Android Based Controller for Railway Gate Crossing

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Abstract: The system is designed for the control over the railway level gate crossing. It takes place through an Android Application. The operation includes the opening and closing of the crossing gate. It involves manpower which may be lead to accidents at the crossing gate. The proposed system erases the involvement of humans which are normally placed at level crossing. It involves operation of opening and closing of gate through android.

The operation is controlled by an Android Smart phone or a tablet. When the train is nearby the level crossing the command of closing the level crossing gate is given from the android device. This command will be given to the microcontroller, which gives output signal to the motor and it is switched on to close the gate. Then for gate opening, other command is given to motor through microcontroller with help of motor driver IC. Here Microcontroller of family 8051 is used where the command from android application acts as an input to it. The gate operation is performed based on the output received from microcontroller. The status of gate operation i.e. open or closed is known through a LCD display which is connected to microcontroller.

1. Introduction

Indian railways are in operation for more than 160 years and it covers the whole of India. Indian railways is among the world’s largest network which consist of 115,000 km of track. It covers an entire route of about 65,000 km and 7,112 stations. In 2014-15 Indian railways lugged almost 8 billion travelers annually or we can even say that around 23 million travelers per day [10]. The railway route involves around 14896 unmanned and 17839 manned level crossings [4].

The point of intersection of railway track and roads or highways is level crossing. Earlier these level crossings were having flagman who on approaching of the train would wave a red flag for alerting the road users to stop and clear the railway track. Then manual gates were introduced afterwards.

Also these level crossing gates were controlled through where an oral communication through telephonic or Telegraphic is made to detect the location of the train and allocate the track and according to which railway level crossing gate is operated. When train is arrived at a particular distance then gatekeeper will manually close the gate for using some components. The gates consisted of full barriers covering the whole width of road preventing pedestrians or animals from getting onto the railway tracks.

2. Literature Survey

The operations carried out at the level crossing are unreliable. Mostly it involves long waiting hours for road users for passing of trains. Then accidents occur due to careless nature of road users and may be due to time errors of gatekeepers. All this is result of manual operations or of workers causing injury and death.

Nearly 17% of total railway accidents occur at level crossing. The year 2013-14 have registered over 4 critical accidents at railway level crossings [5]. Many various systems have been proposed and some implemented but they have some shortcomings. Some system have poor stability and performance while others utilize active sensors which defects like instability and short reliable life cycle , hence requiring replacement every few years and thereby making the system expensive.

3. Existing System

Indian railways are in operation for more than 160 years and it covers the whole of India. The entire network covers 64,000 km of rail route. Safety and reliability are very important features of Indian railways. When people or vehicles are passing a level crossing, an accident may occur and it is impossible to make a prediction given all the possibilities. If train drivers rely solely on their own eyes or warning signals given off by detecting devices, they usually do not have enough time to react when an obstacle appears at a level crossing, giving rise to an accident.
To overcome the deficiency, high technology products have played an increasingly important role. Some of the existing systems are:-

3.1. Intelligent Level Crossing Safety Control System

The development of the level crossing safety control system uses chipset and circuit assembly in its composition. It also employs computer simulation in design, debug and inspection to ensure robustness. At first, AVR ATmega16 was used in simulation as the microcontroller because of its availability. Eventually, Microchip PIC24FJ256GB106 was chosen for use. The main program of AVR ATmega16 chipset was written in C language, but the I/O hardware control code was written in assembly language. As mentioned above, to facilitate the implementation and debugging of the PIC24FJ256GB106 chipset, the same variables were defined in simulation and actual implementation. In addition, operation of the level crossing security gates is coordinated with the sensors that detect train movement. In the prototype model, stepper motors were used to control the security gates [1].

3.2. Automated Unmanned Railway Level Crossing System

The point of intersection of railway track and roads or highways is level crossing. As train is approaching from either side of the level crossing the sensors placed at a distance from gate senses the train and performs the required operation. Here an indicator light is also used for alerting the motorist regarding motion of train. When the wheels of the train move over, both the tracks then they are shorted to ground thereby acting as a signal to the microcontroller which indicates arrival of train. When train arrives the transmitter IR senses and gives signal to receiver IR to generate an interrupt which causes the stepper motor to rotate in clockwise direction. Once the interrupt ends stepper motor rotates in anticlockwise direction [2].

3.3. Anti-Collision and Secured Level Crossing System

The system presents a pressure sensor. If some vehicle gets caught on rail-line at level crossing then pressure sensor detected object and performs required action. It makes use of microcontroller PIC16F84A. The control system uses two IR sensors and microcontroller is used as controller. Sensors are placed at both sides of the level crossing gates. Two IR sensors are also used which will give signal to microcontroller which will pass its signal to DC motor and will rotate accordingly [3].

The most common features that proposed system includes are:
1. System is controlled through android application.
2. System is scalable as it can meet growing needs.
3. GSM modem is used for attaining efficiency.
4. Compatibility of the system is very high.
5. System can be made to work on any hardware or Software.

Table 1. Comparison with the Existing System

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4. Proposed System

In the proposed system we build an android based controller for railway level gate crossing model. When an analysis is made using daily newspapers then it can be noticed that many railway accidents occur at railway crossings which are unmanned. This may be due to some faulty mechanism being used at the level crossing to control the railway level gate. So here we have proposed Fig 1: Block diagram of a proposed system
a mechanism for controlling the same by using some electronic components. When the train is approaching the railway level crossing from one of the two sides, the sensors will be placed at both the sides which will be at a certain distance from the railway gate detects the train approaching and then the gate operations are controlled. There is an indicator light which has been provided so as to alert the approaching train. This will help in reducing the accidents which occurred at the railway gate crossing may be due to error in signaling or due to faulty mechanism at unmanned crossing.

Figure 1 illustrates the proposed system. In the proposed system there will be a pair of IR sensors which will be placed on both the sides at a fixed distance from the railway level gate crossing. As soon as the train which will be in motion seems to be approaching from one end towards the railway gate it will be detected by those IR sensors being placed. Once the approaching train is being detected the sensors will give a red signal which will be indicating the coming train. This red signal can act as a warning to the road users informing them about the arrival of the train at the level crossing. Also sensors can give a notification to the station master about the arrival of the train. The station master will get a notification on its android application which will be forwarded from the microcontroller through the modem once the approaching train is detected.

An android application will be built where the operations of closing and opening of the railway level gate will be controlled through the android application. This android application will be interfaced to the GSM modem. The arrival of the train will be informed by sending notification on android application to station master. Once the station master is informed about the arrival of the train via notification which is been send to it on the android it gets to know that the train is approaching. Then he sends a SMS to close the railway level gate from the built application. Then the SMS will be send to the GSM modem which is interfaced with the system.

A GSM modem here will be interfaced. A microcontroller of the 8051 family is been used to achieve the control. A motor driver is consolidating with the microcontroller along with the LCD display which will be used to display the status of the gate whether it is opened or closed. The motor will be connected to the motor driver which will perform the gate operation of opening and closing depending upon the need.

On getting the ‘close’ SMS from the application, this SMS will act as an input to the GSM modem. Then the GSM modem will send a signal to the microcontroller which is interfaced acting as an input to microcontroller. The microcontroller will then send an output signal to the motor driver which will activate the mechanism to switch on the motor so as to close the gate. The signal will be red until the train is completely surpassed the railway level gate crossing. Once the train reaches the other end then it will be again detected by the sensor which will be placed at a fixed distance from the gate. On detecting the train the signal will be turned off thereby again sending a notification about the departure of the train to the android application so as to inform the station master. Then the station master again sends the ‘open’ SMS to open the railway crossing gate from its android application. These commands will be forwarded to the microcontroller via GSM modem. This will help the microcontroller to open the gate with the help of motor driver IC. The output of the microcontroller is given to the motor driver to open the gate. An LCD is also interface to microcontroller which will display the status of the gate such that when the closed is closed its been displayed on LCD helping the station master or user to know that the gate is closed and same applies when gate is opened.

5. Conclusion

From the above analysis and information regarding the system we guaranteed say that it is highly economical than manual railway crossing gate system and highly reliable, effective and economical at huge traffic area, rural area and the track where frequency of trains are more. Saving the human life from miserable train accidents should be more important with the help of technology. The results exhibit that it is one of the economical approach for secure railway system.

An alert message from the sensor assembly transferred to the station master regarding the train movements that either to open the gate or to close. The communication between the station master and the train on the track will also an advantage in this approach to reduce the accidents. We are working to develop black box technique for finding the specific reason of accident for further analysis. This technique should be able to bring down the increasing number of accidents at railway crossing. We know that though it is very beneficial but cost is incurred with every installation, but it will certainly a new way to reduce railway accidents.

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7. References


