Intelligent Railway Crossing Gate Control with High Speed Anti-Collision Alerting System

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ABSTRACT

In India, railways have a dense network and the trains run at high speed. Hence, there is a very high possibility of accidents due to collisions, derailment and accidents due to weather conditions. Thus the paper aims at reducing the number of accidents. It considers the vulnerable areas of accident. It includes featureslike anti-collision and automatic gate control, accident detection and power saving in tunnel. These features are mainly modeled using Microcontroller AT89s52. Different types of sensors included in the model play a vital role.

General Terms

Avoid railway accident and save energy

Keywords:

Microcontroller, Motor driver Obstacle sensor, Mechanical sensor, IR sensor, LED.

1. INTRODUCTION

The Indian Railways has the world's fourth largest railway network in the world after United States, Russia and China.

Railway Safety is a crucial aspect of rail operation. Railways being the cheapest mode of transportation are preferred over all the other means.

To avoid such accidents the paper proposed will analyze few vulnerable areas of accidents and help to find out the possible way to reduce the number of accidents. The accidents occurring are mainly due to the carelessness in manual operations or lack of workers. It will be describing few major features namely anti-collision, automatic gate control and track misalignment. Anti-collision will avoid the collision between two trains or the train hitting a heavy mechanical object. Automatic gate control will help the accidents reduce occurring at the railway crossing. Track misalignment will avoid the accidents occurring due to two trains running on the same track in opposite direction. There are few minor features included like tunnel power saving and accident detection. The feature accident detection will enable the immediate help needed after the accident taking place without human interference. Tunnel power saving will help efficient use of power in tunnel.

2. PROPOSED SYSTEM

The proposed system is divided into two sides namely; the train side and the field side as shown in Fig 1 and Fig 2. The train side circuit is fitted on the train.

Train Side

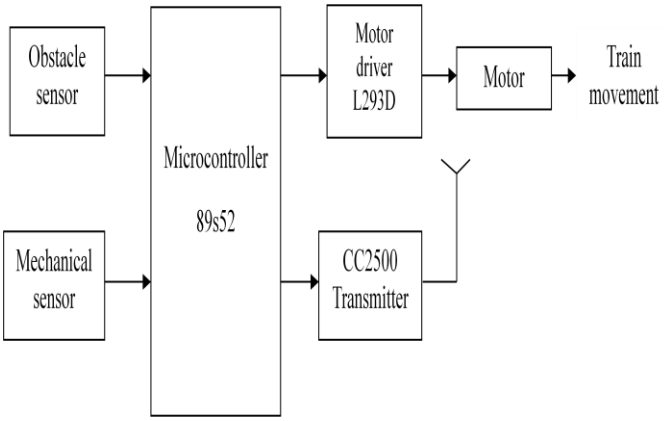

Fig: 1 Block diagram of train side

Field Side

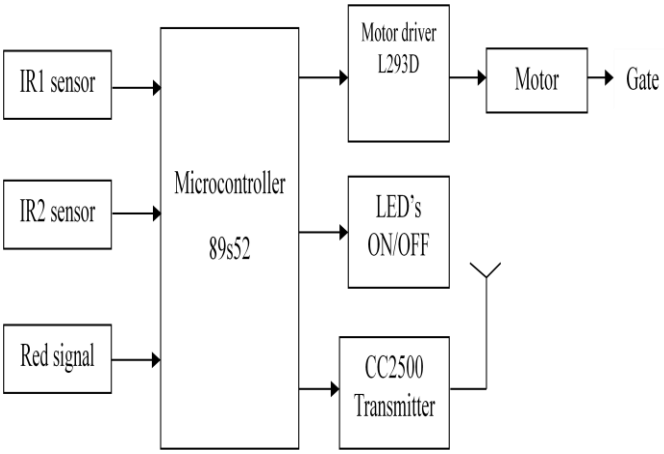

Fig: 2. Block diagram of field side

PC Side

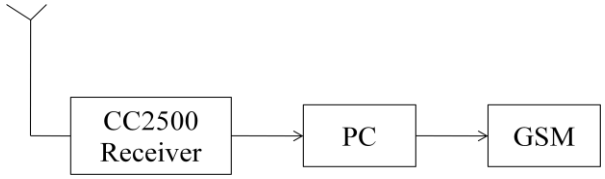

Fig: 3 Block diagram of PC side

2.1. Microcontroller:

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8Kbytes of in-system programmable

flash memory. The device is manufactured using Atmel's high-density, non-volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip flash allows the program memory to be reprogrammed in-system or by a conservative non-volatile memory programmer. It is a 40 pin IC.

2.2 IR (Infrared) sensor:

It is high power infrared emitting diode (950nm) GaAlAs/GaAs. TSAL6100 is a high efficiency diode. It is pair of transmitter and receiver. It works on the principle of line of sight. These sensors will used for implementing automatic gate control and tunnel power saving.

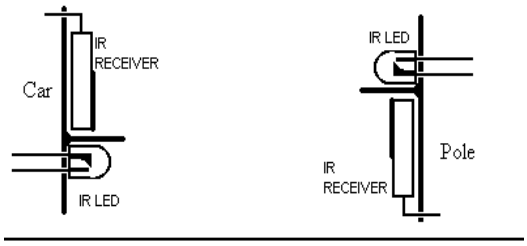

Fig: 4 Schematic diagram of IR sensor

IR receiver consists of Photo Diode. A photodiode is a type of photo detector capable of converting light into either current or voltage, depending upon the mode of operation.

2.3. Obstacle sensor:

It is transceiver. It consists of IR LED and IR receiver (TSOP) and IC555. A constant stream of square wave is generated by IC555 at particular frequency which drives IR LED.

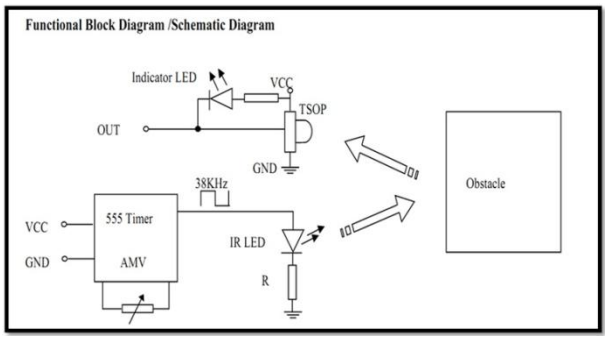

Fig: 5 Functional block diagram of Obstacle sensor

When this signal is hit by on obstacle the signal is send to the microcontroller. This sensor is used to implement anti-collision.

2.4. Motor driver:

L293D is a motor driver IC which allows DC motor to drive on either direction. It is a 16 pin IC which can control a set of two dc motors simultaneously in any direction. It means you can control two dc motors with a single L293D IC. It works on the concept of H-Bridge. It is a circuit which allows the voltage to flow in either direction. The change in the direction of the voltage enables the motor to rotate in clockwise or anticlockwise direction. In a single L293D chip there two H-BRIDGE circuits inside the IC which can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors.

2.5. CC2500 transceiver module:

MO-CC2500 is a FSK /MSK transceiver module. It provides expensive hardware support for packet handling, data buffering, bus transmissions, link quality indications and wake on radio. It has a high performance and easy to design. It can be used in 2400-2483.5 MHz ISM/SRD band system. The modules frequency output power, sensitivity can be programmed.

3. FEATURES

3.1. Automatic gate control system:

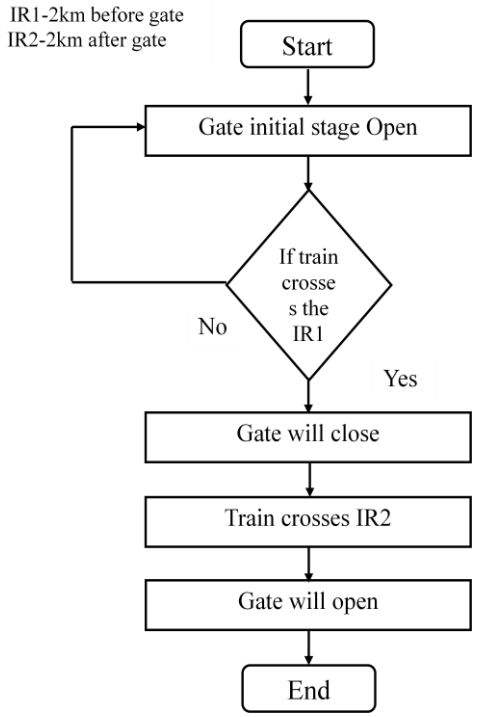

Fig: 6 Flowchart of automatic gate control system

Main feature of our project is automatic gate control. This feature is implemented using two pairs of IR sensors. One pair is placed before the gate at certain distance; another pair is placed after the gate at a distance.When the train crosses the line of sight path of the first pair of IR sensor the sensor will send the signal to the microcontroller.

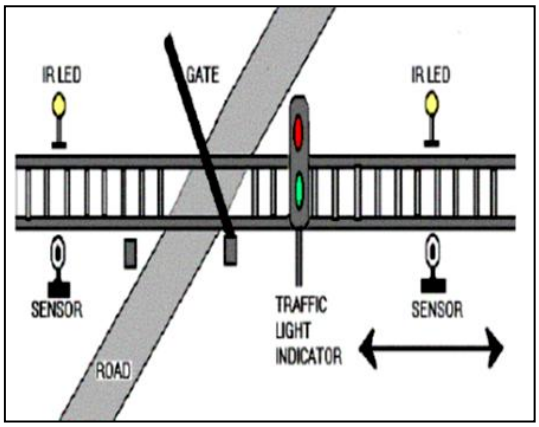

Fig: 7 Illustration of gate control

This signal will be send to the microcontroller at the field side near the gate. This signal sent will further open the gate. Same

process will repeat when the train will cross the second pair of IR sensors.

3.2. Anti-collision system:

Anti-collision will be implemented using the obstacle sensors fitted on the train side. The obstacle sensors sense the obstacle using infrared LED and infrared detectors. The signal will be fed to the microcontroller. As soon as the signal is received the microcontroller will take the necessary actions to stop the train. The obstacle sensor is essential is a transceiver which helps to transmit the signal to the microcontroller.

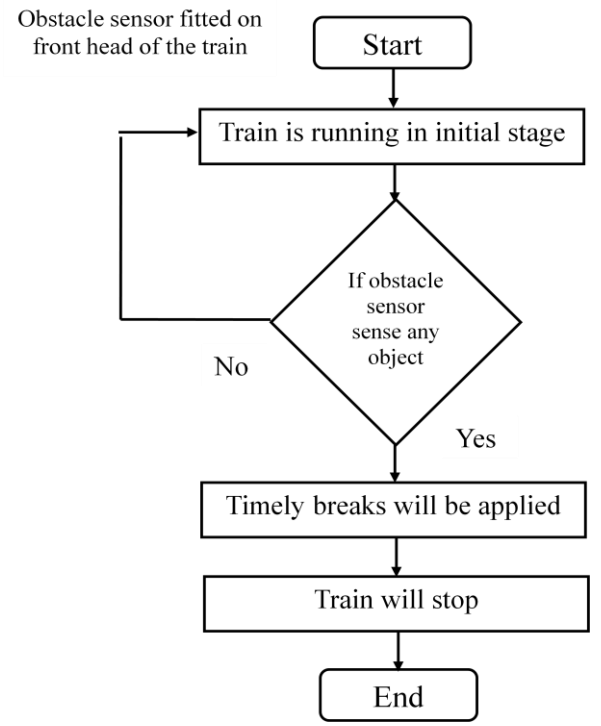

Fig: 8 Flowchart of anti-collision system

3.3. Accident detection

This is another feature with the sensor network and communication network for disaster management, in which the concerned authorities dealing in disaster management get the message on their mobile phones about disaster information. The proposed model will be using the GSM technology and on-board mechanical sensors to detect an accident or crash. The mechanical sensors will sense the accident and will send the signal to the GSM module. The GSM module will then send an emergency message to the nearest hospital and police station.

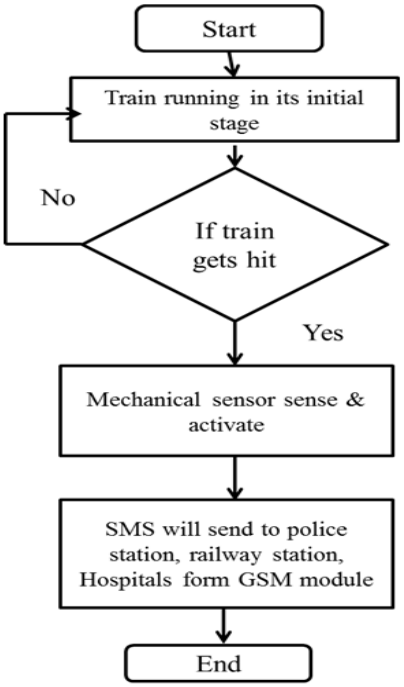

Fig: 9 Flowchart of accident detection

3.4. Tunnel power saving system:

Tunnel power saving is implemented using two pairs of IR sensors. One pair will be fitted at the entrance of the tunnel and other pair at the end of the tunnel.

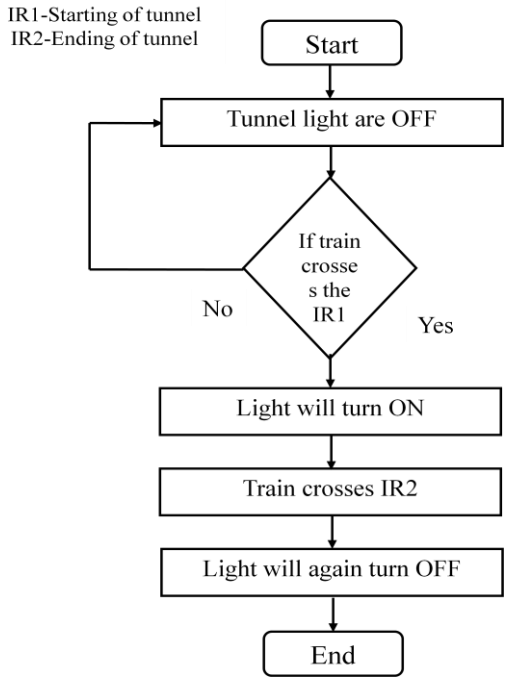

Fig: 10 Flowchart of tunnel power saving system

The lights are initially OFF, when the train crosses the line of sight of the IR sensor at the entrance the signal is giving to the microcontroller at the field and the microcontroller will take the necessary action to switch ON the light in the tunnel. Similarly, the train crosses the line of sight of the IR sensor pair at the exits of the tunnel. Then signal is given to the microcontroller and the light will switch OFF again.

4. RESULT

The result expected by implementing the above mentioned features can be described feature wise.

In automatic gate control the IR sensors placed on the either sides of the gate will sense the presence of the train and will control the movement of the gate according to avoid accidents.

In anti-collision the obstacle sensor placed on the train will sense the obstacle or another train on the same track and will cause the train to stop.

In power saving the IR sensors will sense the train entering the tunnel and will keep the lights ON only as long as the train is there in the tunnel.

In accident detection the sensors will sense the accident that took place and will send an SMS using GSM to the nearest police station, railway station and hospital for immediate help.

5. CONCLUSION

The paper proposed above deals with the safety of railways. The various features mentioned and described in the paper intend to provide secure and safe commutation. The features include anti-collision and automatic gate control lessens the manual interference and hence increases the accuracy and precision to avoid accidents occurring due to more negligence. Accident detection provides emergency assistance needed if an accident occurs.

It shows that it is possible to improve the overall safety of the railway system in India. The result depends on both the railway industry and the regulator working together for effective security. The proposed system provides the means for real time inspection. The purpose of maintenance on the movable and fixed facilities for the guarantee of operation safety and maintenance efficiency.

6. REFERNCES

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