ISSN 2278-9723
DOI:10.31838/ijccts/09.02.05

Research Article

Automatic Railway Gate Controller

MURALI KRISHNA [1], PATHAN ROSHINI[2], TANNEERU VENKATA DURGA MADHURI[3], PULI NAVYA[4], TANNERU MEGHANA[5].

[1]Department of Electronics and Communication Engineering, Assistant Professor, KKR& KSR Institute of Technology and Sciences, Guntur

[2,3,4,5]Department of Electronics and Communication Engineering, UG student KKR& KSR Institute of Technology and Sciences, Guntur

Email:muralikondaveeti1@gmail.com[1],roshinipathan@gmail.com[2],tmadhuri5555@gmail.com[3], pulinavya777@gmail.com[4],meghanatanneru1999@gmail.com[5].

Received: 08.07.21, Revised: 11.08.21, Accepted: 06.09.21

ABSTRACT

The present work attempts to automate the opening and closing of gates at a railway level crossing. In general, level crossing gates are operated manually by a gate keeper. The gate keeper receives the information about the train arrival from a near station. When the train starts to leave the station, the station in-charge delivers this information to the closest gatekeeper to get ready. This human intervention can be avoided by automating the process. In situations where the train is late due to some reason, the gates remain closed for long duration's causing dense traffic jam near the gates. This too can be prevented by automation. The proposed system uses infrared sensors to detect the arrival and departure of trains at the railway level crossing and Arduino to control the opening/closing of gates. The system uses two IR sensors to detect the arrival of the train and a third IR sensor to detect the departure of the train. When the arrival of the train is sensed, signals are provided to the traffic indicating the arrival of the train on the track. When the second sensor detects the train then the signal turns red and the motor operates to close the gate. The gate remains closed until the train completely moves away from the level cross. When the departure of the train is detected by the third sensor, the traffic signal turns green and the motor operates to open the gate. Thus automation of the gate operations at the railway level cross is achieved using sensors

Keywords: Automatic, IR sensors, Motor

I. Introduction

Railways being one of the safest and cheapest modes of transportation are preferred over all the other means of transport. So, it is essential to maintain and improve the current level of safety. A safe railway is more efficient and also a more attractive transport choice, enabling society to address the environmental and economic challenges of the 21st century. Railway safety is a crucial aspect of rail operation over the world. When we go through newspapers, we come across many railway accidents occurring at different railway level crossings and many people are dying. The place where rail track and highway/road intersects each other at the same level is known as "level crossing". Bangladesh Railway said at least 201 people were killed and 349 others injured in 264 accidents at different level crossings in last seven years till 2013[1]. This is mainly due to the carelessness in manual operations or lack of workers at level crossing. There is an inherent unreliability in the present manual system.

Automatic railway gate control system is an arrangement of physical components which sense the arrival of the train and make the gate pull up and pull down automatically. As a train approaches at the railway crossing from either side, the sensors placed at a certain distance from the gate detect the approaching train and accordingly controls the operation of the gate. To avoid the accidents, sensors placed at some distance from the gate detect the departure of the train. The signal about the departure is sent to the micro-controller, which in turn operates the motor and opens the gate. Thus, the time for which the gate is closed is less compared to the manually operated gates since the gate is closed depending upon the telephone call from the previous station. Also reliability is high, as it is not subjected to manual errors. For the railway, research on automatic gate controller systems has traditionally focused on two main areas: information transmission and gate controlling. Problems related to information transmission concern train detection and fast transmission of this information to the control unit. Problems those are related to the gate controlling very sophisticated and challenging. They comprise presence of train, immediate closing and opening of gates. The existing solutions have many complexities and require research for supporting railway.

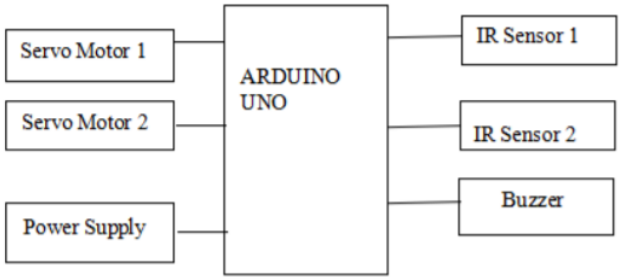
- This circuit can be used in railways near railway gate.
- This can be also used in safe rooms in banks and in car parking areas.
- This can be used in security areas like military and in own apartments.
- Also used in toll gates.

II. Proposed Method

Our Proposed System is a practically working system. Our idea is very simple and effective. The idea is to close the railway level crossing gates automatically and to open them automatically, during the time of train's arrival and departure respectively. Automated concept is to reduce the number of accidents with less manpower. In our system, we are placing IR sensors near the railway tracks. IR sensors are used in this system, because it has a very high range of 4 meters (which is better than other sensors). At a certain distance before the level crossing and after the level crossing, these IR sensors are placed. The reason for sensor placement is to sense, both the train's arrival and departure correctly and effectively. As soon as the train reaches the 1st sensor which is been placed before the level crossing, senses or detects the train, it sends a message to the Arduino connected, and then the buzzer will be turned on automatically so that the road users will be able to know that the train is nearer to the crossing and they can wait till the train passes by. As soon as the buzzer sound starts, the servo motor connected with the level crossing gates will close them automatically. The reason to use servo motor in our system is that it is working is based on Angular Rotation which means that at first the gates will be at 90° which is open, at then during the time of train's arrival the gates will be at 0° (closed), and after the train passes by it will return its original position which is 90° (opened). The proper working of the level crossing gates are because of the attached servo motor (with angular rotation). In case if we have used other motors there would have been a problem in opening and closing of gates because they lack angular rotation. This servo motor helps the gates to come back to normal position (90°) from closed position (0°) instead of going into the ground (270°). As soon as the train passes the second sensor, placed at a certain distance after the level crossing gates, buzzer sound will be turned off itself and the gates will open automatically, and then the road users can use the level crossing road safely. The second IR sensor is placed a little far, comparatively higher distance than the distance between 1st IR sensor and the level crossing gates (because of the train's length).

This whole design is connected with the Arduino Uno At mega 328p, which has a code uploaded in it before the whole process. Code is the main key to work the whole system. Though the idea and working of our system is simple, its usage will be more 11 effective. It will definitely reduce the railway level crossing accidents and will ensure people's.

- Prevention of accidents inside the gate.
- Reliable machine, which operates the railway gate even without gate keeper which makes it useful for operation at unmanned crossings.
- Power supply at the motor operation and signal light is required.
- Battery which is charged by means of a solar cell can be used in remote areas where the power supply can't be expected.
- High performance.
- Time delay due to manual work.
- Easy to use.



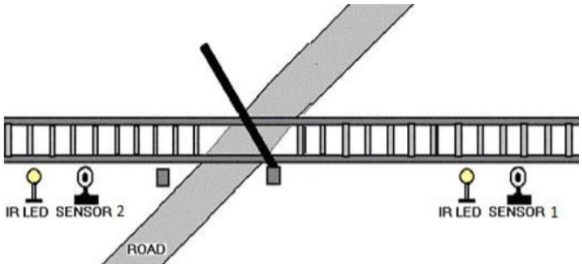
III Working Method

When we turn ON the circuit there is no IR radiation towards photo-diode and the Output of the comparator is LOW. When we take some object (not black) in front of IR pair, then IR emitted by IR LED is reflected by the object and absorbed by the photo-diode. Now when reflected IR Falls on Photo-diode, the voltage across photo-diode drops, and the voltage across series resistor R2 increases. When the voltage at Resistor R2 (which is connected to the non-inverting end of comparator) gets higher than the voltage at inverting end, then the output becomes HIGH and LED turns ON. Voltage at inverting end, which is also called Threshold Voltage,

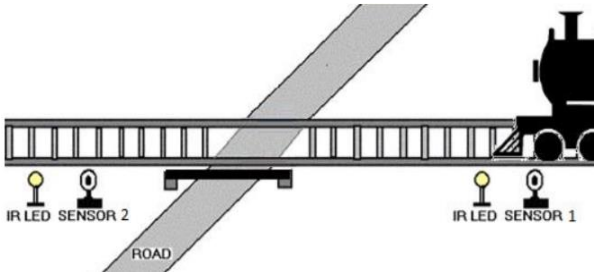
can be set by rotating the variable resistor's knob. Higher the voltage at inverting end (-), less sensitive the sensor and Lower the voltage at inverting end (-), more sensitive the sensor.

The working of the project is very simple and is explained here:

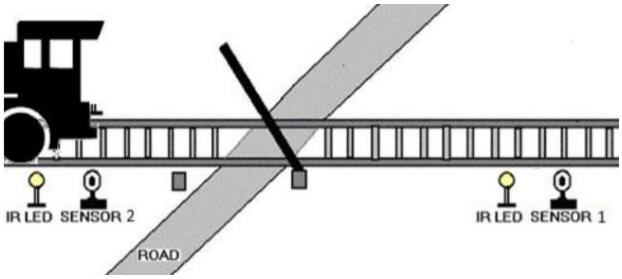
- Practically, the two IR sensors are placed at left and right side of the railway gate. The distance between the two IR sensors is dependent on the length of the train. In general we have to consider the longest train in that route.



- Now we'll see how this circuit actually works in real time. In this image, we can see the real time representation of this project.
- If the sensor 1 detects the arrival of the train, micro-controller starts the motor with the help of motor driver in order to close the gate.



- The gate remains closed as the train passes the crossing.
- When the train crosses the gate and reaches second sensor, it detects the train and the micro-controller will open the gate.



IV Result

By employing the automatic railway gate control at the level crossing the arrival of train is detected by the sensors placed near to the gate. Hence the time for which it is closed is less compared to the manually operated gates. The operation is automatic. Error due to manual operation is prevented.

- Sensor senses the vibration of train 3-5km away.
- Output given to the Arduino micro controller.
- Arduino controller gives instruction to close the gate.
- Gate is closed automatically using stepper motor.
- Gate is opened only after the train passes.

Conclusion

Automatic railway gate control system is centred on the idea of reducing human involvement for closing and opening the railway gate which allows and prevents cars and humans from crossing railway tracks. The railway gate is a cause of many deaths and accidents. Hence, automating the gate can bring about a ring of surety to controlling the gates. Human may make errors or mistakes so automating this process will reduce the chances of gate failures. Automation of the closing and opening of the railway gate using the switch circuit reduces the accidents to

a greater extend. The obstacle detection system implemented reduces the accidents which are usually caused when the railway line passes through the forest. Most of the times greater loss has been caused when animals cross the tracks.

The limitation of this project is the use of IR sensors. Hence, any obstacle in the way of the sensor will be detected. Another important limitation is that this project does indeed close and open the gate but it cannot control the crossing of cars and vehicles. It only controls the gate. To combat this problem pressure sensors can be used as extension to the present work. We are using IR sensors but it is better to use load sensors. We have not used load sensors because it was not economically feasible. As a future scope of work, our system can be implemented in real time by fixing the current limitations using new technologies.

Future Scope

The accidents due to railway level crossing and the obstacle can be avoided in real time by implementing this system and the whole process is completely automatic. In future the features like wireless system can be implemented in the real time operation. In real time operation vibration sensors can be used in place of IR sensors for the detection of arrival and departure of train. So the vibration sensor serves better when compared to the IR sensors for the real time.

And also the GPS system can be implemented and interfaced with the circuitry. GPS system ensures that the correct location of the obstacle can be sent to the nearby railway station through GSM modem. This helps to get the exact location of the obstacle so that the work for the clearance of obstacle can be done faster.

References

1. Pradeep Raj, “Increasing accidents in the unmanned level crossing of the railways”, 2012. (Introduction)
2. Xishi Wang, Ning Bin, and Cheng Yinhang, “A new microprocessor based approach to an automatic control system.”, International Symposium on Industrial Electronics, pp. 842-843, 1992. (Proposed solution)
3. Jeong Y., Choon-Sung Nam, Hee-Jin Jeong, and Dong Shin, “Train Auto Control System based on OSGi”, International Conference on Advanced Communication Technology, pp.276-279, 2008.
4. Atul Kumar Dewangan, Meenu Gupta, and Pratibha Patel, “Automation of Railway Gate Control Using Micro-controller, International Journal of Engineering Research & Technology, pp.1-8, 2012.
5. http://www.ti.com/lit/ds/symlink/l293d.pdf
6. Gunyoung Kim, Kyungwoo Kang, “Railway Gate Control System at Railroad- Highway Grade Crossing in Korea”.
7. http://www.indianrailways.gov.in/railwayboard /view section.jsp?lang=0&id=0,1
8. http://www.indianrailways.gov.in/railwayboard /uploads/directorate/stat econ/pdf/YEAR BOOK ENG
9. http://engineersprojects.blogspot.com
10. Siti Zaharah, Transit District Advance Automated Train Detector System Case Study Description, pp: 115-135.
11. Ahmed Salih Mahdi, Al-Zuhairi, Automatic Railway Gate andCrossing Control based Sensors &Microcontroller”, Interna-tional Journal of Computer Trends and Technology (IJCTT),Volume 4, Issue 7, July 2013
12. Krishna, ShashiYadav and Nidhi, Automatic Railway GateControl Using Microcontroller, Oriental Journal Of ComputerScience & Technology, Vol.6, No.4, December 2013.
13. J. Banuchandar, V. Kaliraj, P. Balasubramanian, S. Deepa,N. Thamilarasi, Automated Unmanned Railway Level Cross-ing System, in International Journal of Modern EngineeringResearch (IJMER) Volume.2, Issue.1, Jan-Feb 2012 pp-4584