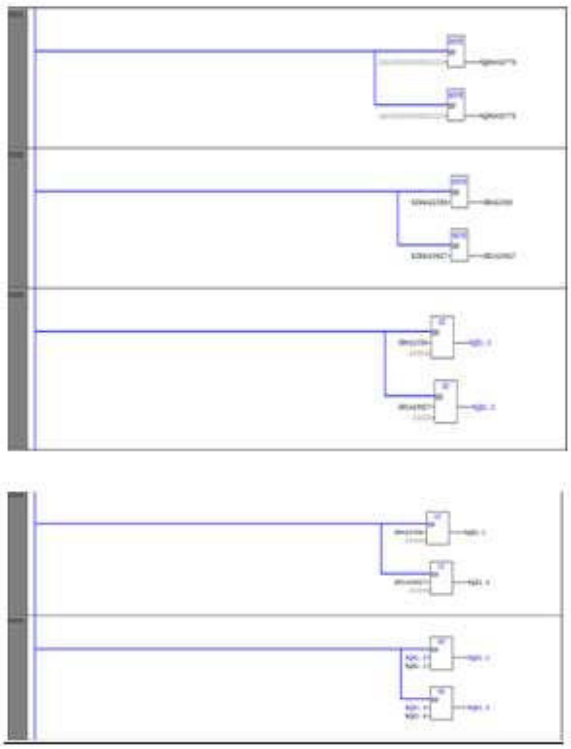

Figure 9 : Ladder Diagram

Fig. 9 shows the ladder diagram %SX1.0, %SX1.1, %SX1.2, %SX1.3, %SX1.4, %SX1.5, %SX2.0, %SX2.1%SX2.2,%SX2.3,%SX2.4 are digital outputs. %JW4 and %JW6 are analog system inputs, and %SW4 and %SW6 are analog system outputs. The system is in simulation mode. The simulation mode has some default binary values, which are the default binary values that you need to assign in the program, and these binary values need to be converted into a word, and can run simulation mode conversion in the program.

% JW4 and% JW6 are the inputs of the ultrasonic sensors connected to the PLC. VW and VW1 are the outputs of the ultrasonic sensors that receive the VW and VW1 outputs as inputs for the main function block (GT) and the auxiliary function block (LT). RW and RW1 are compared with the value assigned in the largest function block. If VW and VW1 are greater than the assigned value, the% SX1.0 and% SX1.3 LEDs illuminate and the

track is said to be faulty. is not greater than the assigned value, then% SX1.0 and %SX1.3 do not display the LED and check whether there is a minor condition. If RW and VW1 are less than the assigned value, %SX1.1 and% SX1.4 indicate the LED. The note reads: If they are not less than the assigned value, %SX1.1 and %SX1.4 are displayed Do not activate the LED.The outputs of the GT and LT function blocks are connected to the OR gate. Then check the conditions: if one of the GT and LT function block outputs is 1, the track is faulty. When both GT and LT are the output of function block 0, the track is in a normal state.

CONCLUSION

The prospective method is an alternate way that replaces physical railway error detection methods with automated PLC-Based fault detection. The design entirely cancels physical work to detect errors. Provide a fastest fault detection system that automatically reports and predicts. Information about railway failures will be immediately sent to the appropriate railway traffic control center via the GSM system, thereby reducing accidents and reducing precious lives. Perform multiple types and complexity of control functions.

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