

Automatic Accident Control System on Railway Tracks

Ranu Dewangan, Pratibhadevi Umesh

Abstract— The main object of this study is to design & implement automatic accident control system on railway track. The system developed is able to sense the presence or absence of vehicles or any object on track within a certain range by setting the appropriate duration, the loco pilot which is present in train for driving can observe with the help of PLC. In train 2 lights are present one for clear line or other for any problems are present on track. The PLC checks the status of the sensor the system resolution is depend on the output provided by the sensors, then PLC checks the priorities and then provided output signal to the light present in train for ON or OFF the RED or GREEN light and on time is depend on the specific priorities.

Key Words - PLC, Zigbee sensor, LED, RS-232, RS-485.

I. INTRODUCTION

It is very useful in today's life. With the help of this we can remove the coming accident. This will make with the help of PLC[2]. The driving control section of the train or engine side of the train two lights are present which is programmed by PLC. These two lights have color RED or GREEN. RED light is use for danger and GREEN light use for clear signal. Their function is **when train is coming in any track and same track is damage or any fault are present or any object are present or from other side other train is coming in speed at that time RED light which is present in engine boogie automatically GLOW or ON, they inform that the driver who is driving the same train.** From this driver will get inform with the help of RED light turn ON and it indicates any danger is present on this track which is near, from this train will be slow and automatic will be stop with the help of PLC and coming accident will be remove[1]. In older days this is use with the help of microcontroller and that is critical but now a modern accidental control system on the railway track can have multiple control strategies. We need to understand the function of track accidental control system so that we can improve driving habits by controlling the speed. In order to reduce the number of associated railway accidents. The more numbers of drivers who know about the operation of accident control signal in railway track. After stop they are waiting for the GREEN light ON for the clear signal[6].

Ranu Dewangan, Department of Electronics and communication Engineering, Technocrats Institute of Technology & Science, Bhopal (M.P.), India, Mobile 9993528506

Pratibhadevi Umesh, Department of Electronics and communication Engineering, Technocrats Institute of Technology & Science, Bhopal (M.P.), India, Mobile 7389393612

The main aim in design and developing of the automatic train control on the railway track is to reduce the accident on the railway track and also to minimize the collision on railway track and can also to be maximize used by railway board that can cross on mathematical function to calculate the waiting time. The automatic train control system on the railway track consist of three important parts-

- PLC controller
- Hardware. These usually comprise of RED and GREEN light
- Sensor. The sensor will check the presence problem on the railway track.

II. OVERVIEW OF PLC BASED ATOMATIC CONTROL SYSTEM ON THE RAILWAY TRACK

The main theme of this report is to build and verify the design and understand the concept. The main objective is to build a hardware device that has:

- The ability to collect the information of the busy tracks by sensors and providing the output to PLC.
- The ability to take decision against the information and change the time according to the priorities.

III. ADVANTAGES

- Increase capacity of the intersection.
- Reduce collision, accident.
- If any interrupt are present on railway track then train automatically stop from these coming accident will remove.
- There programming is easy, which can easily use by railway board.
- From these, we are going safely.
- It will provide good result.
- Cost is low.

IV. WHAT IS ATOMATIC ACCIDENT CONTROL SYSTEM ON THE RAILWAY TRACK?

An automatic accident control system on the railway track sense the presence or absence of any fault on the railway track and reacts according to the sensors output. In this system PLC tacks a data from sensors and checks the priorities after that PLC provides signal to the engine boogie of the train.

The automatic accident control system works in four different modes are Normal flow, Peak time, OFF time and Manual operation.

Peak time and OFF time modes are depended on the sensor output then the change the status. Automatic accident control system on the railway track totally depends on the sensor output and takes decisions.



Fig 1: object on track

V. WHAT IS PLC?

A PLC (Programmable Logic Controller) is a device that was invented to replace the necessary sequential relay circuits for machine control. The PLC works by looking at its inputs and depending upon their state, turning on/off its outputs[2]. The user enters a program, usually via software, that gives the desired results.

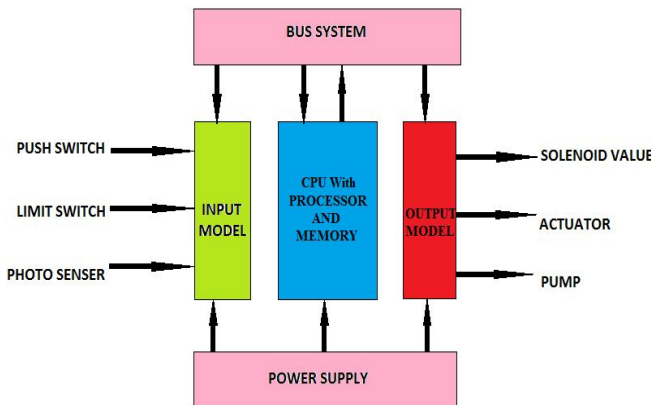


Fig 2: PLC Architecture

VI. SYSTEM BLOCK DIAGRAM

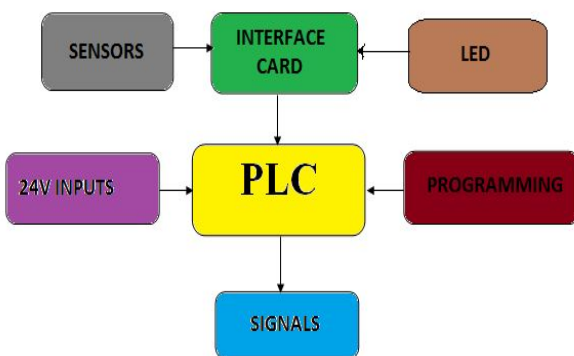


Fig 3: System block diagram

A. PLC T100MD Module

T100MD2424+ is a member of the highly popular T100MD PLC family. The basic unit comprises 24 digital Inputs and 24 digital Outputs, 8 analog I/Os. Two of the digital Outputs (7 & 8) which can be also defined as PWM Outputs (it is two channel pulse width modulated (PWM) Output) can each deliver 2A continuous, 24VDC (active high) current to the

load and up to 10A peak. The 8 analog I/Os are configurable as 8 AI, no AO or 6AI and 2 AO. All analog Inputs are 10-bit resolution (4 to 8 channels) and all analog Outputs are 8-bit resolution (1 to 2 channels).

T100MD2424+ is expandable up to a total of 96 digital inputs and outputs with an optional expansion module. It has an RS232 and an RS485 port. Both of them are conversant in MODBUS protocol. The built-in LCD port allows simple interface to industry-standard LCD modules from 8 characters to 80 characters.

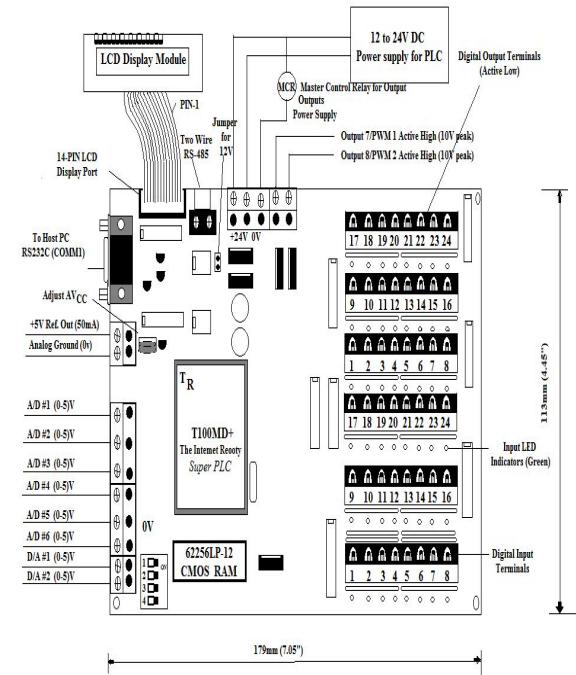


Fig 4: PLC T100MD Module

One Independent RS232 port for connecting to a host PC for monitoring or programming and One Independent RS485 port for networking or for connecting to external peripherals such as RS485-based analog I/O cards and LCD display etc. The compactly designed T100MD2424+ PLC can be easily installed in many kinds of metal enclosures or plastic. You need to use 4 or 5 PCB standoff (or same screws and nuts) to support the controller and fasten it to a console box.

Analog I/Os Ports: in this port the 8 channels of analog I/Os are available via an 8-way detachable screw terminal connector analog the left edge of the T100MD2424+ PLC and the PLC also supplies a +5V analog reference –voltage Output. It has conversion time-10us per channel and It has built-in Sample & Hold circuit.

Digital I/Os Ports: Detachable screw terminals are provided for quick connection to all digital I/Os and for power supply wires. Each block of screw terminals can easily be detached from the controller body, enabling easy replacement of the controller board when it will be necessary. Since the terminal block for digital I/Os are inserted vertically to the board surface, you need to remove the terminal block before you can start wiring. Use a small flat-head screwdriver and insert underneath in the terminal block, apply even pressure to raise the terminal block until it becomes loosened from the connecting-pin strip, as shown below:

If these special I/Os are not used, then they can be used as ordinary ON/OFF (switch) type I/O in the ladder diagram.

Although wires of up to 24 AWG may be connected directly to the screw terminal, insulated crimp ferrules should be used to provide a good end termination to multithreaded wires. Use of ferrules reduces the possibility of stray wire-strands short circuiting adjacent terminals and their use is therefore highly recommended.

B. Interface Card

A WIC or WAN interface card is a specialized network interface card (NIC) that allows a network device such as a router for connecting and transmitting data over a wide area network. (A NIC provides the interface between a local area network and a device) A WIC has a built-in Channel service Unit or Data service unit (CSU/DSU) interface that allows the card to communicate (transmit/receive) with a router that is connected to a WAN.

And on this project the interface card is used between the sensors Output and PLC for interfacing. In this card we use Opto coupler is used for short the two pin i.e. pin # 1 and pin # 25. When the input is approaches from sensor then a current limiting resistor is used to reduce the current and drops the voltage for a specific limit.

C. Signal Board

It is a device and this indicates the status of the signal. The purpose of signal board in train is to ON or OFF lights (Red, Yellow and Green). The timing of this depends on the Input given by the PLC according to the timing of the programming priorities. In this case, once signal open at a time and all other signals are stopped. Each signal light is a combination of four LEDs, two LEDs are connected in parallel and other two LEDs are connection in series[1].

D. Communication Ports

The latest revision (Rev. D or D-1) of the T100MD+ features two independent serial ports and these serial ports can simultaneously communicate with other devices using a variety of protocols. They can also be programmed to accept or send binary or ASCII data using the TBASIC built-in commands such as INPUT\$(n), INCOMM (n), OUTCOMM n, PRINT #n, d.

a) The first serial port is COMM1. It has an RS232 port, which is compatible with most PC RS232 ports.

b) The second serial port is COMM3. It has a two wire RS485 port that allows multiple PLCs. This multiple PLCs have been connected by a master PLC or a single host computer for networking or to implement a distributed control system.

E. ZIGBEE Sensor

Zigbee PRO offers full wireless mesh topology network, low power networking capable of supporting more than 64000 devices on a single network and it is possible by mesh[4]. It provides standardized networking designed for connecting the widest range of devices, in any industry or large area, into a single control network.

Zigbee PRO now offers innovative feature and an optional network, green power for connecting energy harvesting or self powered devices into Zigbee PRO networks.

The Zigbee specification enhances the IEEE 802.15.4 standard by adding security layers and network and an application, frame work[3][5].

Some of the characteristics of Z-include:

a) For this the global operation in the 204GHZ frequency band according to IEEE802.15.4.

b) Regional operation in the 915MHZ (Americas) & 868MHZ (Europe).

Green power feature:

It allows battery less devices security join Z-PRO networks (for Zigbee PRO). It is the most eco-friendly way to power Zigbee products such as switches sensors, dimmers and many other devices. These devices can now be powered just by using widely available, but after missed sources (connection) of energy like motion, light, vibration, to name a few.

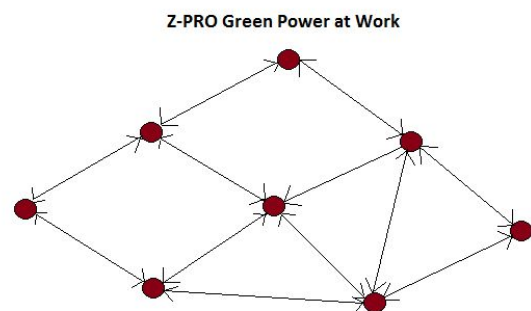


Fig 5: z-PRO Green Power Work

Z is a wireless networking standard that is aimed at remote control and sensor applications which is suitable for operation in isolated locations and in harsh radio environments so it will very useful in large area.

Zigbee technology build in IEEE standard 802.15.4 which define the physical and MAC layers[3]. **They can add Zigbee devices (sensor) to more areas, big place with greater ease, including locations where power is unavailable, not allowed for safety reasons or for historical preservation purposes.** Plus, this devices can join larger Zigbee networking and deliver more control than ever before.(Software Features: ZigBee HA 1.2 pre-certified, firmware pre-programmed, Thread upgradable)

The technology which is defined by the ZigBee specification is intended to be simpler and less expensive than other wireless personal area network (WPANs), such as Wi-Fi or Bluetooth.

F. Toggle Switch

The most familiar form of switch (ON/OFF condition) is a manually operated electromechanical device with one or more sets of electrical contacts, which are connected to external circuits i.e. if it will connect from the system then electrical supply will flow on the system. **Each set of contacts can be in one of two states: either "open", meaning the contacts are separated from device and the switch is non-conducting, or "closed", meaning the contacts are touching the device or connect the system and electricity can flow between them.** The mechanism actuating the transition between these two states (open/closed) can be either a "momentary" (push-for "on" or push-for "off") type or "toggle" (flip switch use to continuous "on" or "off") type.

A switch may be directly manipulated by a human as a control signal for a system, such as a keyboard button, computer or for controlling power flow in a circuit, such as a light switch.

This is automatically operated switch which is used to control the motion of machine to control the accident on railway track.

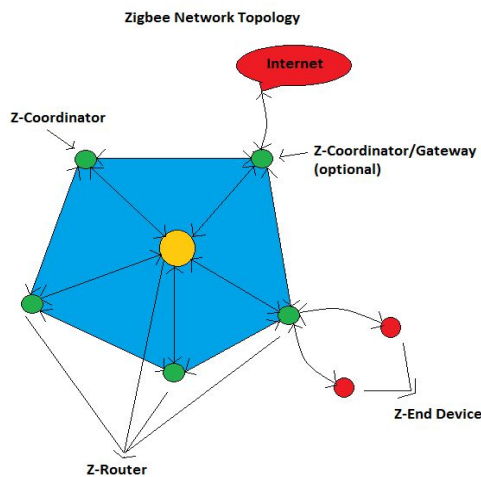


Fig 6: Zigbee network topology

VII. CONCLUSION

An Automatic Accident Control System on Railway Track has successfully been designed and developed. The Zigbee sensor is interfaced with PLC Module. This interface is synchronized with the whole process of accident control on the railway track. In this of prototype can easily be implemented in real life situations. With the help of Zigbee sensor we can control accident on railway track and we use this sensor on train. It will sense till long distance in track. Today it will very useful for railway board.

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REFERENCES

- [1]Sevamraju *et al.*, "Robust Railway Crack Detection (RRCDS) Using LED-LDR Assembly," *IEEE published*, pp. 477- 482, 2012.
- [2]A. J Crispin, 1997, "Programmable Logic Controller and their Engineering applications", second edition.
- [3]ZigBee "IEEE 802.15.4" *Ieee 802*. Retrieved 2012-10-18.
- [4]Solomon, S., "Sensors Handbook". *McGraw- Hill*, New York. 1999
- [5]Anjali Bissal *et al.*, "Train Collision Avoidance System Using Sensors and Zigbee Technology", *international journal of research in engineering and advanced technology*, March 2013.
- [6]J. W. Webb, "programmable logic controller principle and application", PHI, fifth edition.

Authors

Ranu Dewangan, pursuing M. Tech. in Digital Communication from Technocrats Institute of Technology & Science, Bhopal (M.P.), Department of Electronics & Communication Engineering



Prof .Pratibhadevi Umesh, Professor Department of Electronics & Communication Engineering, Technocrats Institute of Technology & Science, Bhopal (M.P.)

