International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 11 | November - 2022 Impact Factor: 7.185 ISSN: 2582-3930

Automatic Railway Gate Control System using Raspberry Pi

Prof S.V Phulari, Adesh Giri, Rutuja Jadhav, Nikhil Shinde, Chinmay Gonde

Department of Computer Engineering, PDEA's College of Engineering Manjari, Pune, India.

Abstract— **The work presented in this paper attempts to automate the opening and closing of gates at a railway level crossing. Normally, level crossing railway gates are operated by a gatekeeper manually based on the information received from railway station. In situations where the train is late, the gates remain closed for durations casing dense traffic jams near the gates. This human intervention can be avoided by automating the process which also minimizes the risk factor of accident at level crossing due to lack of human attention. The proposed system uses infra red sensors to detect the arrival and departure of train at the railway level crossing and the Raspberry Pi module is incorporated to control the opening and closing of the gate with the help of servo motor. When the arrival of train is sensed by first sensor, signal turns red and the motor operates to close the gates. The gates remain closed until the train us completely moves away from the railway gate. When this situation of departure of train is detected by the second sensor, the traffic light turns green and motor operates to open the gates. Thus, the automation of the railway gate is achieved using sensors and raspberry pi.**

1. INTRODUCTION

The railway system is most widely used mode of public transportation in India which makes the railway safety a crucial aspect for its operation. It is a one of those modes of transport that has to face lots of challenges due to human errors such as level cross accidents. A level cross is an intersection of a road and a railway line which requires a continuous human coordination and monitoring, the lack of which may results in accidents at this junction. The traffic at the level crosses is controlled by manually operated gates which are normally done by gatekeeper. In order to avoid the error caused by human interventions, the proposed work in the paper introduces a concept of automatic opening and closing of railway gates at the level crossings. Level crossings are monitored and managed by the gatekeeper and the usually gatekeeper is instructed by means of telephone from the control room. But the chances of manual error that could occur at this level are high since it requires the detailed and actual knowledge of train time table and train running status. The delay in opening and closing of gate could lead to severe railway accidents. The accident at the railway crossing is one of the major challenges faced by the Indian railways for which the lots of ideas and efforts have been employed to overcome this major issue.

The work presented in this paper attempts to develop a system which automates the gate operations i.e. opening and closing at the railway crossing using Raspberry Pi. The existing system involves the manual operation by the gate keepers which mainly depends upon the information received from control room. The human errors such as delay in informing the gatekeeper about arrival of the arrival of the train, delay in gate operation by gate keeper, obstacles stuck in the level cross etc. leads to increasing rate of accidents at the level cross. Thus the railway automation system aims to deal mainly with reduction in total time taken for gate operation at the level cross and ensuring the safety of passengers at the level cross when the train passes. The reduction in direct human intervention such as communication from control room, during railway gate operation in turn helps to reduce the human errors. Due to which there is possibility of information loss in the commutation between gatekeeper and the control room is reduced. Since the gate operation is based on Infrared (IR)

Sensor, the time for operation of railway gates is reduces which also includes the time for which the gates will remain closed. This ensures that the routine traffic must be held for least amount of time at the railway crossing. The paper intends to develop an automatic railway gate control system which is reliable and secured than the existing manual systems. The paper is organized as follows. Chapter II gives information about the related work which is previously carried out. Chapter III deals with the system overview and its requirements. Chapter IV describes the system architecture, block diagram, circuit diagram and the hardware requirements. Chapter no. V discuses about the result of experiments carried on the basis of proposed system as stated earlier in chapter no. IV. Finally, the conclusion and future scope about the system described in the paper is mentioned in chapter VI

2. SCHEMATIC DIAGRAM

3. DESCRIPTION

A) WORKING METHODOLOGY:

In this paper we are concerned of providing an automatic railway gate control at unmanned level crossings replacing the gates operated by gate keepers and also the semi-automatically operated gates. It deals with two things. Firstly, it deals with the reduction of time for which the gate is being kept closed. And secondly, to provide safety to the road users by reducing the accidents that usually occur due to carelessness of road users and at times errors made by the gatekeepers. By employing the automatic railway gate control at the level crossing the arrival of train is detected by the sensor placed on either side of the gate at about 5km 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) placed at about 2km and 180m, so as to bring it to halt well before the level crossing. When no obstacle is sensed GREEN light is indicated, and the train is to free to move. The departure of the train is detected by sensors placed at about 1km from the gate. The signal about the departure is sent to the microcontroller, 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 tomanual errors.

B) GATE CONTROL:

Railways being the cheapest mode of transportation are preferred over all the other means .When we 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. We, in this project have 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.

C) INFRARED CIRCUITS:

IR CIRCUITS: This circuit has two stages: a transmitter unit and a receiver unit. The transmitter unit consists of an infrared LED and its associated circuitry.
IR TRANSMITTER: The IR LED emitting infrared light is put on in the transmitting unit. To generate IR signal, LM358 IC based operational amplifier isused.
IR RECEIVER: The receiver unit consists of a sensor and its associated circuitry. In receiver section, the first part is a sensor, which detects IR pulses transmitted by IR-LED.

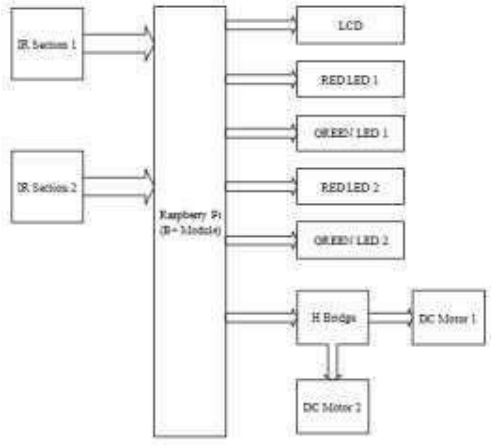
D) STEPPER MOTOR:

Stepper motors convert electrical energy into precise mechanical motion. These motors rotate a specific incremental distance per each step. Thenumber of steps executed controls
the degree of rotation of the motor's shaft. This characteristic makes step motors excellent for positioning applications. For example, a 1.8° step motor executing 100 steps will rotate exactly 180° with some small amount of non-cumulative error.

The speed of step execution controls the rate of motor rotation. A 1.8° step motor executing steps at a speed of 200 steps per second will rotate at exactly 1 revolution per second.
Stepper motors can be very accurately controlled in terms of how far and how fast they will rotate. The number of steps the motor executes is equal to the number of pulse commands it is given. A step motor will rotate a distance and at a rate that is proportional to the number and frequency of its pulse commands.

4. SYSTEM ARCHITECTURE

The system comprises of two IR transmitter and receiver pairs i.e. IR section, Raspberry Pi module, LCD, assembly of LED and servo motor section. This system uses regulated 5V, 1A power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer. The block diagram for system is shown below



5. Fig 2: Block diagram of proposed system

One of the IR section is located at one end of railway gate. The second pair is located at another end of railway gate. In each pair, the transmitter and receiver are arranged face to face across the railway tracks in such away that transmitter is placed on one side of the track and receiver will be there on another side of the track facing towards the transmitter. The receiver should get the signal from the transmitter. The detailed flow is described in flow diagram. Whenever any train is arriving on the track, the IR signal at sensor 1 gets disturbed due to interruption of train. Thus, the Raspberry Pi identifies the arrival of train and before closing the gates issues a siren to alert the people who are on track. After 30 seconds, Raspberry pi issues a command to close the gates by rotating servo motor. When the train is completely passed, it is to be sensed by the second IR sensor which is located the second end of railway gate based upon which the gates will get opened. The second IR sensor identifies train since IR signal gets disturbed when it comes in between transmitter and receiver. Now, the Raspberry Pi will now wait till train gets completely passed which is notified when receiver again gets IR signals. Till this time gate is completely closed, once train left, Raspberry Pi issues command to open gates by rotating servo motor in opposite direction. For a programming a Raspberry Pi module, the official programming language is Python.

6. CONCLUSION

Automatic railway gate control system is centered on the idea of reducing human involvement for closing and opening the railway gate which allows and prevents accidents near level crossing. 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 and reduces the errors made by gate keepers. The accidents are avoided at place where there is no person to manage the railway crossing gates. Here we use the servo motor to open and close the gates automatically when it rotates clockwise or anticlockwise direction tooperate the gate automatically.

In the obstacle detection part the ultrasonic sensor sensed the obstacle and the train stops as soon as the obstacle detection message is conveyed to the nearby railway station as well as for the train operator. So through this system any obstacle on track can be detected and accident can be avoided and also the message as been conveyed to the concerned.

7. ACKNOWLEDGEMENT

We take this opportunity to thank the teachers and senior authorities whose constant encouragement made it possible for us to take up a challenge of doing this project. We express our deepest sense of gratitude towards our Hon'ble Head of department
DR. R. V.PATIL for giving permission to use the college resources and his constant encouragement for this work.

We are grateful to Prof. S.V. PHULARI for his technical support, valuable guidance, encouragement and consistent help without which it would have been difficult for us to complete this project work. He is a constant source of information to us. We consider ourselves fortunate to work under the guidance of such an eminent personality.

Last but not the least; we are thankful to our entire staff of Computer Department for their timely help and guidance at various stages of the progress of the project work.

8. REFERENCES

[1]. R.Gopinathan and B.Sivashankar, "PLC based railway level crossing gate control", International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE). ISSN: 0976- 1353 Volume 8 Issue 1 –April 2014.

[2]. Pradeep Raj, "Increasing accidents in the unmanned level crossing of the railways", 2012.

[3]. Xishi Wang, Ning Bin, and Cheng Yinhang, "A new microprocessor based approach to an automatic control system." InternationalSymposium on Industrial Electronics, pp. 842-843, 1992.

[4]. 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.

[5]. KSCSE, KSCSE library: "Railway track monitoring system", project report.

[6]. Sangita N.Guja, Jagruti R.Panchal, Lalita K.Wani, "Improving safety with obstacle detection and track following car using sensor, GPS and GSM", International Journal of Research in Engineering and Technology.

[7]. www.arduino.cc/reference