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SELF-RELIANT RAILWAY ACCIDENT AVERTING ARRANGEENT, USING MECHATRONICS

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Abstract - *India owns a second largest rail network in the world. It is the cheapest mode of conveyance, but sometimes comes standstill due to accidents and mishaps. The Majority of these accidents are consequences of train derailments, improper maintenance of track, collision with cars, trucks trying to cross train tracks, faults in train track and level crossing. To eradicate these causes an advanced PLC based fault detection technology can be utilized. This paper is comprised of implementation of two systems which can potentially overcome the flaws in track maintenance and Gate control mechanism of level crossing. Currently both the operations are performed manually and may result in possible dangerous situations due to negligence of personnel involved in the work. With the advent of PLC based automation, human intervention can be greatly abbreviated. Current Manual operation of gate control is replaced by automatic gate control at the level crossing. Also Fault detection of rail track is served through the advanced PLC based system with vibration monitoring sensors and ultrasonic sensors. Execution of these systems results in highly reliable and safe operation, avoiding any possible chances of an accident which may occur due to current manual methods. This system can be carried out in almost all unmanned level crossing in train.*

Key Words: PLC, AUTOMATION, RAILWAYS, SENSORS

1. INTRODUCTION

Train accidents are not uncommon in the world. Unfortunately, when these accidents occur, people are often seriously injured or even killed. Accidents involving trains are often the result of mechanical failures and human error, and often it's a combination of both. In India the number of rail accidents has declined from 325 in 2003-04 to 106 in

2015-16. In 2015-16, majority of the accidents were caused due to derailments (60%), followed by accidents at level crossings (33%). Casualties and compensation, consequential like collision, failure of railway staff, etc. also the reasons of the railway accidents. To avoid the same we automate the control of railway gates by using simple electronic components and PLC. Sensors are placed at the track and when it senses train passing on the track it gives input to the PLC and PLC is programmed in such a way that when sensor gives input to PLC it starts a buzzer and after some time it close the road gate that no one can pass until train crosses the second sensor. A second sensor is placed after the road crossing. When this sensor senses that train is passed, then it gives input to a PLC which opens the road gate for motorists. The same process will happen when a train comes from the other side. Another objective is to find the breakage in railway track which we are detecting by using vibration monitoring sensor and ultrasonic sensor. The present work is focused on bringing down the accident rate by automatically detecting the breakage/s on the tracks.

1.1 ROLE OF AUTOMATION IN RAILWAY SAFETY FIELD

Technical progress has made train control systems capable of supervising, operating and controlling the entire operational process. The key elements for this are:

- Automatic Train Protection (ATP): ATP is the system and all equipment responsible for basic safety; it avoids collisions, red signal overrunning and exceeding speed limits by applying brakes automatically. A line equipped with ATP corresponds (at least) to a GoA1.

- Automatic Train Operation (ATO): ATO insures partial or complete automatic train piloting and driverless functionalities. The ATO system performs all the functions of the driver, except for door closing. The driver only needs to close the doors, and if the way is clear, the train will automatically

Proceed to the next station. This corresponds to a GoA2.

- Automatic Train Control (ATC): ATC performs automatically normal signaler operations such as route setting and train regulation. The ATO and the ATC systems work together, to maintain a train within a defined tolerance of its timetable. The combined system will marginally adjust operating parameters such as the ratio of power to coast when moving and station dwell time, in order to bring the train back to the timetable slot defined for it. There is no

driver, and no staff assigned to accompany the train, corresponding to a GoA4.

1.2 REASONS BEHIND CHOOSING METRO AUTOMATION

Unattended Train Operation has many benefits and many beneficiaries: customers, operators, funding authorities and staff. The implementation of UTO systems allows operators to optimize the running time of trains, increasing the average speed of the system, shortening headways up to 75 seconds, and reducing dwell time in stations (in optimal conditions) to 15 seconds. There are a few reasons like greater flexibility in operation, impressive safety records, increase in quality of service, financial feasibility, etc.

2. FLOW CHART FOR GATE CONTROL

Figure -1: Flow Chart

3. SYSTEM OPERATION

3.1 Automatic railway gate control system

In these eight IR sensors, two limit switches, two gear motors, buzzer & LED's are used. When the train passes from first two IR sensors, buzzer and red LED gets on to indicate that the train is going to come on the track & after train passes in front of next two IR sensors then get close automatically with the help of gear motor. After that when train passes through next two IR sensors, red LED becomes green and after it passes from next two IR sensors gate will automatically open with the help of geared motor rotating in anticlockwise direction. This action will perform in anticlockwise direction also.

3.2 Parking of train engines at the junction

In this movable track is used which can be rotated in 360 degrees with the help of gear motor for parking of two engines.

3.3 Track shifting mechanism

In this BO motor is used. By using this motor, tracks can be shifted in particular desired direction when required.

3.4 Train collision detection

Here one sensor is placed in front of each train. When these two trains come in front of each other or any obstacle come in front of the train and when there is a chance of accident by collision, sensors sends signals and both the trains stop before accident.

3.5 Crack detection present in tracks

Here two ultrasonic sensors are used with vibration monitoring system. When these systems pass over the track, it checks that track is ok or not. When any discontinuity or crack or misalignments of tracks are present it will stop the train and signals to the main station that there is problem at a particular place.

4. CONTROL SYSTEM

The PLC used for the project is Allen Bradley Micro Logix 1200/1762 Series C with 16 digital inputs and outputs

For communication we used RS-232-C port which is a built-in in Micro Logix 1200 controllers. .

RSLogix500 has been selected in the projects for PLC programming.

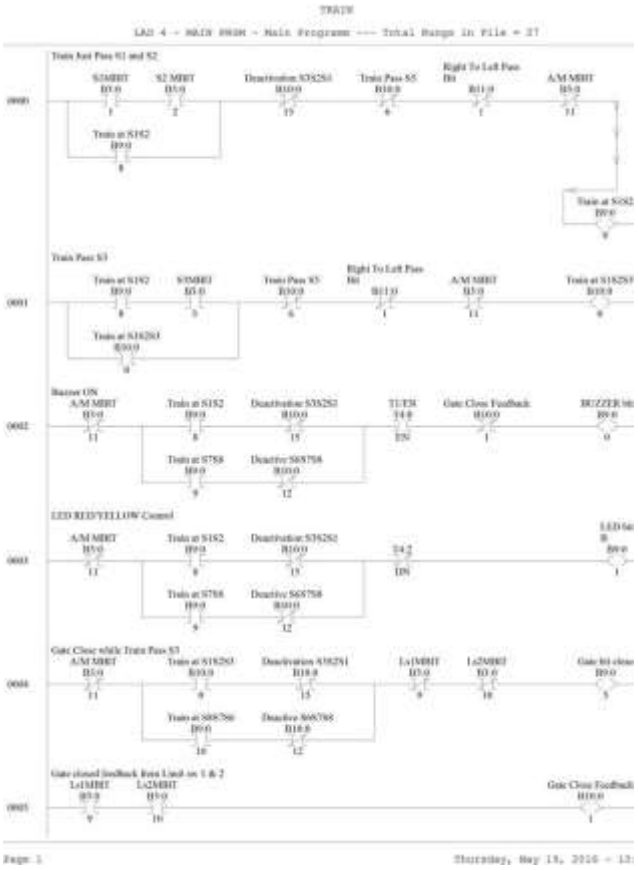

Figure -2: PLC Program

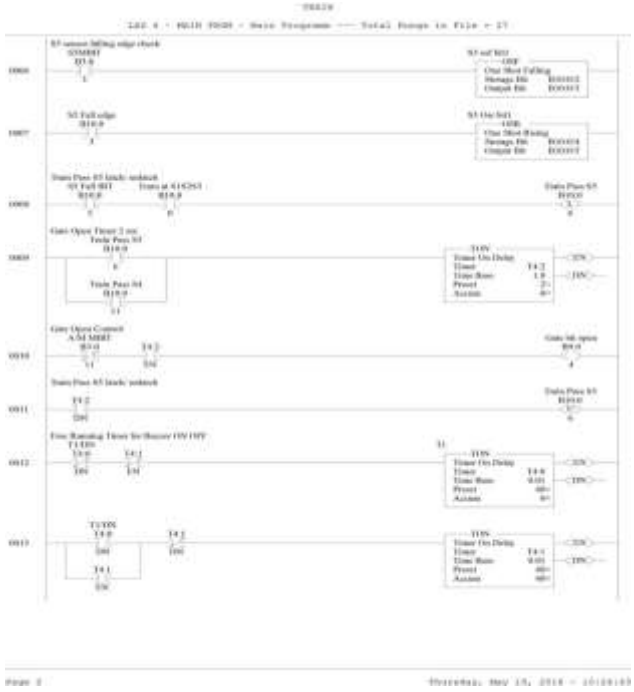

Figure -3: PLC Program

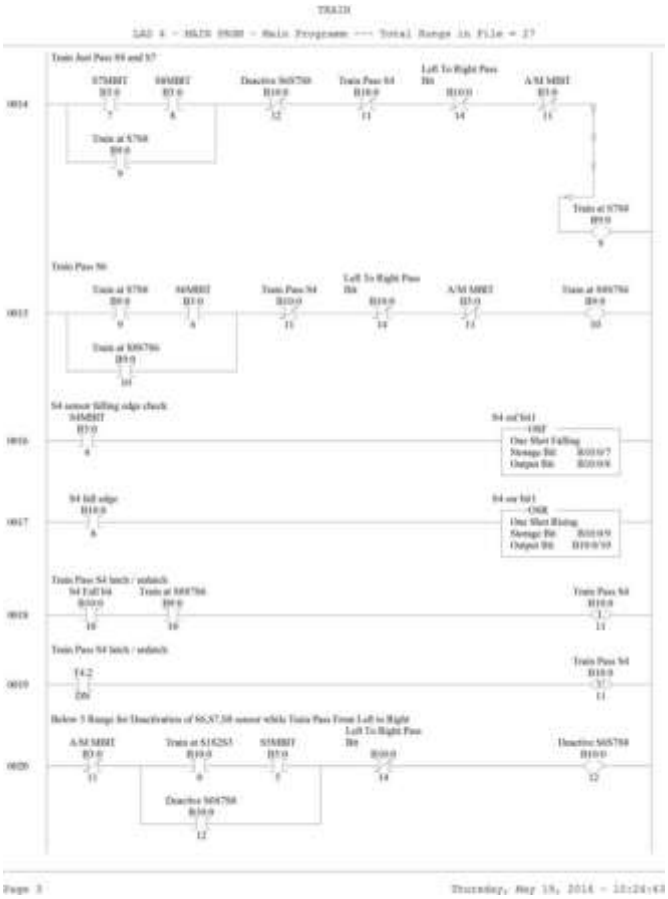

Figure -4: PLC Program

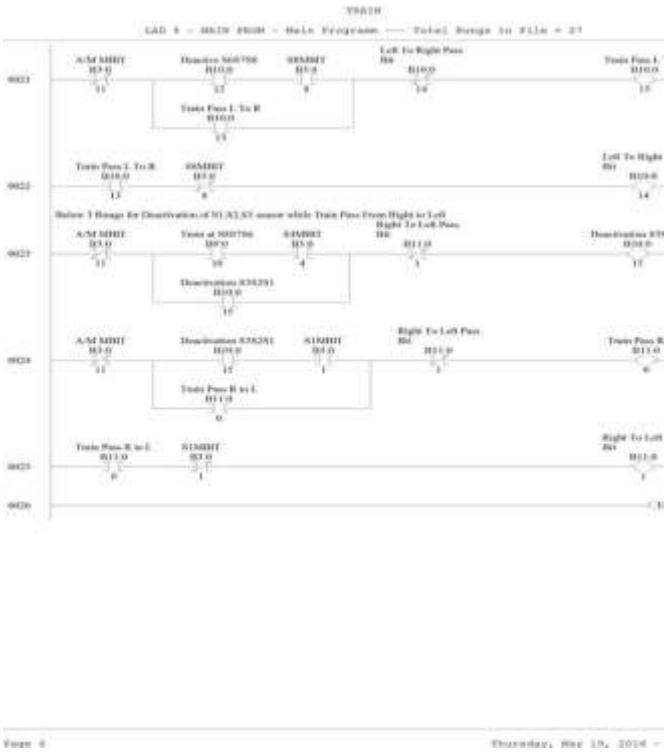

Figure -5: PLC Program

5. EXPERIMENTAL SETUP

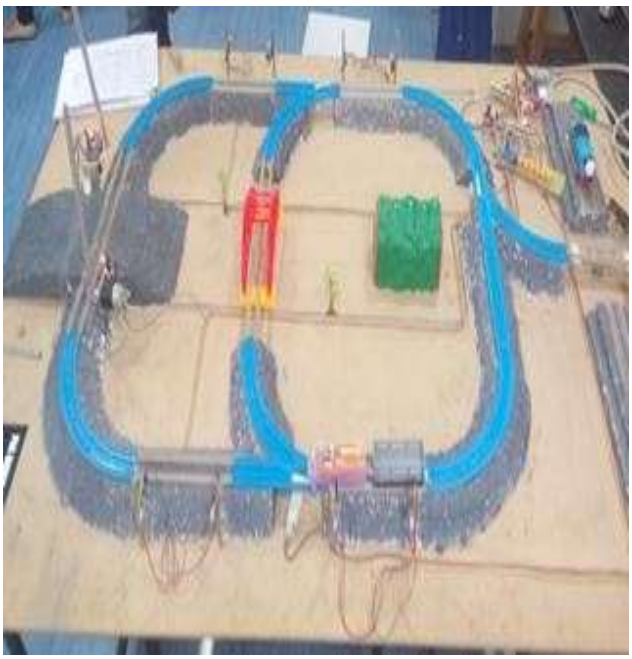

Figure -6: Experimental Setup

6. CONCLUSION

Train operations become more exact and timely as the automation system controls the trains. Safety improves with increased automation as computerized systems control train movements more precisely than humans. Most important thing is we are able to detect breakages in railway track and we can broadcast that data directly to the command room.

7. FUTURE SCOPE

- Fire detection and notification system in trains.
- GPS based railway track survey system.

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