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Railway Gate Crossing Control Using PLC Automation

Prakash H.More, Vaqar A Shaikh and Nitin B. Shinde.
Department of Electrical Engineering (SIER), Agaskhind, Sinnar, Dist: Nashik

Abstract
In the rapidly flourishing country like ours, accidents in the unmanned railway crossings are increasing day by day, No fruitful steps have been taken so far in these areas. Our paper deals with the automatic railway gate operation i.e. automatic railway gate control at a level crossing by replacing the gates operated by the gatekeepers, It deals with two things, Firstly it deals with the reduction of time for which the gate is being kept closed and secondly, to provide safety to the road users by reducing the accidents. By employing the automatic railway control at level crossing the arrival of the train is detected by the sensors placed in the side of the tracks. Hence, the time for which it is closed is less compared to the manually operated gates. The operation is automatic so error due to manual operation is prevented. Automatic railway gate control is highly PLC based arrangements, designed for use in almost all the unmanned level crossing in the train.

Keywords: *PLC, Capacitive sensor, DC Motor*

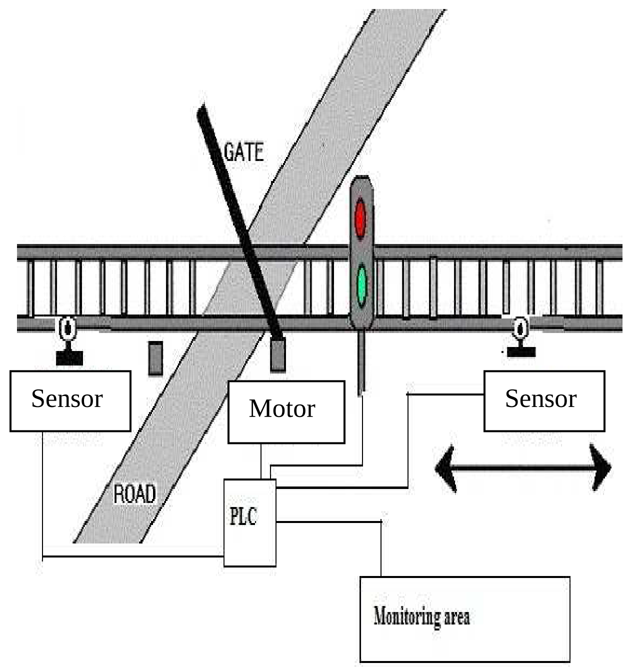
I. Introduction

The place where track and highway/road intersects each other at the same level is known as “crossing”. There are mainly two types of level crossing they are Manned Level crossing and Unmanned Level crossing. Railways being the cheapest mode of transportation are preferred over all the othermeans.When we go through the daily newspapers we come across many train accidents occurring at unmanned railway crossings. This is mainly due to the carelessness in manual operations or lack of workers. We in this , have come up with a solution for the same. Using simple electronics components we have tried to automate the control of railway gates. As a train approaches the railway crossing from either side, the sensors placed in the tracks at a certain distance from the gate detects the approaching train and accordingly controls the operation of the gate. When the wheels of the train moves over the track, the sensor 1 sense and detect the train and send signal to PLC to indicate the train arrival

II. Accident Avoidance Details

When the train arrives in a particular direction the capacitive sensor senses and generates appropriate signal, then at the same time the signal is sent to the PLC to do the function according to the ladder diagram fed to PLC.At the same time PLC produces an output signal to the DC motor to rotate in clockwise direction. When the output is from sensor 2 is sent to PLC it send another signal to DC Motor to rotate in anticlockwise direction.

LINE SKETCH OF THE PROJECT



HARDWARE IMPLAMANTATION

- PLC
- Sensor.
- DC Motor

III.Block Diagram Descriptions

PLC:

PLC defines as a “digitally operating electronic apparatus which uses a programmable memory for the internal storage of the instructions for implementing specific functions such as logic, timing, counting and arithmetic, sequencing to control through digital or analog input/output modules, various types of machines or processors."

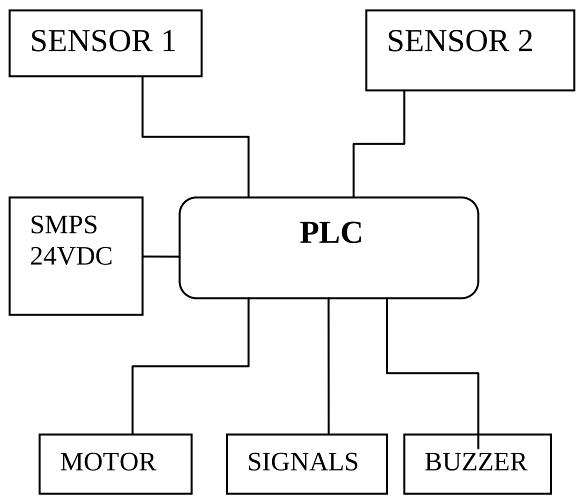
DC Motor:
Geared DC Motors can be defined as an extension of DC motor which already had its insight details demystified here. A geared DC Motor-30RPM, 12Volts geared are generally a simple DC Motor with a gearbox attached to it. The speed of the motor is counted interms of rotations of the shaft per minute and is termed as RPM.The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This insight will explore all the minor and major details that make the gear and hence the working of geared DC motor. At the first sight, the external structure of a DC geared motor looks as a straight expansion over the simple DC ones.

Capacitive Sensor:
Capacitive proximity sensors can detect both metallic and non-metallic targets in powder, granulate, liquid, and solid form. This, along with their ability to sense through nonferrous materials, makes them ideal for sight glass monitoring, tank liquid level detection, and hopper powder level recognition.
In capacitive sensors, the two conduction plates (at different potentials) are housed in the sensing head and positioned to operate like an open capacitor. Air acts as an insulator; at rest there is little capacitance between the two plates. Like inductive sensors, these plates are linked to an oscillator, a Schmitt trigger, and an output amplifier. As a target enters the sensing zone the capacitance of the two plates increases, causing oscillator amplitude change, in turn changing the Schmitt trigger state, and creating an output signal. Note the difference between the inductive and capacitive sensors: inductive sensors oscillate until the target is present and capacitive sensors oscillate when the target is present.
Because capacitive sensing involves charging plates, it is somewhat slower than inductive sensing ... ranging from 10 to 50 Hz, with a sensing scope from 3 to 60 mm. Many housing styles are available; common diameters range from 12 to 60 mm in shielded and unshielded mounting versions. Housing (usually metal or PBT plastic) is rugged to allow mounting very close to the monitored process. If the sensor has normally-open and normally-closed options, it is said to have a complimentary output. Due to their ability to detect most types of materials, capacitive sensors must be kept away from non-target materials to avoid false triggering. For this reason, if the intended target contains a ferrous material, an inductive sensor is a more reliable option.

SENSOR DISTANCE CALCULATION

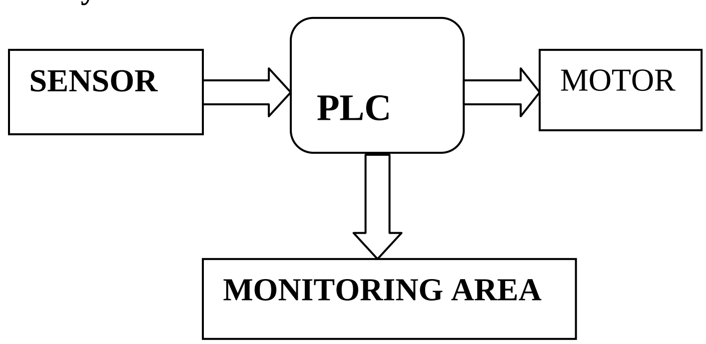
Hence the distance of sensors from the gate is taken as 2KM
Timing Calculation:
Maximum speed of train in level crossing gate: 80km/hr.
Average speed of train in level crossing gate: 40km/hr.
Minimum speed of train in level crossing gate: 20km/hr.
Execution Time:
At maximum speed total time of execution: 1 min 30 sec.
At average speed total time of execution: 3 min.
At minimum speed total time of execution: 6 min.

IV.Block Diagram



The above architecture shows the arrangement of the components and connected in such a manner.here each and every component has connected in such away to communicate and to do control functions of all the components. By having a monitoring area all the process can be monitored at a single place.PLC is placed in central because it does all the functions according to sensor inputs

V.System Architecture



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Here we can see the complete flow process of the project the signal from the sensor will play major role in complete process as an initial state the signal is sent to PLC then it produces the output base on our ladder program the it is fed to drive the DC motor only needs the pilses.As a monitoring area we will have some display arrangements to monitor complete process.here signal to the monitoring area will be taken from the PLC.

VI. PLC Ladder Diagram.

FOR UNI -DIRECTIONAL CONTROL
PLC ladder diagram plays as important role here without it no function is possible. Here PLC diagram means the program for the PLC which is stored in it to do the function according to the diagram.

X0- Arriving train input of Sensor 1 for UP track.

X1- departure train input of Sensor 2 for UP track.

Y0-Operation of motor to closing gate.

Y2-for buzzer sounds.

Y1-Operation of motor for opening gate

TMR- Time delay for motor operation.

M1 to M9-These are memory bits used for avoiding repetition of above instructions.
This is the ladder diagram to control the gate with the help of input signal from the sensor. This diagram shows the control ladder for unidirectional passage of train.

VII. Application

- Real Time Transport System.

Advantages

- Accident Avoidance
- Human Safety
- Quality and accurate service

VIII.Conclusion

The accidents are avoided at places where there is no person to manage the railway crossing gates.Here we use the DC motor to open and close the gates automatically when it rotates clockwise or anticlockwise direction to operate the gate automatically.When the train arrives in a particular direction the sensor senses and generates appropriate signal,then at the same time the PLC provides certain output signal to the DC motor to function.when the signal from PLC is sent to the DC Motor rotates to function open/closes the gate according to the signal output from sensor.

IX. Acknowledgement

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