Smart Railway Gate System using IOT

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Abstract—The automation of Railway gates at intersections crossing is very important to avoid accidents near it. At present, railway crossing gates are operated manually by gate operator. When a train leaves the station, the in-charge person of the station sends the signal/information to the gate operator about the departure and arrival of the train. The involvement of human is avoided by automating the process. If train’s arrival is delayed by any reasons, the care is taken that gates are not opened for long period of time due to this it leads to the traffic jam and also wastage of time. The system uses two Infrared (IR) sensors in order to sense the arrival and going movement of the railway engine. Train’s advent when detected, signal in the form of sound and warning light signal indication is given to the commuters to warn about advent of train towards me. Sensor I sense the advent of the train the warning is given in the form of red color light and the driving agent attached to the gate will start to shut the opened gate. In order to control the gate motor has been used. The gates are made to shut unless and until the train passes completely moves away from railway gate. The motor helps in lifting and shutting the gate based on coming going of the train which is done with the help of sensors. Sensors will play a vital role in automating the things along with the help of motor and arduino as a controller, raspberry.

Keywords—Automation; IR Sensor; Obstacle detection; Railway gate; Sensor formatting;

I. INTRODUCTION

Railways are one of the most common used modes of transportation in India. Error free railway operations are very rare these days due the human negligence and miscommunications which leads to accidents and delay in advent of the train; the path or the area where roadway and rail lines meet is known railway cross. A gate is placed for controlling the movement of the vehicles which requires human effort and coordination, mistiming in this leads to accidents. Gates are manually operated, errors which may give rise while closing and opening, the technique suggested here paper introduces a whole new way of automating the things. These are usually handled by a concerned person and he/she will be communicated by some way of communication from station’s controlling department. Percentages of incorrectness are high at Railway crosses are at the peak because of the human errors and also due to the lack of the knowledge of train timings. If detainment happens in lifting and shutting gate and irresponsibility may cause big disaster. Current proposed work here tries to develop a mechanism which does the automation of gate operations (opening and closing) using Arduino, Raspberry Pi, IR sensor and using Motor for closing and opening of a gate.

Some of the challenges faced by the Railway Department with regard to this is the increase in percentage of accidents near crossing. Present mechanism consists of human operations which happen based on communication messages got from the Railway station. Mistakes in sending the information/signal to the gate operator regarding train’s arrival, some delay or problem with respect to the closing and opening of the gate or regarding anything which might have got between the tracks which in turn cause the mishap near the crossing. Our system helps in dealing with some issues i.e. Lessens the overall waiting duration spent by people near crossing and it guarantees protection of the humans near crossing during the passing of the train when near crossing. As the human involvement is present in operation of gate which will be reduced which reduces probability
of mishap and colliding of trains coming at the same time from opposite direction near crossing. Sensors play a major role in automating the process of gate lifting and closing. This paper shows an automated Smart way of controlling the gates at crossing which provides reliability, security when compared to current system.

II. RELATED WORK

Some of the previous systems related to the railway gate automation are found in [1–4]. The automation of gate was first tried in Korea. This System was efficient in reduction of mishap level near crossing. Magnetic sensors played an important role in the Korea’s automations of crossing gates. Sensors which were deployed under the ground were unaffected by the changes caused in environment and they help in recognizing vehicular direction. In [4] current Railway’s Technology is tried to introduce here and discussed about the disadvantages of manual system. The train’s detectors here sensors play a prominent component in automating the system and also cost effective.

III. SYSTEM OVERVIEW

Lifting and shutting of bars located at crossing works on sensors. The structure of the system comprises of sensors which detects advent and going of train in order to operate gate using Infra-Red Sensors. Suggested structure of system consists of two IR sensors. One for identification of arrival and another for departure of train. Arduino and Raspberry Pi-3 are used for controlling the system as well as it in turn sends the arrival and departure of the train i.e. its data to the cloud. System built here consists of the sound and signal alert which help in the warning the people near the railway crossing. IR Sensors and DC motor are controlled by the Arduino and Raspberry Pi collectively. The motors are controlled by the L298 motor driver shown in figure 3 which helps in the speed and angle of rotation of the gate.

The major components are used in the Automating the Railway Gate are sensors. A sensor is the one which detects the objects which are near. Here we have used IR sensor, L298 Motor Driver for controlling the motors which help in controlling the operation of the lifting and shutting up bar of gate.

3.1 IR sensor, IR sensors used here help in detecting the train using infrared receiver and transmitter. Infrared sensors have potential in noticing an object based on the thermal or heat radiations which it senses which was emitted from the object. It detects the radiations emitted by the object to detect its presence in the surrounding. IR sensor is one of the widely used components for object detection.

3.2 L298 Motor Driver, L298 motor driver is a motor driver or a controller which help in coordinating, controlling and helps in giving specific angle of rotation to the Motor. This is one of the core important part of Smart Railway Gate System. This helps in controlling the gate’s motion.
which is coordinated with IR Sensor which detects the presence of train based on the output of the IR sensor the motor is controlled whether to open the gate or to close the gate. This finally helps in automating the gates.

3.3 DC Motor, Here the 12V DC motor has been used but the Motor can be varied based on the gate length and its weight. Motor is controlled using the Motor Driver which in turn is coordinated by IR Sensors.

3.4 Thing speak Cloud, For the better analysis of the system, the system is monitored using Cloud i.e. Thing speak cloud, the cloud is an open IoT platform with analytics which lets to store and collect sensor data. Each advent and departure of railway is stored in cloud. Graph shown below gives analysis of the trains arrival and departure at one particular railway crossing gate. In graph 1 indicates that train has been departed and 2 indicate train has arrived. Based on this the frequency of arrival and departure of the train at a particular station will give the railway department information regarding the level of security need to undertake at that particular point.

The analysis helps in analyzing the severity of the actions to be undertaken at the railway level crossing. Live analysis can be seen so that to take effective measures immediately. This is how analysis of the data helps in further improvement of the system. Analysis is not restricted to this itself; based on the need, the system can always customized to required settings and analysis can be done.

3.5 Raspberry Pi, It is used as a server for collecting the data and sending the same to the Thingspeak cloud storage. Raspberry Pi here acts a server and also the controller of the all Sensors, Motors, LEDs and Buzzers. Once configured properly the Raspberry Pi coordinates all the devices smoothly without any problems.
Static IP assignment to Raspberry Pi is done so as to control system remotely. This is one of the major advantages of the system as it can be controlled, monitored and examined from sitting at one place. Customization in the controls can be as per the need as the Raspberry Pi enabled system provides various mechanism to do the task.

IV. SYSTEM ARCHITECTURE

Based on the Indian Railway Speed and optimal gap where detectors can be kept in order to check the presence of train distance around 5km is chosen away from railway gate and when train when it departs that distance is chosen as 1km [1]. Here we discuss a mechanism which comprises of two Infra-Red Sensors Detectors (IR1 and IR2), LED light which acts as a Warning Signal indication and one Buzzer which acts as an alarm which gives us warning alert to people near the railway crossing which are all controlled by the Raspberry Pi. In real world scenario, the IR Sensors should be kept beside the railway line near the crossing; safe gap of 4-5km and 0.5-1km apart on either part Railway crossing. The put forth system consists of DC motors which help in controlling the operation pertaining to the crossing gates. As an extended security option sound notification from buzzer is given when train comes and goes near crossing for a certain amount time.

![Fig. 4. Block Diagram representing Smart Railway Gate](image)

The overall flow of system is depicted as shown above. Figure shows the components involved in system. IR1 sensor detects the arrival of a train. After detecting the train, it sends a signal to the motor such that gate is made to close and the LED and Buzzer also become active so that people can be intimated regarding advent of railway. When engine comes near Infra-Red 2 sensor, it sends signal and makes motor to get powered on, motor gets started and the gates connected to that motor will close and simultaneously red LEDs are switched on. The system is built using the IR sensors which are interconnected with Motor which is used in opening and closing of gates. IR Sensor1 is placed at a safe distance away from the railway crossing gate which senses coming of train which in turn activates motor which closes the gate and IR Sensor2 detects the departure of train which is also placed near some safe gap from gate which would be decided initially, when triggered activates the motor to open the gate indicating departure of the train. This process happens much number of times a day. People near the railway crossing gate are notified about coming and going of the train by the sound that is produced by the buzzer and also the light signal is indicated simultaneously as a safety measure. The components are interconnected as shown in the figure 4, all the components of system are connected to Arduino which in turn are connected to Raspberry pi which is connected to cloud. Information about arrival and departure of train is obtained in thing speak cloud which can use for the analysis purpose and improving security measures. The data obtained from the cloud can serve for the records as well as for other purpose like the daily arrival and departure of train and also the traffic intensity at that railway crossing point.

V. LIFTING AND SHUTTING OF GATE
Figure 5 tells about flow of the opening and shutting of gate. When train is sensed near crossing gate which makes to close the gate. Next immediate work is to sense the going of railway train from crossing. IR2 sensor senses the going of train which makes motor to get in to action so make gate open. DC motor is initially configured and controlled using L298 Motor Driver to operate with the specific speed and specific angle of rotation. Figure below depicts the flow of operation of gate concerning the various other components attached and connected.

VI. RESULT
The put forth system has been experimented taking practical conditions happening in real world which behaves as a prototype of Railway level cross. Vital devices consists of a model toy train track set shown in Model consists of toy train which acts as a railway engine cum train, two Infra-Red sensors, DC motor which helps in gate operation, a motor driver in order to control angle of rotation and speed of rotation, LEDs along with buzzer jointly coordinate to tell about the advent of train to people as a warning sound. All the components are controlled by the Arduino which in turn is connected to Raspberry Pi which acts as a central coordinator for the all the devices and it also sends the data received to the cloud for the future analysis and live monitoring as depicted as shown in figure 4.

6.1 Railway Crossing Gate Operation, An Infra-Red sensor is kept at one end of railway line and other one at near the crossing. When train moves near first sensor which is sensed by the sensor, which gives signal from a yellow color LED near crossing telling the people at the railway crossing that the gate will be closed. Another sensor kept at a certain gap from crossing which senses engine and activates the buzzer which in turn makes motor to completely close gate and makes signal to turns red. The buzzer makes signal till the train moves away from sensor which is kept at the other end.

VII. CONCLUSION AND FUTURE SCOPE
Automation of the railway gate control system is implemented in order to reduce interaction of
lifting and shutting the crossing gate which allows and avoids vehicles and people from passing the crossing. Rail crossing has been the root cause for of mishap and many fatal issues. Automation of the crossing gates makes easy and secure to control the gates. Humans may make incorrect or mishaps which may be very dangerous, automation of whole thing will shorten possibilities of the mishaps and incorrectness. Automation of the lifting and shutting of the railway crossing gate with the usage of Arduino using sensor and using motors will help in controlling the gates. This can be implemented in the remote area where it is difficult for humans to work in like in the places of extreme weather. As everything in this world has a limitation our put forth system poses some limitations which usage of Infra-Red sensors are. Irrespective of train or any other object in its coverage area it will detect as an object is detected which is inaccurate. Second limitation happens to be while lifting and shutting of crossing gate but this fails in avoiding the movements of the vehicles trespassing. We only control crossing gate here. In order to resolve this issue, we take help of pressure that acts as an add on to the put forth work. Along with Infra-Red sensors it would be good to use load sensors. Here the load sensor usage is limited as it is not economically feasible for small area but when implemented in a larger extent this will provide a huge impact. Future implementation can be made by resolving the current issues using the above said suggestions and incorporating them in the system.

REFERENCES
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