

## **AUTOMATIC RAILWAY GATE CONTROL SYSTEM TO REDUCE THE ACCIDENTS**

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### **ABSTRACT**

It has been noticed that a lot of fatalities of lives occur every day due to manually operated rail gates all over Bangladesh. These happen mainly at places where the rail road passes through a city, locality or unmanned gates of the crossing zones. Currently, gatemen mainly operate on the assumption of a train departure schedule from the station to reach a crossing zone. But at times there are departure delays or maybe the train reaches crossing zones earlier, leaving the gateman unprepared to close the gate. Accidents are more likely to happen in such cases, causing severe damage to human lives and properties near the rail crossings. This presents the development and implementation of automatic rail gate control system as well as real time monitoring of train and obstacle detection for developing countries like Bangladesh. This was carried out using Arduino Nano along with IR Sensor, IR LED, DC Motor, DC Motor . This system is a combination of old technology with recent wireless technology and analytics to provide the best possible service to the nation. It also suggests the effectiveness of real time information of train position. The main objective of the automatic railway gate control system is to ensure the efficiency, quality, time management, and most importantly public safety, using wireless based communication network for the development of the railway industry in Bangladesh.

**Keywords:** IR Sensor, IR LED, DC Motor

## 1. INTRODUCTION

Railways are the largest inland mode of connectivity and transport inside a country. Poor maintenance of level crossings and railway bridges by the authorities, among other issues, contributed to the rise in rail accidents. Negligence of officials lead to the increase of death toll in the past 10 years than ever. Poor management with manual system that dates back to the British era made it quite vulnerable. Vision for a digitalized railway system is imminent . There were 129 railway-related accidents last year, in which 39 people were killed and 155 injured, and most of the accidents were caused by signal violations and derailments. At least 198 people were killed and 347 were injured in 162 railway-related accidents, while Shipping and Communication Reporters Forum (SCRF) stated that at least 421 people were killed and 366 injured in 393 railway related accidents in 2019. It demonstrates how reluctant people are maintaining safety rules and regulations while using a manually operated rail gate . The rail route of Bangladesh is almost about 2855 route kilometers with 3975 kilometers of track, managed by about 26,458 regular staffs. Bangladesh Railway (BR) is the largest Government-owned and Government-managed transportation agency of the country. There are a minimum of 444 stations around the country. The operating revenue in average was approx. 6030 million Taka in 2012, though operating expenses was 15670 million Taka in total.

## 2. PROPOSED SYSTEM

It is a simple 2D diagram of the model for the system where 4 sensors, an unnamable gate crossing, and the movement of the locomotive, a station and control station are depicted. When the train crosses sensor 1, it sends a notification to two places as shown in the diagram: sensor 2 and the control center. Sensor 2 gets prepared and takes the necessary steps needed to close the gates. Meanwhile, if an official need to know the live location of the train on the track, we have used a point which shows a general vicinity of the train by the moving train image. Although GPS could have been used, sensors 1 and 4 are used to keep the system simple and implement an alternative to GPS. After crossing these points, it sends a notification to the nearest up ahead station and the control center. So, there will be updates to all the designated points and the authority will know if the train will arrive on time or not, and can let the passengers know before they arrive at the station and wait.

### **3. LITERATURE SURVEY**

Information systems on railway stations are variously referred to as a Passenger Information System and Passenger Information Display. Professional railway staffs often refer to them as Train Describers. What ever it is called, there must be a reliable way of informing the passengers where the trains are going and incoming to the station. Passenger information systems are essential for any railway . One of the most common complaints by passengers on railways is the lack of up to date and accurate information. When asking the staff for information, passengers expect an accurate and courteous response with the latest data. There is nothing different than the your guess is as good as mine when a train is delayed or has not appeared on time. This means that staff must have access to the latest information and they must be trained to use it properly and to pass it onto passengers .response when a member of staff is asked what is happening.Information displays publish in public areas must be visible in all weather conditions and be updated regularly with correct information. There are two types of information- constant and instant. Constant information is described as that which describes the services and fares available and which changes only a few times a year or less. This information can be displayed on posters and fixed notices. There also must be special offers which can be posted from time to time.Instant information is that which changes daily or minute by minute. This is better displayed electronically or mechanically for the public- both systems can be seen around the world. For instant systems, it can be assumed that passengers require to know

## **4. METHODOLOGY**

Here we use the DC motor to open and close the gates automatically when it rotates clockwise or anticlockwise direction to operate the gate automatically. When the train arrives in a particular direction the vibration sensor senses and generates appropriate signal, then at the same time the PLC provides. The proposed system uses three infrared sensors to identify the arrival and departure of trains. The system also implements obstacle sensor which detects any obstacle on the track and controls the operation of the train. Sensors and DC motors are programmed using Arduino micro-controller. When there is any obstacle on the track the IR sensor placed at the front end of the train will detect the presence of any obstacles and send signal to the Arduino. Then Arduino convey the obstacle detection message to the nearby railway station. By employing this system at the level crossing the arrival of the train is detected using IR sensor placed on the either side of the gate. LED indication on either side are provided to the road users indicating the closure and open of the gates.

## BLOCK DIAGRAM:

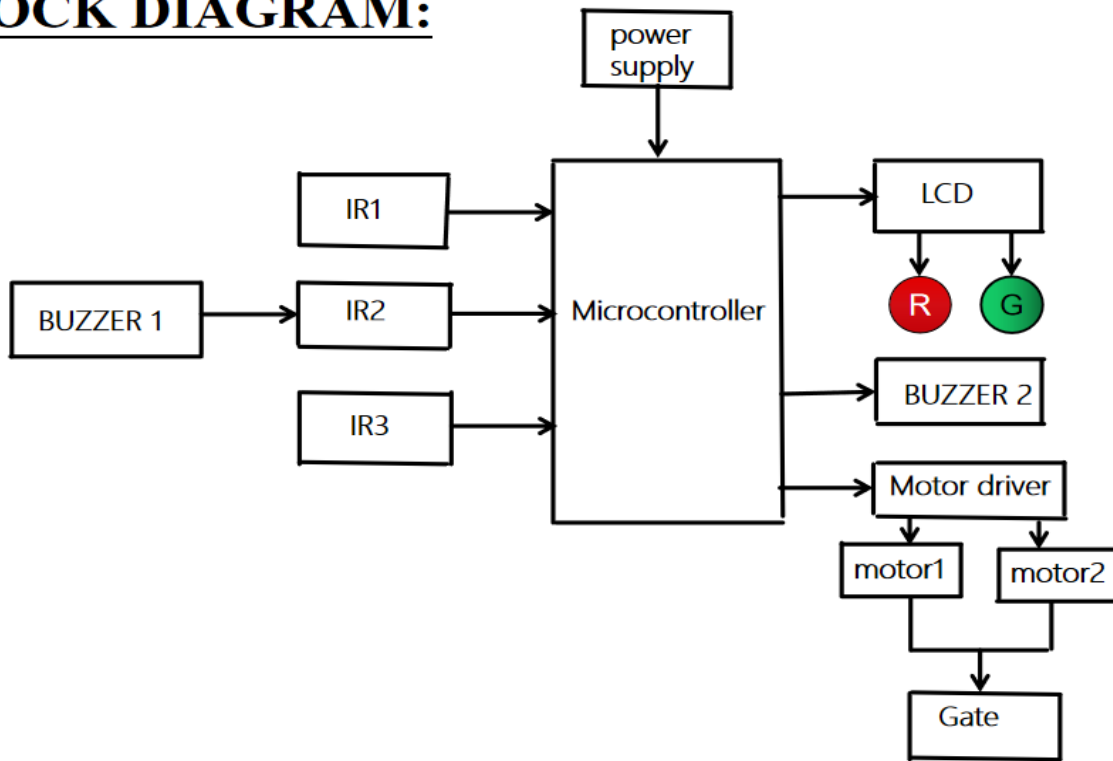


Fig1:Block Diagram

## 5. HARDWARE REQUIRED:

### 5.1.1 Arduino Uno Board

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

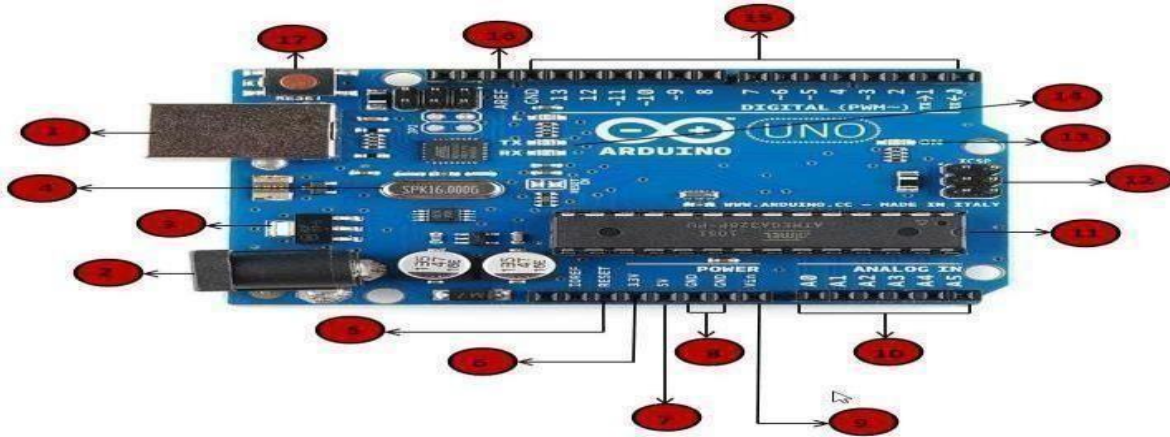


Fig1:Arduino Uno Board

The Uno differs from all preceding boards in that it does not use the FTDI USB- to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

### 5.1.2 Power Supply

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others

This power supply section is required to convert AC signal to DC signal and also to reduce the amplitude of the signal. The available voltage signal from the mains is 230V/50Hz which is an AC voltage, but the required is DC voltage(no frequency) with the amplitude of +5V and +12V for various applications.

In this section we have Transformer, Bridge rectifier, are connected serially and voltage regulators for +5V and +12V (7805 and 7812) via a capacitor (1000 $\mu$ F) in parallel are connected parallel as shown in the circuit diagram below. Each voltage regulator output is again is



connected to the capacitors of values (100 $\mu$ F, 10 $\mu$ F, 1  $\mu$ F, 0.1  $\mu$ F) are connected parallel through which the corresponding output(+5V or +12V) are taken into consideration.

## 5.1.3 IR SENSOR

IR wireless is the use of wireless technology in devices or systems that convey data through infrared (IR) radiation. Infrared is electromagnetic energy at a wavelength or wavelengths somewhat longer than those of red light. The shortest-wavelength IR borders visible red in the spectrum. The longest-wavelength IR borders radio waves.

Infrared energy is light that we cannot see, but our bodies can detect as heat. It is part of the electromagnetic spectrum that includes radio waves, X-rays and visible light. All of these forms of energy have a specific frequency, as represented in the chart below

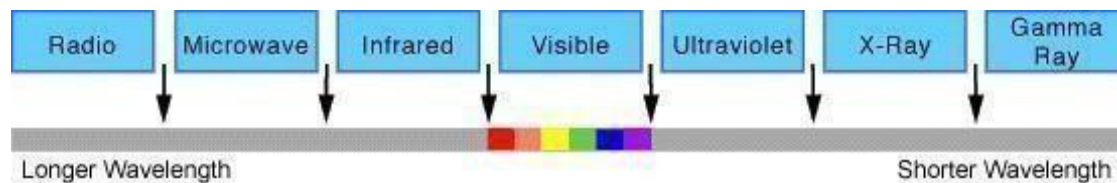


Fig2:IR Sensor

Infrared energy is comprised of those frequencies that exist just below the red end of the visible spectrum, and for cooking properties they have a very unique benefit - when they strike organic molecules (such as any type of food), they cause the molecules to vibrate, thereby creating heat. Although almost any type of electromagnetic energy can cause heating, for the purpose of cooking, infrared energy is the perfect choice.

## 6. SOFTWARE REQUIRED:

### 6.1 Introduction to Arduino IDE

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

#### 6.1.1 The key features are

- Arduino boards are able to read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions.



- You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE (referred to as uploading software).
- Unlike most previous programmable circuit boards, Arduino does not need an extra piece of hardware (called a programmer) in order to load a new code onto the board. You can simply use a USB cable.
- Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.
- Finally, Arduino provides a standard form factor that breaks the functions of the microcontroller into a more accessible package.

After learning about the main parts of the Arduino UNO board, we are ready to learn how to set up the Arduino IDE. Once we learn this, we will be ready to upload our program on the Arduino board.

## 7. RESULT

- We have designed a proposed system to avoid accidents due to the manual operation of railway gate control and less information about obstacles on the railway track. ▮
- The major components of the model are a railway track, a toy train, IR sensors, an AVR microcontroller, LED signals, servo motors, LCD Display, a buzzer, etc.
- Two IR sensors are placed at both sides of the level crossing. When the train passes the first sensor, it will be detected by the sensor and a red LED will glow at level crossings indicating that the train is arriving at the station and the gate will be closed automatically.
- When the train crosses the IR sensor 2, a green LED will glow at the level crossing indicating that the train has departed from the level crossing and the gate will open automatically. ▮
- Buzzer indicates the arrival of the train at a level crossing. ▮
- LCD will show the status of the train.



## 8. CONCLUSION

An automatic rail gate control system along with real time monitoring and automatic train- stop due to obstacle was presented. A hardware prototype was made and tested successfully. Wireless monitoring of real-time train position and obstacle detection was also tested. A scenario of practical implementation and its challenges were also discussed. This type of project can be helpful and saves a lot of human lives if implemented appropriately, especially in the developing countries like Bangladesh. The advantages are accident avoidance, less human intervention, safety, and quality of services, accurate gate open/close. The prototype is accordingly made to avoid the accidents at the unmanned crossing after its effective use at the unmanned crossing we can propose this



project/prototype at the manned crossing which could reduce the accidents that take place near the crossings. To make it completely automated we need to equip a never-ending source of energy that could operate the gates and the appropriate solution is the solar energy that can be obtained through the solar panels.

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