

Designing of Railway Signalling, Interlocking System And Controlling With PLC

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Abstract- Railways are the primary means of transport in India from ancient times. Though Railways are economical and environment friendly, people aren't choosing railways as primary means of transportation due to certain drawbacks. Major reason is that our Railway System is Inefficient. There is delay in signalling, transportation and accidents occurring during track changing. This is due to lack of technology. Though there exist several technical methods of Signalling and Interlocking they are not completely efficient and up-to-date. To overcome certain drawbacks in Railways, we have come up with a technique of automatic control of track signalling, gate signalling and automatic Interlocking using components like PLC, Arduino and Raspberry Pi.

This Implementation takes Railways to another level, which gives effective and efficient results. Any modifications in this system can be changed easily with programming.

Keywords- Raspberry Pi, Programmable Logic Controller(PLC), Interlocking, Arduino.

I. INTRODUCTION

There are basically two purposes achieved by railway signalling.

1. To safely receive and dispatch/ trains at a station.
2. To control the movements of trains from one station to another after ensuring that the track on which this train will move to reach the next station is free from movement of another train either in the same or opposite direction. This Control is called block working. Preventing the movement from the opposite direction is necessary in a single line track as movements in both directions will be on the same track. Apart from meeting the basic requirement of necessary safety in train operation, modern railway signalling plays an important role in determining the capacity of a section .The capacity decides the number of trains that can run on a single day. By proper signalling the capacity can be increased to a considerable extent without resorting to costlier alternatives.

The main aim of this project is to employ next level technology in Railways by using electronic devices like PLC, Arduino, Raspberry Pi in Railway systems which results in Automatic control of Railway gates and proper Interlocking mechanism.

II. EXISTING SYSTEM

In railway signalling, an interlocking system consists of signal equipment that prevents opposing movements through a system of tracks such as junctions or crossings. The signalling equipment and tracks are referred to as an interlocking plant. An interlocking is designed, so that it is improbable to display a signal to proceed unless the route to be used is proven to be safe.

Initially mechanical interlocking was used which consisted of levers, pulleys, steel wire to control signals and channel iron to operate points.

However, in this type of interlocking the area of control was limited. Then relay interlocking is introduced. In Indian Railways, the existing interlocking system is a relay based interlocking system which is semi-automated.

Disadvantage : Relay based interlocking system was time consuming because if any alterations were required then the rewiring of panels and devices was to be done. This also means that the system is more prone to errors and is not 100 percent fail safe.

III. DESIGN PROCESS

Below figure shows the Block Diagram of Proposed System and the arrow marks shows the flow of Operations.

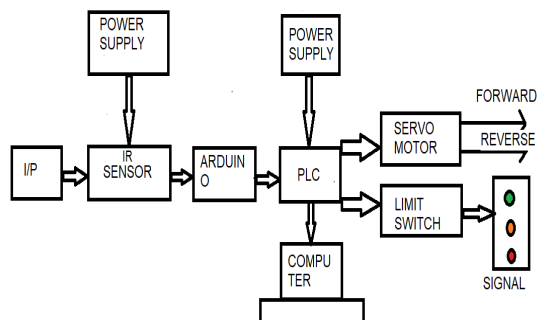


Fig 1 : Block Diagram of Project

A. Automatic Railway Gate Crossing

In Automatic railway gate crossings we used IR sensors to detect objects. When the train is approaching a railway gate for road passage, an IR sensor is placed a few meters before approaching the gate so that the IR sensor senses the object. Servo Motors are used in the gate because it is very easy to use and does not require any driver IC or circuit. Servo motor has three pins. The first pin is PWM, second is Vcc and third is GND. Servo motor receives the PWM signal from Arduino and rotates the motor at fixed angle according to duty cycle of signal. The 2nd IR sensor is placed a few meters away from the gate, so similar to the first sensor when the sensor senses the train, a signal is sent to the servo motor, now the connection of the limit switch is released and the gate opens.

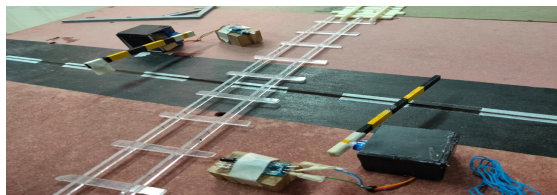


Fig 2 : Railway Gate Crossing

B. Track Changing(Interlocking)

To control the movements of trains from one station to another after ensuring that the track on which this train will move to reach the next station is free from movement of another train either in the same or opposite direction. This Control is called block working. Preventing the movement from the opposite direction is necessary in a single line track as movements in both directions will be on the same track. Consider the case of track changing. When the train is approaching the station by default it goes to platform 1, it passes on track 1(Main Line), but if the platform is busy then the train has to wait outside the station until that track is free or it. This problem can be overcome by the Interlocking mechanism.

Interlocking is defined as : In railway signalling, an **Interlocking** is an arrangement of signal apparatus that prevents conflicting movements through an arrangement of tracks such as junctions or crossings. Interlocking systems have an important safety responsibility in the railway infrastructure. Therefore it is absolutely essential that these systems will not fail in an unsafe manner.

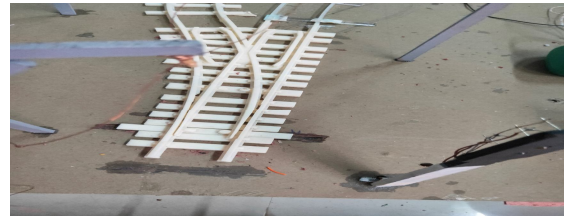


Fig 3 : Railway Track Changing

IV. PROJECT CONSTRUCTION



Fig 4 : Train Crossing Railway Gate

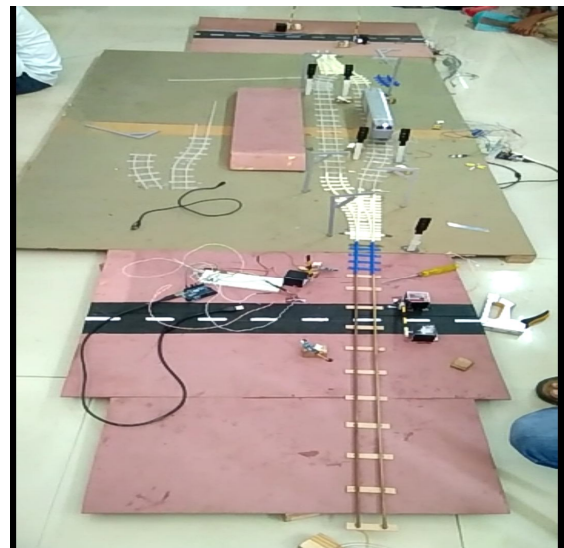


Fig 5 : Train Changing the Track

V. RESULT

By employing the PLC and arduino programming for automatic control of railways would decrease the railway traffic. Also automating railway gate control at the level

crossing, the time for which it is closed is less compared to the manually operated gates and also reduces the human labour. The accidents are avoided by using the servo motor to open and close the gates automatically when it rotates clockwise or anticlockwise direction to operate the gate automatically by the PLC. motor to open and close the gates automatically when it rotates clockwise or anticlockwise direction to operate the gate automatically by the PLC.

Controllers like servo motor, Limit switch serve the major mechanical functionality of automatic controlling and signalling of gates and automatic track changing.

Advantages :

- 1) Make the passengers safe.
- 2) Reduce the human effort and accident occurrence probabilities.
- 3) Eliminate trains being delayed.
- 4) Avoid derailling.
- 5) Fast update of the relevant information.
- 6) Number of speed trains can be increased.
- 7) Easy traffic control.

VI. CONCLUSION

The automated railway signalling and interlocking system design will be a best Source of information in order to implement the hardware in railways. The aim of this project is mainly to eliminate major drawbacks currently facing. In the design the use of sensors and PLC makes the communication and also the detection easier than the traditional process.

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