



# **AN INTELLIGENT ELECTRONICS SAFETY SYSTEM FOR RAILWAY LOCOMOTIVE TO HAULT FORCEFULLY AT A SAFE DISTANCE DURING DISPLAY OF RED HOME SIGNAL TO PREVENT OF MISTRACK CHANGING FOR AVOID ACCIDENT.**

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In railways loop lines and the traffic signals are the most important part of the railways system. Loop lines are constructed in station area to accommodate more number of trains and to ease out the train operations. Normally, these loop lines are constructed with a length of 750 meters which can accommodate a full length goods train with multiple engines. The main line has straight track, while the loop line has low speed turnouts at either end.

The main basic function of a loop line is, a loop line or passing loop is where a slow train, normally a freight train but sometimes a local passenger train can be temporarily parked while a faster train overtakes it. Sometimes the length of the loop is just long enough to stop the train. Other times it may run for a few miles allowing the train to run slowly but keep moving while the faster train speeds past. In this track changing system like from mainline to loop line or loop line to mainline or the train changing track from loop line to sub loop line in these situations the locopilot must maintain the red home signal before changing the track and The train should haulted at the red signal indicator location zone before changing the track until the track selection and changing process is completed. After completing of the process the red signal indication change to green indicator signal and then the pilot can move the train slowly to desired forward direction. In this case if the locopilot just overshoot or avoid the red signal then the train may be derail or the train may be collided with another train, as an example a train is waiting in the loopline or subloopline previously and the red signal overshoot train just go to that track and collided with that previously parked train or may be the train can hit another upcoming train on that track which is coming from reverse direction. Sometimes one train is just departure the platform and just going to a desired direction and also at that same time a train is just going to siding for maintenance then maybe due to signal error or track misalignment or maybe the pilot just over shot the red home signal the siding train just hit the previous train at a critical point during parallel motion. These kinds of accidents are frequently happening but these can be solve and the accidents can be prevent or avoid. Just a few modifications in the track and in the signal indicator system, by installing an innovative electronics device just beside the traffic signal mast and one more just installed in the railway locomotive.

The working of the system is very simple. When a train is just arrive at a correct distance of red home signal indicator. The safety device which is fitted just beside the signal post or mast communicate with an electronic device which is fitted in the locomotive via IR system and the engine is just lock at that correct location and the loco pilot can not move the train in forward direction either mistakenly or forcefully, and when the red home signal just turn into a green signal then the loco

pilot can move the train in forward direction just reset the safety system in the locomotive after a short duration and the accident can be prevented in our railway system to improve the traffic safety and improve the passenger service and also the freight service very well.

#### THE DETAIL BLOCK DIAGRAM AND WORKING PRINCIPAL OF THE SYSTEM

The all modern electric locomotives are currently operated by 25kv lines in modern railway system. In this block diagram of the electric locomotive, firstly the current is collected by the pantograph system of the locomotive and then fed to the step down transformer. The transformer getting the neutral line for complete the circuit from the railtrack through the wheel axle system. Now the transformer step down the 25kv high voltage to a lower AC voltage. Then the step down AC volt is rectified by the main rectifier. Then the rectified DC link volt is supply volt is supplied to the main inverter and auxiliary inverter . In this description only the main inverter and control circuit principles are explained. The main inverter can easily convert the rectified DC from the main rectifier to the three phase AC supply because the three phase AC is required for the traction motors for proper operation. In the block diagram the three phase AC is applied to the traction motor controller circuit. The traction motor control circuit block section is integrated with various protective functions to protect the locomotive in faulty conditions and this is a very common feature in all modern locomotives. A electro mechanical switch is used in the traction motor power circuit section. It is normally closed to start the train and remains closed all the time power is required. It is opened by a command from the driving controller, no volt detected, overload detected and wheel spin or slide detected. This electro mechanical switch is one kind of a safety isolator for the traction motors for better protection. In this safety system my safety device can be interface like a add on device to this system. An IR pick up sensor is just fitted behind of the cowcatcher or bumper of the locomotive, just beneath and center position of the loco pilot cabin. The sensor is connected with the controller device.

The operation of the device is very simple. First as an example for the application of the system. We can choose like a track changing option from a loop line to sub loop line. I describe the process with few set of tracks , a combination of mainline loopline and sub loopline.. In the diagram two mainlines and three looplines are present. A link track is present between loopline 1 and sub loopline 2, for the track changing of the train from mainline to sub loopline. In this diagram we can observe that a signal indication post is present just at the starting location of the linkline and now according to my design an IR array driver device is just installed near the signal indicator post. A straight IR line is placed between the two railtracks and attached with the sleepers and stretched to the A direction almost 50 meters. Now if a train is coming from A direction and want to change the track and want to go from main loopline to sub loopline. In this situation if any train is parked in the sub loopline previously. Then the red home signal must be display by the signal indicator post and the upcoming train from A direction should be halted at a safe distance until it gets the line clear signal from the signal system.

The clear operating principal of the system= Firstly the IR array driver device is interfaced with the red home signal light and the IR array is connected with the IR array driver device. Now if the subloopline is block by a parked train previously then the red home signal is light up to warn the locomotive pilot of the upcoming train coming from A direction and instruct him to stop and halt the train, at that time the IR array is also become active and start emitting the IR beam. The array is stretched to almost 50 meters from the signal indicator post. A receiver device to pick up the IR ray is already attached just behind the cowcatcher and just beneath and center position of the locomotive cabin. When the train just arrive on the IR array the sensor of the locomotive quick pick up the IR beam and send command signal to the controller section and the controller section just open the line breaker electromechanical relay switch and disconnect the power supply to the traction motor system and also activate the brake system by controlled amount of power and stop the train automatically in a safe distance. In this case if the locopilot is overshoot the red home signal by mistake or forcefully the automatic system automatically protect the train and avoid the dangerous accident and protect life and property easily and efficiently. This way my designed system works and can safe the railway passenger and freight service efficiently. When the blocked subloopline is become empty and the signal indicator post just switch off the red home signal and show green all clear signal the IR array is switch off automatically now the locopilot just press a system reset switch and line

breaker electromechanical switch is close again and allow power to the traction motor system and now the locopilot can move the train to the forward direction at a desired speed.



