Imperial Journal of Interdisciplinary Research (IJIR)
Vol-3, Issue-4, 2017
ISSN: 2454-1362, http://www.onlinejournal.in

Unmanned Railway Crossing Gate Control Based On PLC

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Abstract—*With advent of long lasting technologies, the world not just covered miles from the use of charcoal trains to the metros but also reduces the accidents that happen due to human error. Unmanned Railway Crossing is an effort that not only prevents accidents due to human errors but also plays a key role in creating the level crossings automation based, that reduces the unnecessary time for which the gate being closed. When a train passes through the crossing, the man sat at the nearby control centre to open up and close the gates manually every time when the train passes and rate of plausible human error increases, this needs an alternative with minimum human error, maximum safety and high efficient railway crossing gates. The project deals with the centre which monitors the whole connection of railway crossings in the vicinity which can control almost all gates in a city.*

Key words— *PLC, DC motor, Proximity sensor.*

I. INTRODUCTION

Before we begin with, the question arises, what is "level Crossing"? level crossing is a place where railway tracks and road intersects each other at level plane. There are basically two kinds of level crossings:

1. Manned Railway Crossing
2. Unmanned Railway Crossing

This project deals with the unmanned railway crossing. This project is basically designed to use automation system governing the large number of level crossing. This will reduce down the number of accidents happening per year due to human error or lack of human labourer. The project works in a way that proximity sensors which are placed at the side of tracks come into effect when the train approaches the railway crossing gates. As the sensor 1 senses the train in range, it sends signal to the PLC and based on the ladder logic, it produces an output signal to the dc motors to start the rotation anticlockwise direction and close down the gates. Similar happen with the sensor 2 placed at the side track when senses the train in range rotates the gate in clockwise or reverse direction.

II. Block Diagram and Description

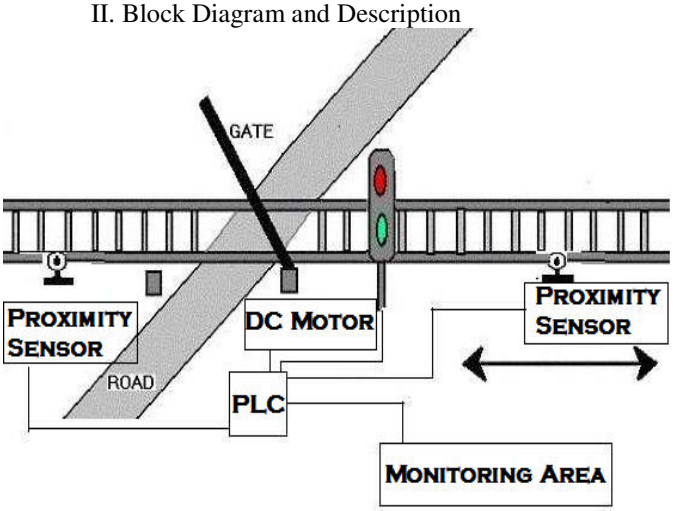


Fig.1. Block Diagram Of Project[1]

III. LINE SKETCH OF THE PROJECT

1. PLC

PLC stands for "Programmable Logic Control" which can be defined as an electronic apparatus operated digitally using a programmable memory for instructions storage for implementation of specific function such as arithmetic operations, timing, logics, sequencing to control via analog or digital modules and other various types of industrial processes.

Programmable Logic Controller : AC500 : General Specifications

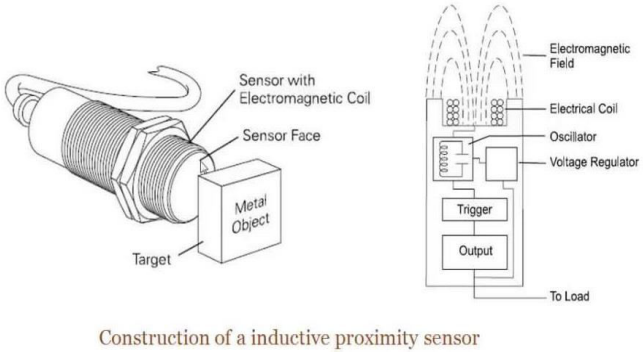
Irem		Specification
Power Voltage	AC receiving power	100/110/120V AC (50/60Hz), 200/220/240V AC (50/60Hz)
	DC receiving power	24 V DC
Power voltage fluctuation range		85 to 264 V AC wide range
		21.6 to 26.4 V DC
Allowable instantaneous power failure		85 to 100V AC : for a momentary power failure of less than 10 ms, operation continues 100 to 264 V AC : for a momentary powr failure of less than 20 ms, operation continues
Operating ambient temperature		0 to 55 °C (Storage ambient temperature -10 to 75 °C)
Operating ambient humidity		20 to 90% RH (no ccondensation) (Storage ambient humidity 10 to 90% RH (no condensation))
Vibration resistance		Conforming to IEC (EN) 61131-2 (147m/s2 , 3times in each of 3 directions X, Y, Z)
Noise resistance		• Noise voltage 1,500Vpp Noise pulse width 100 ns, 1 μs (Noise created by the noise simulator is applied across the power supply module's input terminals. This is determined by this company's measuring methods.) • Based on NEMA ICS3-304 (with the exception of input module) • Static noise : 3,000V at metal exposed area
Insulation resistance		20 MΩ or more between the AC external terminal and case ground (FE) terminal (based on 500V DC mega)
Dielectric withstand voltage		1,500V AC for 1 minute between the AC external terminal and case ground (FE) terminal
Grounding		Class D grounding (ground with power supply module)
Usage environment		No corrosive gases, no exceessive dust
Structure		Open, wall-mount type
Cooling		Natural air cooling

1. DC Motor

This circuit is centred with the only aim to switch the current in both the motor windings on and off and to control its direction. This part discussed in this section is connected to the relay and relay with the power supply. The DC motor of 12V is used with application of 24V supply, which technically halves its number of rpm.

2. Proximity Sensors[3]

The proximity sensors used here are of following specification:
Voltage range: 6-36 V DC
Current: 200 mA
Type: PNP type
Sensing Rnage: 4mm
The sensors are placed pretty near the tracks so that it could detect the train. The two terminals of sensors are connected with +24V DC and -24V DC supply and one is used as input therefore connected to the PLC inputs. The similar is being done with all the four sensors. The construction and basic working of proximity sensor is shown in Fig.2.



Construction of a inductive proximity sensor

Fig.2 Proximity Sensor

3. Relay[2]

This section of circuitry is basically centred to trip the circuit based on programmed logic in PLC. The 8 pin 24V DC relay being used as output which work as a bridge between PLC output and DC motor.

IV. SYSTEM ARCHITECTURE[2]

The system architecture is of the project is explained by a block diagram shown in fig.3.

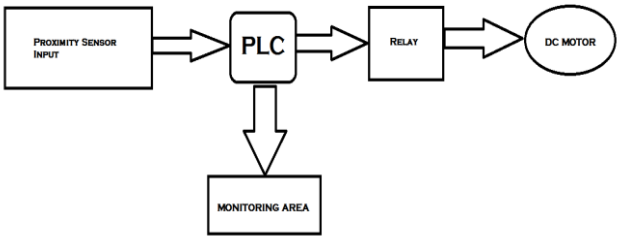


Fig.3 System Architecture

V. CONNECTION STUDY

This section of paper describes the circuit connection with various components. The PLC used in this project is AC500 which has eight inputs and six outputs, inputs being the four sensors and the output being relays. With input I0, the sensor's black wire is connected and rest of the two wires namely blue and brown are connected to -24V and +24Vterminals of DC supply respectively. Similarly the inputs I1, I2 and I3 are connected with sensors 2,3 and 4 respectively. The eight pin relay is circuited in a way the terminals 1 and 4 are short circuited with trip circuit to pin 9 and 12 respectively, pin 5 and 8 are connected to the motor terminals of +12 V DC and -12 V DC. Pin 14 being the output pin connected with PLC output O0. Pin 9 and 12 are given the power supply of +24 and -24 V DC and pin 13 is connected to -24 V DC. The common of PLC is connected to +24V DC supply to

complete the power supply circuit. The conncection is shown in Fig.4

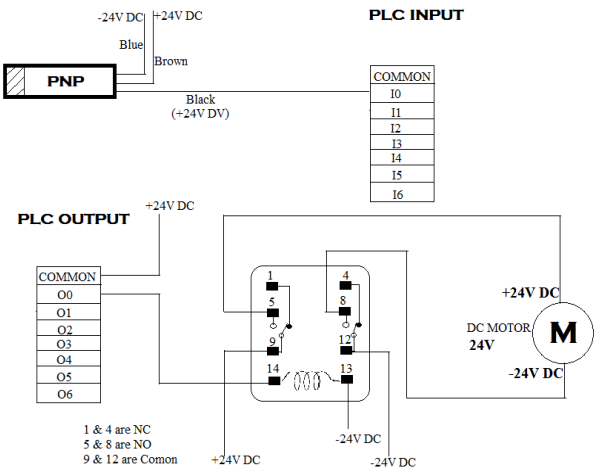


Fig.4. Circuit Connection

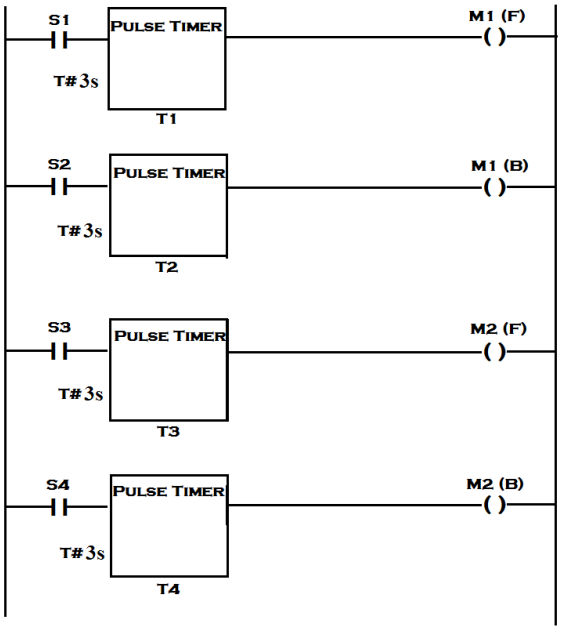


Fig.5 Ladder Logic

VI. CALCULATIONS

Since, the supply is of 24 V and DC motor used is of 12 V

Rated speed of 12V DC motor = 10rpm

Therefore, on application of 24V DC Rated speed = 5rpm

Total time of execution = 6 sec

Number of rotations in 6 sec = 0.5

Therefore, 3 seconds for quarter rotation which is intended in this project.

Similar in clockwise action of motor for opening the gate.

VII. PLC LADDER DIAGRAM FOR UNIDIRECTIONAL CONTROL

PLC ladder diagram is analogous to the programming in computer languages. Without it no function or automation is possible. The below mentioned is the ladder diagram through which movement of gate is being controlled. Inputs are sensors and the output is motor rotation. Ladder logic is shown in Fig.5.

VIII. ADVANTAGES

The advantage of this project is reduction of number of accident due to human error. The control over a single area where every fault can be monitored on a screen my minimum number of persons.

- Accident avoidance.
- Human safety.
- Smart and accurate service.

IX.C ONCLUSION

The accidents are avoided up to a great extent and the human resource which was previously used to just close and open the gate is also replaced by a smart automatic system and now we can use that same human resource at some other more important positions. Here we used DC motors to open and close the gates automatically by its rotation in anticlockwise and clockwise directions respectively. Whenever the train arrives from a particular direction the proximity sensor gives signal to PLC and it generate an appropriate signal for the operation of DC motor to close/open the gate. PLC sends operating signal to the dc motors according to the output signal of sensors to open/close the railway crossing gate.

X. FUTURE SCOPE

The very aspect of this project relies in the fact that over 9000 railway tracks going to be changed over year 2017 and this kind of automation is sooner be in implementation which strengthens the MAKE IN INDIA concept

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