

# Automatic Railway Gate Control using Arduino Uno

Yash Dev Varshney<sup>1</sup>, Akash Kumar Singh<sup>2</sup>, Rohit Ranjan<sup>3</sup>, Praveen Singh<sup>4</sup>

<sup>1,2,3,4</sup>Student, Dept. of Electronics and Communications Engg., IMS Engineering College, Ghaziabad, India

**Abstract:** As Human safety is major goal for Railways. The intention of this of paper is to achieve automatic control at the level crossings when the arrival/departure of the train takes place replacing the manual gate control. The railway gate automatically is closed when a train passes through the railway crossing. The detection of arrival and departure of train is done by using two IR sensors. The gate opening and closing is to be done using servo motors which is controlled by Arduino Uno. In addition, with this the status of the gate will be given to the motorman well in advance which insures more safety from the accident. Buzzers are used to indicate the closing of gate for the people who are trying to cross the gate. This system helps in avoiding the increased number of the accidents at level crossing in India. The hardware is supported by the Arduino C programming. The proposed system is more reliable and cost efficient.

**Keywords:** Railway Gate, Micro Controller, Arduino, Sensor, Servo Motor.

## 1. Introduction

In today's scenario Railway safety becomes the most important aspect of railways all over the world. As we know the Railways is the cheapest mode of transportation, and due to manual operation, accidents are likely to happen. There are 30348 level crossings on Indian Railways across the country. 18785 are man handled and 11563 are non-man handled level crossings out of 303048 level crossings. To avoid accidents over previous five years 4792 level crossings have been removed by the respective Zonal railways of Indian Railways. The Indian ministry of Railways made a decision focusing on eliminating all level crossings on availability of railway funds, which could be controlled automatically.

The suggest system helps in achieving the safety and to prevent accidents at the level crossings that are non-man handled. The Automatic railway gate control system can be employed under non man handled level crossing where the chances of accidents are higher and requirement of reliable operation are there. Since, the proposed model suggests an automatic system, it helps in reducing the error which is in manual operation and it will be used as highly reliable source. The proposed model of automatic gate control at level crossings is highly economical based on the arrangement done by using Arduino and Servo motor which makes the design for use in almost every non man handled that is unmanned railway crossings.

The proposed model suggests a design to control a railway level-crossing by servo motor using Arduino controller. The connection of motor is done from Arduino with the help of a driver IC for controlling the railway gate. Two IR sensors are used to detect arrival of the train and two are used to detect departure of the train. IR sensors are checking the complete closing of gate.

## 2. Related work

Earlier opening/closing of crossing gates were fully controlled by gatekeeper. The method was that when train departs from any station a controller or a station master was used to call to contact the gatekeeper and inform the gatekeeper about the departure. On receiving the message, the gatekeeper closes the gate by calculating the time from station to the gate. However, the gate remains closed for long time even if the train is late for some reasons. This can be eliminated by using an automatic railway gate control which uses a sensor near to the railway gate that detects the arrival of a train and closes the gate. Note this requires very less time compare to manual operation of the gates and reduces the manpower. The Proposed model to automatically control the crossing gateway helps in achieving the safety and to prevent accidents at the unmanned level crossings. The Automatic railway gate system can be employed in an unmanned level crossing where the chances of accidents are higher and reliable operation is required. Since, the proposed system is automatic, it helps in reducing the error which is in manual operation and it can be used as high reliable source.

## 3. Proposed Model

In the proposed system, sensors are used to detect the train arrival and departure. The System uses three different sensors to control the rail arrival and departure. Arduino is used for program the sensors. As shown in functional diagram of our proposed model in Fig. 1. The following materials and components are used in this proposed system for automatic gateway control system. The block diagram as shown in Fig. 1, describes the working of our proposed system. Where an Arduino is used for connecting devices like IR sensor, Servo Motor. In the Proposed Model the servo motor is used for monitoring of cross Way and IR sensors is used to detect the motion of objects nearby the crossway, which when detects the

train or motion of any other vehicle nearby the crossway it takes the corresponding action of whether opening or closing the gateway at the crossing.

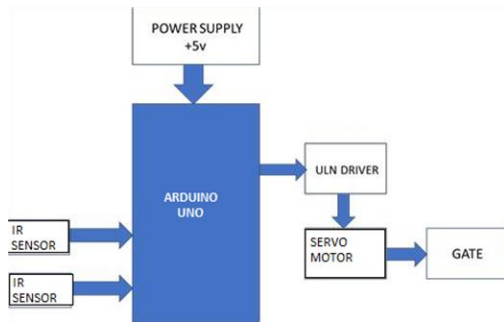


Fig. 1. Functional block

#### 4. Working

In this proposed model we use the step down transformer to convert the voltage to 12 volts after which the voltage regulator which converts this 12 volt to 5 volts as the motors and sensor works on 5 volts. Here the bridge rectifier is also used for the purpose of converting the AC to DC. A capacitor is used to filter the pulsating DC supply to pure DC supply. After this Supply is given to ARDUINO the servo motor and IR sensor are controlled and interfaced through the ARDUINO. Now the IR sensor senses the arrival/departure of the Train and accordingly sets up the Buzzer to notify the surrounding/nearby area. After which the servo motor which here is used to control the gateway system at the crossing itself takes the corresponding action to whether open or close the gateway accordingly.

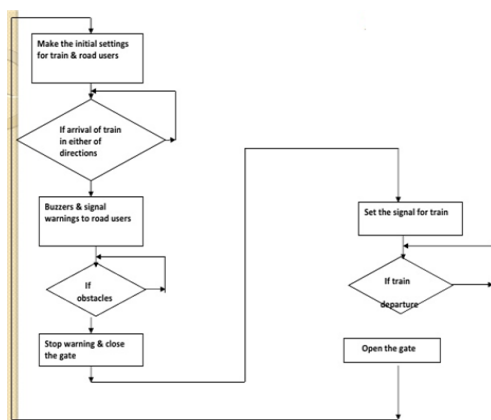


Fig. 2. Flow Chart of designed system

#### 5. Hardware Specifications

The hardware used in the automatic railway gate controller is discussed below. The main component for the system and their working is explained shortly as follows:

##### A. Arduino Uno

If you like tinkering with electronics but time constraints and a lack of knowledge are problem you from making a start, then Arduino is the solution. It is a micro-controller based on an open

source electronic prototyping board which can be easily programmed with a user friendly software like Arduino IDE

Arduino consists of both Hardware and Software where hardware is physical circuit board available for connection of devices and software as IDE used for coding or programming of system. The Arduino IDE use embedded C as the basic coding language making the learning easy and process user friendly. UNO is popular board among beginners as easy learning and programming can be done here.

Arduino board consist of the USB connection port used for proving connection to the computer, A port for power supply, Micro-Controller for programming based analysis of system, Analog as well as Digital pins for connection as per requirement which can be done by using male to male or male to female connecting wires, Ground, Rx/Tx which is receiver and transmitter leds are also available within the Arduino board.



Fig. 3. Arduino

In addition to the hardware features, the Arduino IDE uses a simplified language for programming that is basic embedded C language which make it easier to use and learn. Finally, Arduino provides a standard form factor which can break out the functions of the micro-controller into easily accessible package

##### B. IR Sensor

In Today's world which is full of nanotechnologies sensors plays very vital role specially in robotics and Automations. Sensors make our life easy by automatically sense and control the devices. one of which is IR sensor. IR sensor is very popular sensor, which is used in Remote control system, Line follower robots and in our proposed system too i.e., Automatic Railway Gate control system. The working principle of IR sensor is based on the IR LED which emits IR radiation falling on a photodiode which is used to sense that radiation . The resistance within the photodiode changes with change in the amount of radiations. The key benefits of infrared sensors include their low power requirements, their simple circuitry and their portable features.



Fig. 4. IR sensor

The drop in voltage level across it also changes and by using

the voltage comparator(LM358) the change in voltage can sensed and accordingly can generate the output.

**C. Voltage regulator**

A voltage regulator uses simple feed-forward design and may or may not involve negative feedback. It can use two types of mechanism namely as an electromechanical mechanism, or an electronic component. Depending on the situation. The regulator itself is a system designed to automatically adjusting the voltage level and maintaining a constant voltage level as per the requirement.

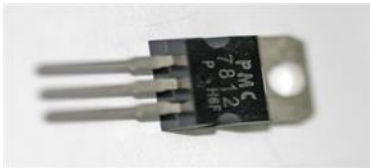


Fig. 5. Voltage Regulator

The regulators also are used in power supplies in computers where they stabilize the Dc voltages used by the CPU processors.

**D. Servo motor**

Servo motor is nothing but a part of closed-loop system. It consists of various parts like shaft (for rotation), an amplifier, a control circuit (for controlling the rotation mainly) and an encoder or resolver. A servo motor has the capability of rotating the parts of machines with high efficiency and precision on its own that's why it is self-contained electrical device. The output shaft has the capability of moving at a particular angle, position and velocity which differs it from other motors. The controller is the most important part of servo motor designed and used specially for this purpose. The servo motor is a closed loop mechanism that incorporates position at feedback in order to control the rotational or linear speed and position.

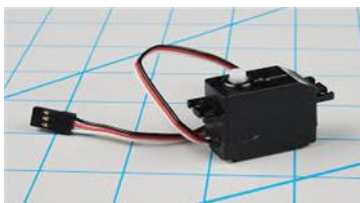


Fig. 6. Servo Motor

**E. Step down transformer**

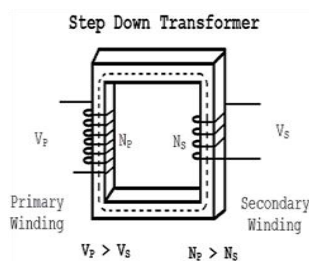


Fig. 7. Step down transformer

A Step down Transformer is a type of transformer, used to converts a high voltage (at primary end) to a low voltage (at secondary end). In the coil windings of the step down, the primary winding has more turns than the secondary winding. The Fig. 7. shows a basic step down transformer

**F. Buzzer**

A buzzer is a device which is used to make a beeping noise. The most commonly used buzzer is piezoelectric buzzer. A piezoelectric buzzer is just made up of a flat piece of piezoelectric material which is having two electrodes. These type of buzzers requires an oscillator or something else like microcontroller to derive. If D.C supply is given, it will give a click. The buzzers are used where we want something which gives an audible noise. Buzzer in this proposed model is used for providing an alert warning about the arrival or departure of the train which is tuned with the Arduino. As through the IR sensors detects the arrival or departure of train, Arduino orders the buzzer to give sound which denotes about the alert of arrival/departure of the train. It has two terminals one is positive terminal and the other one negative terminal as shown below in the figure.

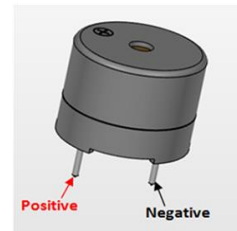


Fig. 8. Buzzer

**G. LED's**

LED is nothing but Light emitting diode. LED is a two-lead semiconductor light source. It is a p-n junction diode emitting light when it gets activated. On applying suitable voltage to the leads, electrons are able to recombine with minority charge carriers producing current which help in conducting light .



Fig. 9. LED

**6. Conclusion**

The proposed model successfully made human safety possible in areas like railway crossing nearby rural as well as urban areas. The servo motor and sensor like IR and Ultrasonic sensor processes combinable to make a system where an object/vehicle or train itself is sensed if it passes the gateway and corresponding actions are taken by motor to open or close the gateway, also the buzzer is used for warning the nearby area

about the arrival of train which decreases the rate of accidents nearby the railway crossings. The sensors are installed before a genuine range from the gateway so that warning time for arrival of train or its departure is enough to take the corresponding decision and also in that much time the closing/opening of gateway through use of servo motor is done accordingly.

### References

- [1] <http://www.indianrailways.gov.in/railwayboard/uploads/directorate/signa/do wnloads/leve-crossing.pdf>.
- [2] [http://www.indianrailways.gov.in/railwayboard/uploads/codesmanual/SEM-II/SignalEngineering%20ManualICh14\\_data.htm](http://www.indianrailways.gov.in/railwayboard/uploads/codesmanual/SEM-II/SignalEngineering%20ManualICh14_data.htm)
- [3] <http://164.100.47.134/intranet/Indianrailway.pdf>.
- [4] [http://www.mind.ilstu.edu/curriculum/medical\\_robotics/dcmotor.jpg](http://www.mind.ilstu.edu/curriculum/medical_robotics/dcmotor.jpg).
- [5] [http://www.robosoftsystems.co.in/roboshop/media/catalog/product/pdf/IR\\_si ngle.pdf](http://www.robosoftsystems.co.in/roboshop/media/catalog/product/pdf/IR_si ngle.pdf).
- [6] <https://elecrom.wordpress.com/2008/02/19/how-to-make-simple-infrared-sensor-modules/>.
- [7] [http://en.wikipedia.org/wiki/Classification\\_of\\_railway\\_accidents](http://en.wikipedia.org/wiki/Classification_of_railway_accidents).
- [8] <http://www.slideshare.net/AtchyuthSonti/automatic-railway-gate-control-12526197>.