Journal of The Gujarat Research Society
ISSN: 0374-8588
Volume 21 Issue 8, August 2019

CONTROLLING AND MONITORING OF AUTOMATIC RAILWAY GATE VIA IOT

Dr. Devaraj Verma
Faculty of Engineering and Technology
Jain (Deemed-to-be University), Ramnagar District, Karnataka – 562112
Email Id- c.devaraj@jainuniversity.ac.in

Abstract

Automatic railway gate and track switching system is used to avoid accidents in railway systems. Because of errors in track change & collision with trains coming from the opposite side of the track, the main causes of accidents are due to unsuitable operation of the railway barrier. To prevent accidents, this paper utilizes IR automated communication systems to automate railway systems. An IR transmitter is attached to one side of the track at the railway gates and coupled with an IR receiver on the other side of the track. At a certain distance, two IR TX-RX pairs are mounted on either side of the railway gate. Switches that is located at an acceptable distance on both sides of the railway gate on the railway track. The MCU can detect the location of the trains by using the IR circuit and switches, and the MCU controls the railway gate control motor. In order to prevent head-to-head collisions, an anti- collision device is also attached to our project. To stop the train and prevent collisions, a laser torch and LDR related technology are used here.

Keywords: *Railway, Track, Gate, Accident, Sensor*

I. INTRODUCTION

A level crossing occurs where a railway line is intersected by a road or path on one level, without recourse to a bridge or tunnel. It is a type of at grade intersection. The term also applies when a light rail line with separate right-of-way in reserved track crosses a road in the same fashion. Other names include railway crossing, railroad crossing, road through railroad, train crossing or grade crossing. Early level crossings had a lagman in a nearby booth who would, on the approach of a train, wave a red flag or lantern to stop alralic and clear the tracks. Manual or electrical closable gates that barricaded the roadway were later introduced. The gates were intended to be a complete barrier against instruction of any road traffic onto the railway. In the early days of the railways much road traffic was horse drawn or included livestock. It was thus necessary to provide a real barrier. Thus, crossing gates, when closed to road traffic, crossed the entire width of the road. When opened to allow road users to cross the line, the gates were swung across the width of the railway, preventing any pedestrians or animals getting onto the line. With the appearance of motor vehicles, this barrier became less effective and the need for a barrier to livestock diminished dramatically. Many countries therefore substituted the gated crossings with weaker but more highly visible barriers and relied upon road users following the associated warning signals to stop.

It is a topic of much contemporary relevance. It proposes a unique and economical method for improving the safety of our level crossings. Road accidents at railway gate are a leading cause of death and injury worldwide. Surveys conducted by Indian Railway found that about 17% of total railway accidents in India is crossing accidents of which majority occurs at passive railway crossings. Railways being the cheapest mode of transportation are preferred over all the other means .When people go through the daily newspapers we come across many railway accidents occurring at unmanned railway crossings. This is mainly due to the carelessness in manual operations or lack of workers[1]. This project has come up with a solution for the same. Using simple electronic components we have tried to automate the control of railway gates. As a train approaches the railway crossing from either side, the sensors placed at a certain distance from the gate detects the approaching train and accordingly controls the operation of the gate. Also an indicator light has been provided to alert the motorists about the approaching train[2].

It is a topic of much contemporary relevance. It proposes a unique and economical method for improving the safety of our level crossings. Road accidents at railway gate are a leading cause of death and injury worldwide. Surveys conducted by Indian Railway found that about 17% of total railway accidents in India is crossing accidents of which majority occurs at passive railway crossings. The operation of railway gates at level crossings is not so reliable nowadays. Primarily the road user has to wait a very long time before the arrival of the train and even after the train is left. And secondly the chances of accidents that is usually made by the carelessness of the road users or due to the time errors made by the gatekeepers is more. Here comes the importance of automatic railway gate control systems. In this project we detect the arrival of the train and warn the road users about the arrival of the train [3].If no obstacle is found a green signal is given for the train to pass, otherwise a red signal is given to slow down. After the obstacles are cleared, the gate is closed and the train is passed .We will make sure that the train is passed and reopen the gate. The system deals with two things. Firstly, it deals with the reduction of time for which the gate is being kept closed. And secondly, provide safety to the road users by reducing the accidents. In the automatic railway gate control system, at the level crossing the arrival of the train is detected by the sensor placed near to the gate. Hence, the time for which it is closed is less compared to the manually operated gates and also reduces the human labor.

Servos are controlled by sending them a pulse of variable width. The control wire is used to send this pulse. The parameters for this pulse are that it has a minimum pulse, a maximum pulse, and a repetition rate. Given the rotation constraints of the servo, neutral is defined to be the position where the servo has exactly the same amount of potential rotation in the clockwise direction as it does in the counterclockwise direction. It is important to note that different servos

will have different constraints on their rotation but they all have a neutral position, and that position is always around 1.5 milliseconds (ms)[4].
The angle is determined by the duration of a pulse that is applied to the control wire. This is called Pulse width Modulation. The servo expects to see a pulse every 20 ms. The length of the pulse will determine how far the motor turns. For example, a 1.5 ms pulse will make the motor turn to the 90 degree position (neutral position).When these servos are commanded to move they will move to the position and hold that position. If an external force pushes against the servo while the servo is holding a position, the servo will resist from moving out of that position. The maximum amount of force the servo can exert is the torque rating of the servo[5]. Servos will not hold their position forever though; the position pulse must be repeated to instruct the servo to stay in position. When a pulse is sent to a servo that is less than 1.5 ms the servo rotates to a position and holds its output shaft some number of degrees counterclockwise from the neutral point. When the pulse is wider than 1.5 ms the opposite occurs. The minimal width and the maximum width of pulse that will command the servo to turn to a valid position are functions of each servo. Different brands, and even different servos of the same brand, will have different maximum and minimums. Generally the minimum pulse will be about 1 ms wide and the maximum pulse will be 2 ms wide[6].
Another parameter that varies from servo to servo is the turn rate. This is the time it takes from the servo to change from one position to another. The worst case turning time is when the servo is holding at the minimum rotation and it is commanded to go to maximum rotation. This can take several seconds on very high torque servos. One of the major advantages of this system is its simple circuit and working principle. The circuit is divided into three parts. First one is the microcontroller section, second is the IR sensor section kept on rail and third is the servo motor which is used to operate the gate. All of them are discussed in detail in the following sections. By employing the automatic railway gate control at the level crossing the arrival of the train is detected by the sensor placed on either side of the gate at about 5 km from the level crossing. Once the arrival is sensed, the sensed signal is sent to the microcontroller and it checks for possible presence of vehicle between the gates, again using sensors. Subsequently, buzzer indication and light signals on either side are provided to the road users indicating the closure of gates. Once, no vehicle is sensed in between the gate the motor is activated and the gates are closed. But, for the worst case if any obstacle is sensed it is indicated to the train driver by signals (RED)[7].
three pairs of IR transmitter & receiver, an MCU, relay circuit, gate control motor, track changing system and an anti-collision system. Two IR TX-RX pairs are used for the working of railway gates. Both pairs are mounted at a fixed distance which is away from the gate at each direction. Transmitter and receiver are placed face to face across the rail. IR receiver gets IR signal emitted from the IR transmitter continuously. If the train crosses through the radiation path, then the IR receiver at the end will not get any signal, output of IR is connected to MCU, at same time MCU controls the circuit of relay to close the railway gate. Gate control motor is connected to the MCU through a relay & a relay driver circuit. Energizing of the relay causes the gate motor to close the railway gate. Same time MCU provides RED signals to the vehicles

on the road and GREEN signals to the train. The train passes through the gate and then it reaches the second IR TX-RX pair, at the time the second IR receiver should not get a signal, indicating the passage of the train. Then MCU de-energizes the relay to make the gate open position. And provide GREEN signal to road and RED signal to train[8].

The third IR transmitter receiver pair is placed nearer to the station to find out the arrival of another train towards the station. If it is detected MCU controls the track changing servo to choose the other track. To avoid the head to head collision of trains, an anti-collision system is used with the trains. Which discloses a laser light emitting torch, an LDR & a transistor based switching circuit. LASER & LDR are mounted on the front side of the train without direct contact with each other. The LDR can sense the laser beam emitted from the opposite side train arriving on the same track. If LDR detects the LASER beam, the transistor based switching in this proposed system stops the motor of the train[9].

II. CONCLUSION & DISCUSSION

The proposed system has many advantages, it will reduce the accidents occurring at the railway crossing, by removing manual operations it will increase the accuracy & reduce errors. It will reduce the collision of trains & also manage the route of a particular train to avoid any delay in reaching its destination. Trains will always be on time at the station no delay will be caused which occurs in manual operation. Security can be implemented by placing a tracker in the train in order to monitor the location of the train in case of any issue. Solar panels can be used to generate power for the system thereby increasing the efficiency of the system.

III. REFERENCES

[1] E. G. C. Crawford and R. L. Kift, "Keeping track of railway safety and the mechanisms for risk," Safety Science, vol. 110, no. July, pp. 195–205, 2018, doi: 10.1016/j.ssci.2018.07.004.

[2] L. G., C. Singh, and N. Jha, "Automatic Railway System," International Journal of Computer Applications, vol. 159, no. 8, pp. 30–33, 2017, doi: 10.5120/ijca2017913018.

[3] A. Sherwade, A. Pawar, B. Ghadge, and D. Srivastava, "Automatic Railway Gate Control & Power," vol. 4, no. 4, pp. 1937–1944, 2016.

[4] M. Danish, P. K. Singh, M. Shekhar, and M. K. S.U, "Automatic Gate with Track Switching," Ijarcce, vol. 6, no. 5, pp. 545–549, 2017, doi: 10.17148/ijarcce.2017.65105.

[5] M. R. S. Azim, K. Mahmud, and C. K. Das, "Automatic Train Track Switching System with Computerized Control from the Central Monitoring Unit," International Journal of u- and e-Service, Science and Technology, vol. 7, no. 1, pp. 201–212, 2014, doi: 10.14257/ijunesst.2014.7.1.18.

[6] H. Balani, C. Gupta, and K. Sukhwal, "Advanced safety applications for railway crossing 1," no. 12, pp. 49–53, 2015.

[7] S. Mahmud, I. Reza Emon, and M. M. Billah, "Automated Railway Gate Controlling System," International Journal of Computer Trends and Technology, vol. 27, no. 1, pp. 1–5, 2015, doi: 10.14445/22312803/ijctt-v27p101.

[8] A. Satish and D. Palanisamy, "Intelligent System for Automatic Railway Gate," no. August, pp. 24–30, 2017.
[9] R. Kushwaha and B. B. Chaubey, "Automatic Railway Gate Control System," International Journal Of Engineering And Computer Science, pp. 7619–7622, 2016, doi: 10.18535/ijecs/v5i5.45.