Automatic Fault Detection of Railway Track System Based on PLC (ADOR TAST)

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Abstract: **There is an increasing with the number of accidents at railroad railings. Now a days we use different types of transport facilities like Track, bus, flight and car etc but above these facilities we chose to travel with rail because by travelling through the rail is cheap, takes less time to deliver the our product, system and it is the cost efficient but the number of accident on railwyay track due to fault on track and when any obstacle came in front of the train. This paper deals about one of the efficient methods to avoid Train Collisions. Here we are using PLC for automatic control of vibration sensor and ultraviolet sensor, here vibration sensor is use to detect the fault on railway track and ultraviolet sensor is use to detect obstacle in front of the train. After detecting the fault plc will give information about the fault to the loco pilot in the train on the scada screen, in control room also. The main component are used in this project are programmable logic controller(PLC), scada monitor, ultrasonic sensor, vibration sensor etc. We are using scada moniter because it is the bidirectional data transferring device it can show the output of fault and help us to take action according the fault on the track. With the help of this proposed project train can run on time during winter season on foggy condition and on night also where driver unable to see anything. It can be helpful for the Indian railway.**

Keyword:-PLC, Vibration Sensor, Ultrasonic sensor, Scada moniter and alarm system.

I. INTRODUCTION

The basic objective of this project is to give an indication or alarm to us that there is a breakage of railway line or there is any object in front of the railway track. In this proposed project, programmable logic control (PLC) is used for multipal operation with a single device and operation of vibrating and ultrasonic sensor are controlled with help of plc. Vibrating sensor which is used to find the detection of breakage in the railway track. The Indian railway network today has a track length of 1,15,000 kilometers over a route of 65,000 kilometers and 7,500stations. It is the fourth largest railway network in the world exceeded only by those of the United States, Russia and China. In 2011, Indian railway carried over 8,900 million passengers' annually or more than 24 million passengers daily and 2.8 million tons of freight daily. Despite boasting of such impressive statistics, the Indian rail network is still on the growth trajectory trying to fuel the economic needs of our nation. Though rail transport in India is growing at a rapid pace, the associated safety infrastructures are not up to international standards. To demonstrate the gravity of the problem, official statistics say that there have been 14 accidents in 2011, 15 accidents in 2012. On further analysis of the factors that cause these rail accidents, recent statistics reveal that approximately 90% are due to cracks on the rails either due to natural causes (like high expansion due to heat). The present work is focused on bringing down the accident rate by automatically detecting the breakage/s on the tracks. Current technologies used in railways is the Anti-Collision Device (ACD) is a self- acting microprocessor-based data communication device designed and developed by Kankan Railway .The system consists of Loco ACD with a console (message display) for the driver (in each Loco Engine), Guard ACD with remote (fitted in Guard Van), Station ACD with console (fitted in Station Masters' Cabin), Manned and Unmanned Gates ACD with hooters and flashers (in each location) and Repeater ACDs (fitted at locations having obstructions in radio communication such as hilly areas) which work in concert to prevent the following kinds of collisions and accidents like-Head on collisions ,Rear end collisions ,Collisions due to derailment, Collisions at the level crossing gates.

II. COMPONENTS

PLC

A **Programmable Logic Controller**, **PLC**, or **Programmable Controller** is a digital computer used for automation in this proposed project. These controller are specially designed to survive in harsh situation and shielded from heat, cold , dust and moisture etc. PLC consist of a microprocessor which is programmed using the computer language. The program written on

computer and is downloaded to plc via cable. These loaded programs are stored in non volatile memory of the plc.

Fig-1

A visual programming language known as the ladder logic was created to program the plc. Both sensor (Vibrating and ultrasonic senor) connected with plc. In this project we required fast switching so this is the main reason for using plc . When any breakage of railway line detected by vibrating sensor suddenly plc will trip and give signal to us that there is breakage of line. Similerly in case of Ultrasonic sensor , when any object come in front of train then plc will trip and give us a signal of any one is there in front of the train.

Programming a PLC is easier than wiring the relay control panel.PLC can be reprogrammed. Conventional controls must be rewired and are often scrapped instead. PLC takes less floor space then relay control panels.A PLC has facility for extensive input/output arrangements.Maintenance of the PLC is easier, and reliability is greater. PLC can be connected to the plant computer systems more easily than a relay. PLC has very few hardware failures compared to electromechanical relay.

Vibration Sensor

A vibration sensor is a device that uses the piezoelectric effect, to measure changes in pressure, acceleration, strain or force by converting them to an electrical charge. Vibration sensor based on the piezoelectric effect Change in resistance due to the force acting on it and converts it into 4 - 20 mA. They're measuring differences in oscillation and detect the vibration created on the surface.

Fig-2

When the gap in the track is detected or when a running train is detected in front of the standing train, the sensors(vibration sensor and the gap detector) sounds an alarm which is fitted in the operating room in the engine.

Fig-3

This(Fig-1) object sensor shows characteristic of vibration sensor. Characteristics of vibration sensor

- Vibration Monitor.
- Measuring Range RMS: 0 to 25mm.
- Switching outputs: Normally Closed and Analogue 4 to 20ma.

Ultrasonic Sensor

Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. These propagate in the air at the velocity of sound. If they strike an object, then they are reflected back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo.
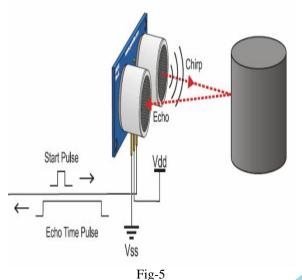
IR2 sensor shows the characteristics of ultrasonic sensor in our model.

Fig-4

This(Fig-1) object sensor shows characteristic of ultrasonic sensor.

Fig-5

As the distance to an object is determined by measuring the time of flight and not by the intensity of the sound. Ultrasonic sensors are used for material testing (to detect cracks, air bubbles, and other flaws in the products), Object detection, position detection, ultrasonic mouse, etc.

Fig-6

The Current output is between 4 mA to 20 mA with 2 relay outputs and Serial Interfaces. In this Reverse polarity protection is used.

3.4.Alarm

In this proposed project we can used high sound alarm and for display purpose we can use SCADA visualization. SCADA is a special type of display software, which have bidirectional commands. Its can show output on display and according to the output an appropriate input command will give by the scada.

We have used two alarm in this project one is in the engine room and another is in the railway control room. So that train driver and observer in control room are able to show the output and they can take action according to the fault.

III. PRINCIPLE AND OPERATION

The principal and operation is very simple when any fault occur in the railway track like breakage of line at any point then vibrating will detect the gape and give us a signal about the fault. Fault can be observe with help of alarm and seen on the scada

Similarly when object came in front of the train then ultrasonic sensor will detect the image of object and give us a signal about the object in terms of alarm and can seen on the scada software. In the given diagram suppose that IR1 is vibration sensor and IR2 is the ultrasonic sensor. Motor denotes the train engine.
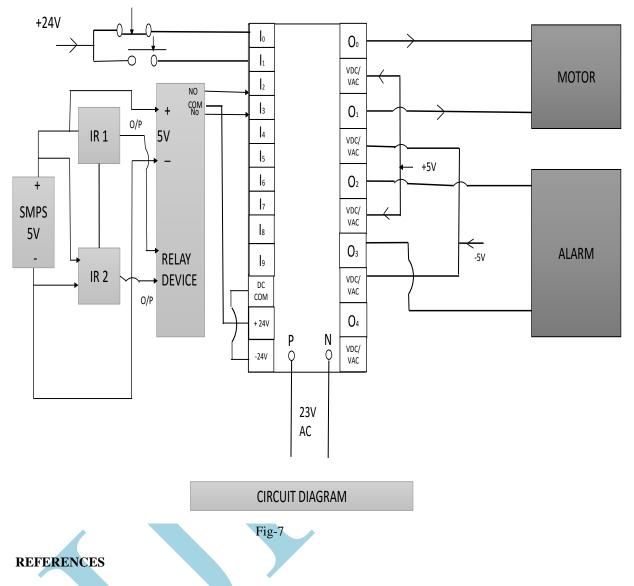
IV. CONCLUSION

The most important advantage of this proposed project is it gives information about the breakage of line to the loco pilot it and also provide information in the control room of railway. As we know that there is a large number accident occur during winter season due to the fog so this project is help to prevent any denial in the railway.

TABLE 1

LIST OF COMPONENT

CIRCUIT DIAGRAM

Fig-7

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