

Automatic Railway Gate Control System Based on RFID, pressure sensor and servo motor

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Abstract –The railway crossing accidents are increasing day by day due to unman railway crossings. This paper presents an automatic control gate system to prevent rail accidents. Pressure sensor, RFID card, Servo motor is used to control the open and close status of the railway crossing gate. In this paper we propose a model where pressure sensor is placed on the railway tracks, RFID tag on the engine and the open and close status of the gate is controlled with the help of servo motor.

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1. INTRODUCTION

According to the statistics from 2009-2015, there were about 800 railway accidents and more than 30% of these accidents were due to unman level crossing. About 1800 people were injured and more than 500 were dead. In mostly cases the crashes occurred when the driver do not pay attention to the warning devices. The main problem around railway crossing is that the motorists drive around the crossing the gates while they are down. So, more efforts are required for railway crossing safety. In India over thousands of trains are running on tracks everyday. There are many unman railway crossings on the tracks which are susceptible to accidents. To avoid accidents at railway crossings, automatic and independent railway gate system comes in picture. Using simple electronic components, we have successfully tried to automate the control of railway gates.

2. RELATED WORK

Existing models to control the gates of the railway crossing are:

1) IR Based Automatic Railway Gate Control System

When the gates are controlled manually, the time for which the gate is open is less, so IR based system is proposed. This system includes microcontroller, DC motor, IR sensor. The sensors are installed near the crossing. When the train reaches the crossing from either side, the sensor detects the train and sends the signal that train has arrived. When the train arrives, the IR transmitter senses and generates a signal; at the same time IR receiver receives the signal and generates an interrupt signal [1]. The motor which is connected with the controller moves in the clockwise direction when the interrupt signal is generated and moves in the anticlockwise direction when the interrupt ends.

This system has the advantage of being cheap and simple with the disadvantage that it is slow and IR sensor gets affected by weather conditions

2) Ultra-Wideband Radar System for Detection at Railway Crossings.

Due to limitations of IR system, the radar system is proposed at the crossing. In this system, beam interruption is used for detecting objects using radar. With beam interruption, a beam is directed towards the reflector and if the beam is interrupted the received power is reduced. This indicates that there is any object [2]. Two radars are required to cover the crossing, each having 50 degree beam width. If one radar is used, then the gain is reduced. When the radar detects the object it activates the alarming system. In this system we detect the vehicles at the crossing, but not the train. This system has the advantage that the optical wavelengths are operated in all weather conditions.

The disadvantages of this system include the fact that:

(a) Radio frequency has harmful effect on human in a longer run and it is less reliable.

(b) It is designed to detect the vehicles at the crossing not the train.

3) GPS & GPRS Based Detection System

Many systems were proposed based on sensor but they were successful up to some extent only. The main reason for the failure of sensor based system was poor stability and less life cycle of the sensor [3]. To avoid these problems, GPS based system was proposed. In this system, train location is obtained using GPS and the data is transmitted via GSM network. The position of the train is periodically sent to the remote server through GPS module. When the train reaches near the crossing, the control room sends the signal for closing of the gate. The control room gets the real time position, speed of the train through GPS system.

This system has the advantage of being fast as compared to sensor based system.

The disadvantages of this system are high initial cost and dependency on GSM network congestion.

4) Video-Analysis Based Railway Road Safety System

In this system, video camera is installed at the crossing. The basic frame work is of image processing based railway crossing surveillance. It will send the pictures of the crossing to the locomotive drivers. The risk path is defined in this system. The image taken by the video camera is compared with the reference image, if there is object detected at the risky path then it will alert the train driver [4]. To obtain separated objects, this method consist the clustering of moving pixels by comparing specific energy vectors associated to the each target and each moving pixel.

This system has the advantage of being fast and simple with the disadvantage that this is less reliable.

5) An Inductive loop automatic railway gate crossing system

In this system the inductive loops are buried under the pavement. When the magnetic material comes near, the impedance changes. In this, we use electromagnetic theory. The two coils are placed on both side of the track. When the train passes through the coils, the medium between the cores is changed and the induced voltage also gets changed. This change is now amplified using the amplifier and then compared using the comparator. This gives us the idea whether there is a train on the particular track or not. The flip-flop is used for giving a steady state signal once the train passes from the track circuit.

3. PROPOSED MODELLING

Keeping in view all the advantages and disadvantages of all the existing systems, a new system has been proposed here .In this, combination of RFID, Pressure sensor, and Servo motor is used to design the system.

The RFID is used to detect the speed, name, location and other details of the train. The pressure sensor is not affected by climate so it is best for use. Moreover, the servo motor implies an error sensing feedback control which is utilized to correct the performance of a system. We use a microcontroller, a dedicated module designed particularly for use with servomotors. Servo motors are DC motors that allow for precise control of angular position. It uses the position sensing device to figure out the rotational position of the shaft, so it knows which way the motor must turn to move the shaft.

The pressure sensor is installed on the tracks and RFID tag is installed on the engine. When the train reaches near the crossing, the pressure sensor senses the pressure and generates the signal for the closing of gate. The pressure sensor is connected with the microcontroller and the servo motor is used for the controlling of the gates. The RFID reader reads the train information when the train is detected. When the RFID reads the tag, it will generate the alarming signal at the crossing. The RFID reader is connected through the microcontroller for better operations. With the help of servo motor the system gets more reliable and there is very less chance for any error.

Figure 1 and Figure 2 represent the block diagram and flow chart of the proposed system respectively.

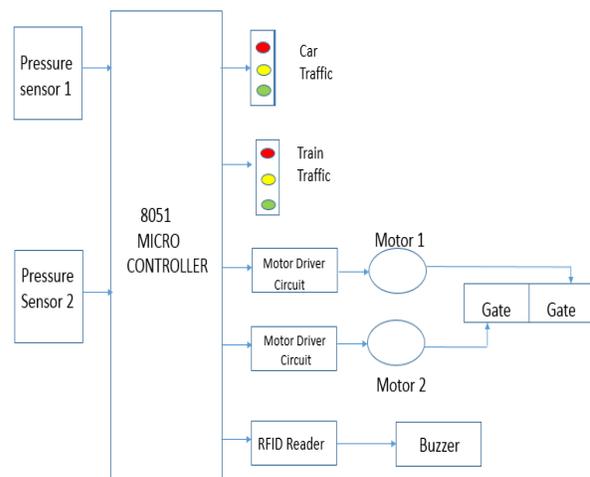


Fig 1: Block Diagram of the proposed system

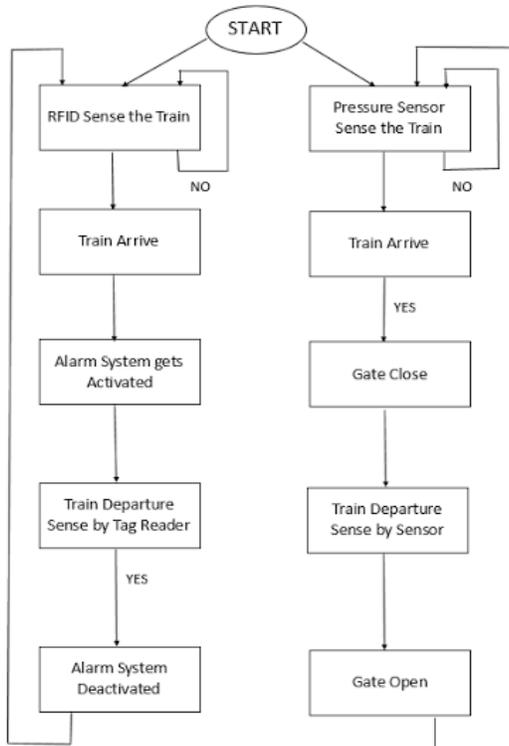


Fig 2: Flow Chart of the proposed system

4. RESULTS AND DISCUSSIONS

The proposed system uses the following components:

- 1) *Microcontroller* - It has built in ROM, RAM, input – output ports, serial port, timer interrupts. It is main control unit to control the process of the system.
- 2) *Pressure Sensor* - This is placed on the both sides of the gate, to sense the arrival and departure of the train.
- 3) *RFID* - RFID system typically consists of a radio-enabled device that communicates with a tag or label, which is embedded with a single chip processor and an antenna. It can read the information on a tag without requiring line of sight or a particular orientation.
- 4) *Servo Motor* - It refers to the error sensing feedback system which is used to correct the performance of the system.

System	Price	Speed	Renability	Accuracy	Weather effect	Design Compl -exity
IR Based	Low	Slow	Less	Low	Yes	Less
Radar Based	High	Fast	Less	High	Yes	High
GPS & GPRS Based	High	Fast	More	High	Yes	High
Video-Analysis Based	High	Fast	Less	High	Yes	High
Inductive loop based	High	Moderate	More	Medium	No	High
Pressure+RFID +Servo motor	High	Fast	More	High	No	Moderate

Table 1: Comparison of various systems on different parameters

Figure 3 shows the actual implementation of the proposed system.



Fig 3: Actual Setup of the proposed system

5. ALGORITHM

Step 1: Start

Step 2: The pressure sensor and RFID reader sense the arrival of the train.

Step 3: If the pressure sensor senses the arrival of the train then step 4, otherwise steps 2.

Step 4: The servo motor is connected to the pressure sensor and the gates are closed.

Step 5: The RFID reader generates an alarming system at the crossing.

Step 6: After the train is passed from the crossing, the gates are opened.

Step 7: If the sensor and the RFID reader sense the train again then repeat from step 2.

6. RESULT

Following results have been obtained from the implementation of the proposed system:

1) *Wide Control Range*-The pressure sensor senses the train and at the same time RFID also senses the train, which gives the information about the train like speed, location etc.

2) *High Reliability*- The proposed system is highly stable as the pressure sensor and RFID tag remain unaffected from the climate and also perform fast operations.

3) *Easy Implementation*-The system is easily implementable, follows simple procedures to perform operations at low operating costs.

4) *Independent Components*- In case of any failure of any of the three components, rest two will work making the system go on as such.

7. CONCLUSION

This paper concludes that the alarm system based on Servo motor, Pressure sensor and RFID improves the reliability of automatic railway gate control system. It also gives the speed and location of the train.

8. FUTURE SCOPE

Since this proposed model suffers from the drawback that it cannot be used for very high speed trains and at the hilly areas where the pressure sensor may not perform correctly, hence future work can concentrate on making it possible work on high speeds too.

REFERENCES

[1] H.Ngwe, Y.Pwint, "Automatic Railway Gate Control System Using Microcontroller," *IJSETR Volume 3, Issue 5, May 2014*.

- [2] F.Maier and A.Bigdeli, "Obstacle-free determination for rail track maintenance vehicles," 11th International Conference on Control Automation Robotics & Vision (ICARCV).IEEE, pp.2172-2178, 2010.
- [3] Y.Lei, H.Xiao, "Research on alarm system of railway crossing based on GPS and GPRS,"IEEE China 2011".
- [4] H.Salmane, "A video – Analysis Based Railway-Road Safety System for Detection Hazard Situation at Level Crossings,"IEEE Transactions on Intelligent Transportation Systems, vol.16, no.2, April 2015.
- [5] J.Xuer, "Visual Monitoring Based Railway Grade Crossing Surveillance System,"Congress on Image and Signal Processing, 2008.

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