Report

Inter Departmental Project - I

on

AUTOMATIC RAILWAY GATE CONTROL SYSTEM

Submitted By

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(Deemed to be University)

-Estd. u/s 3 of UGC Act 1956

(ACCREDITED BY **NAAC** WITH **"A"** GRADE)

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CERTIFICATE

This is to certify that the Minor project/IDP report entitled **"AUTOMATIC RAILWAY GATE CONTROL SYSTEM"** that students **D. Harsha Vardhini (201FA05010), V. Lakshmi Revanth Kumar (201Fa05043), B. Rahul (201FA05059), G. Balaji (211LA05021)** to the Department of Electronics and Communication Engineering, Vignan's Foundation for Science Technology and Research, is a record of work carried out by them under the guidance of **Mr. K. Janaki Ram** of ECE department.

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INDEX

S. No	Contents	Page Number
1	Abstract	
2	Introduction	**4**
3	Components and Description	**7**
4	Working Principle	**13**
5	Flow Chart & Circuit Diagram	**14**
6	Hardware Implementation	**15**
7	Source code	**16**
8	Advantages & Applications	**17**
9	Conclusion	**18**
10	Future Scope	**19**
11	References	**20**

ABSTRACT

This project aims to provide an automatic railway gate at the level crossing replacing the gates operated bythe gate keeper by detecting train and stuck on the level crossing, generating corresponding alert signal and controlling the gate. The solution is provided by developing a train detection module, stuck detection module, signal light module, alarm module, railway gate controller and a controller module. In this project we are using two IR sensors/ultrasonic sensors and servo motors. Train detection and stuck detection module generate high frequency signal through the IR sensor/ultrasonic sensors and detect the presence of object if the transmitted signal is received back by the sensors. Then the controller unit determines whether the obstacle is train or stuck and takes necessary steps by controlling the gate, alarm generator and signal lights.

INTRODUCTION

The place where track and highway/road intersect each other at the same level is known as “level crossing”.There are mainly two types of level crossing they are Manned level crossing and Unmanned level crossing. Manned level crossing is classified into special classes. Class “A”, Class “B”, Class “C”. Unmanned levelcrossing is classified into “C” Class, “D” Class. Railways being the cheapest mode of transportation are preferred over all the other means.

Figure 1: Advanced Railway Crossing

There’re also many level crossings in India which are unmanned. So, they are potentially dangerous for road users. In India we must develop a prototype to be implemented to automatically control railway gate upon arrival as well as departure of train. The project should not be too much expensive but must be reliable. So, we used Arduino uno R3 which is quite reliable as well as affordable. We started to develop our project based upon 8051 microcontroller which is also cheaper than Arduino. But in terms of reliability and implementation of future featured we upgraded to Arduino uno.

WHAT IS LEVEL CROSSING?

A level crossing is an intersection where a railway line crosses a road or path at the same level, as opposedto the railway line crossing over or under using a bridge or tunnel. The term also applies when a light rail line with separate right-of-way or reserved track crosses a road in the same fashion. Other names include railway level crossing, grade crossing, road through railroad, railroad crossing, train crossing, and RXR.

Fig 2: Indian Level Crossing

HISTORY OF LEVEL CROSSING

The history of level crossings depends on the location, but often early level crossings had a flagman in a nearby booth who would, on the approach of a train, wave a red flag or lantern to stop all traffic and clear the tracks. Gated crossings became commonplace in many areas, as they protected the railway from people trespassing and livestock, and they protected the users of the crossing when closed by the signalman/gateman. In the second quarter of the 20th century, manual or electrical closable gates that barricaded the roadway started to be introduced, intended to be a complete barrier against intrusion of any road traffic onto the railway.

Automatic crossings are now commonplace in some countries as motor vehicles replaced horse-drawn vehicles and the need for animal protection diminished with time. Full, half or no barrier crossings superseded gated crossings, although crossings of older types can still be found in places. New technology

is advancing to create new ways of protecting the railway from users of a level crossing, with one of the most recent being obstacle detection scanners fitted to some crossings in Europe.

Fig 3: Manually Operated Level Crossings

In rural regions with sparse traffic, the least expensive type of level crossing to operate is one without flagmen or gates, with only a warning sign posted. This type has been common across North America and in many developing countries. A majority of the level crossings in India were manually regulated. Signals and barriers are installed at allcrossings while manual crossings are additionally required to have the hand red and green signal flags. ButIndian Railways aims at elimination of all unmanned crossings.

COMPONENTS AND ITS DESCRIPTION

HARDWARE COMPONENTS:

- Arduino UNO
- IR Sensor
- Servo Motor
- Power Supply
- Buzzer
- LEDs (red and green)
- Breadboard
- Connecting Wires
- Toy Train

SOFTWARE COMPONENTS:

- Arduino IDE

HARDWARE COMPONENT DESCRIPTION:

1. Arduino Board:

Arduino is a hardware that works as per software instructions. Arduino as hardware is Arduino-UNO, Nano, Mega boards and as a software is Arduino Integrated Development Environment(IDE). It is a prototype i.e., Arduino is an open source based on an easy to use hardware and software.It consists of a circuit board which is a microcontroller that can be programmed and a ready-made software called Arduino IDE, used to write and upload the computer code to the physical board. The programming language of Arduino is a simplified form of C/C++ programming language. Arduino boards are able to read inputs (light on sensor or temperature) and turn it in to output (activating motor, turn LED etc.).

Description of Arduino board pins:

Power USB Plug: Arduino board can be powered by using the USB cable from your computer.

External Power Supply & Vin: Arduino boards can be powered directly from the AC mains power

supply by connecting it to the Barrel Jack

Reset Button & Pin: Arduino Board can be reset by Pressing Reset Button or Giving High (+5V) to Reset Pin **3.3V, 5V & GND:** 3.3V, 5V pins of Arduino will give supply to external devices or sensors which areconnected to it. Several Ground Pins on Board provide Ground Potential to Connect.

Analog In: The Arduino UNO board has six analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.

Digital In: The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labeled "~" can be used to generate PWM.

Analog reference Pin: Sometimes, need to set an external reference voltage (between 0 and 5 Volts) asthe upper limit for the analog input pins.

Tx& Rx Pins: TX (transmit) and RX (receive), the digital pins 0 and 1, to indicate the pins responsible for serial communication. Second, the TX and RX led. The TX led flashes with different speed while sending the serial data. The speed of flashing depends on the baud rate used by the board. RX flashes during the receiving process.

Microcontroller: ATmega328P It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. Also, SRAM Storage: 2KB, ROM Storage: 1KB, Clock Speed: 16MHz, RISC Architecture.

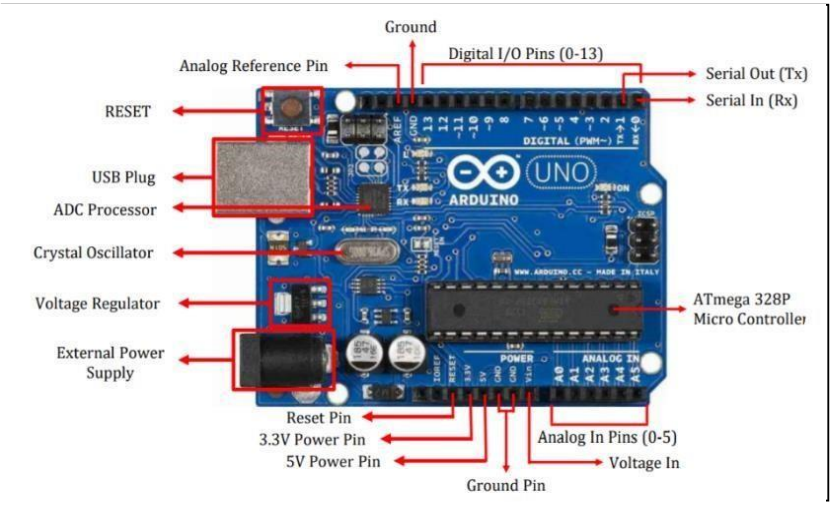

Fig 4: Arduino UNO board and its pins.

2. IR Sensor:

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.

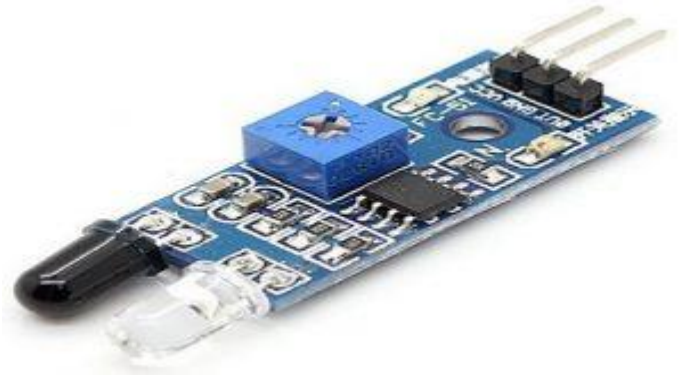

Fig 5: IR Sensor

- VCC Pin is power supply input
- GND Pin is power supply ground
- OUT is an active-high o/p

3. Servo Motor:

A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor

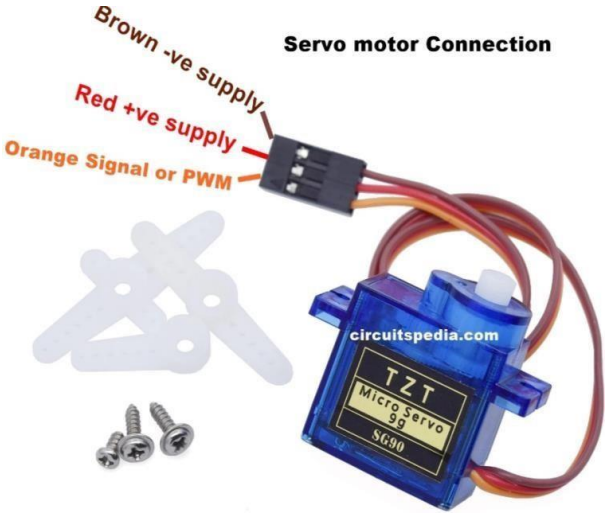

Fig 6: Servo Motor

It consists of three parts:

- Controlled device
- Output sensor
- Feedback system

It is a closed-loop system where it uses a positive feedback system to control motion and the final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal.

4. Connecting Wires:

Connecting wires provide medium to n electrical current so that they can travel from one point on a circuit to another. In the case of computers, wires are embedded into circuit boards to carry pulses of electricity. In a basic circuit, the wire comes from one terminal of a power source, then connects to switch that determines whether the circuits us open or close. the connected wires of device are used to draw power and electricity.

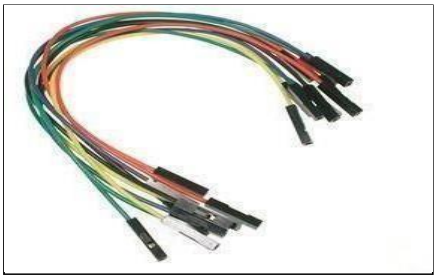

Fig 8: Connecting Wires

5. Buzzer:

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Used for output purposes.

Fig 9: Buzzer

6. LED:

A light-emitting diode is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.

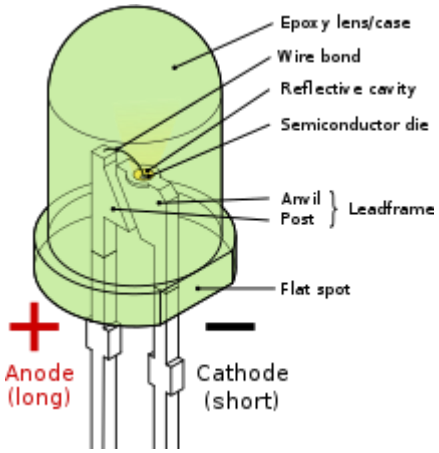

Fig10: LED

SOFTWARE TOOLS

Arduino IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuine hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension.ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

Fig 11: IDE Software

WORKING PRICIPLE

A Railway track of diameter 60cm has been fixed. And the level crossing gate is setup containing two gates facing each other with a gap and the gates are fixed with LED lights and the servo motor has been fixed at the gates, an important point is that the tracks should be in between the level crossing setup. The distance between the level crossing gates is 20cm and the length of the road is 19cm. And the Ultrasonic sensors have been placed before and after the level crossing gates at a distance of about20cm. And sensors are placed at a distance of about 6cm on each side of the track. The whole setup hasbeen connected with the Arduino UNO.

Buzzer is placed near the Arduino. The Arduino has been connected to the external power supply. After the whole setup is ready, a toy train is fixed on the track. Then the toy train starts running with the help of batteries.

From the fig.12 shows ,To start the process, power supply is switched on. After that when we turn on thetoy train, it starts running, and when the train comes nearer to the 1st Ultrasonic Sensor, the crossing gates will be closed, and if it reaches the 2nd one the gates will open. The servo motor attached with the gates, which has Angular Rotation, helps the system with both the opening and closing of the gates. Like the gates, Buzzer will also be turned on automatically as soon as the train reaches 1st sensor and will be turned off when the train reaches 2nd one. During the whole process, the power supply should be turned on. And before all these operations the code for the whole process should be uploaded in the Arduino. The code can be transferred to Arduino with the help of Transmission cable, with the help of that the Arduino can be attached to the computer or Laptop easily. The code can be uploaded and reset easily. Arduino IDE software is used to upload the code in the computer to the Arduino Figure.

FLOW CHART

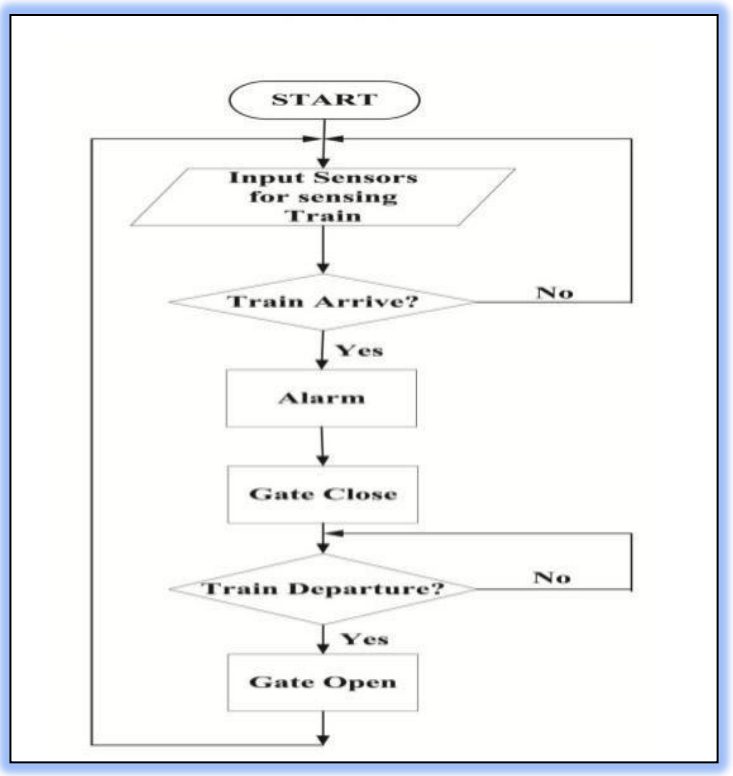

Fig 12: Flow Chart

CIRCUIT DIAGRAM

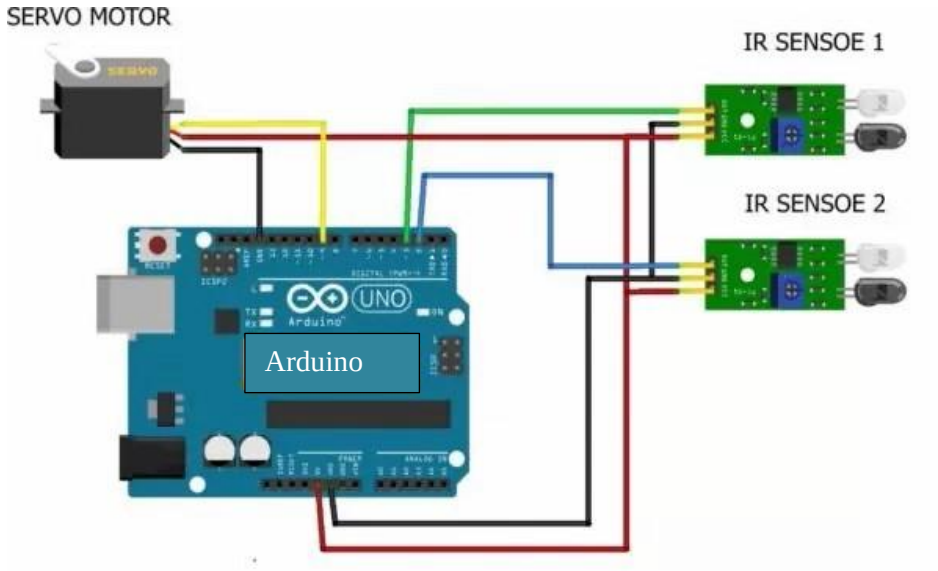

Fig. 13: Circuit Connections.

HARDWARE IMPLEMENTATION

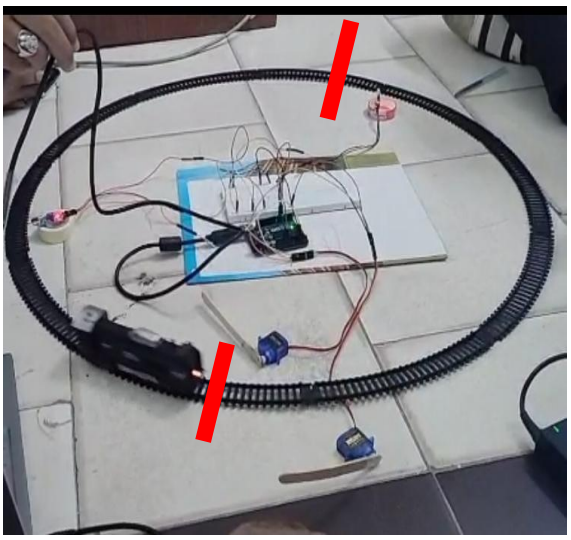

Fig 14: Hardware Implementation

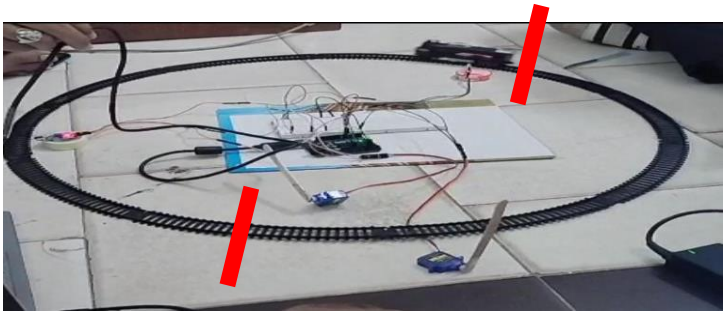

Fig 15 Hardware Implementation

Source Code

```
#include <Servo.h>
const int IRsensor1 = A2;
const int IRsensor2 = A1;
const int BUZZER = 10;
const int Rled = 11;
const int Gled = 12;

Servo myservo1;
Servo myservo2;

void setup()
{
  pinMode(IRsensor1, INPUT);
  pinMode(IRsensor2, INPUT);
  pinMode(BUZZER, OUTPUT);
  pinMode(Rled, OUTPUT);
  pinMode(Gled, OUTPUT);

  myservo1.attach(5); // Servo motor 1 pin connected to D5
  myservo2.attach(6); // Servo motor 2 pin connected to D5

  }
void loop()
 {
   int Sensordata1 = digitalRead(IRsensor1); // read degital data from IR sensor1
   int Sensordata2 = digitalRead(IRsensor2); // read degital data from IR sensor2
   myservo1.write(0); // sets the servo at 0 degree position
   myservo2.write(0); // sets the servo at 0 degree position

  if (Sensordata1 == LOW && Sensordata2 == HIGH)
   {
    myservo2.write(90);     // sets the servo at 90 degree position
    myservo1.write(90);     // sets the servo at 90 degree position
    digitalWrite(BUZZER, HIGH); // turn on buzzer
    digitalWrite(Rled, HIGH); // turn on Red LED
    delay(3000);
   }
  else if (Sensordata1 == HIGH && Sensordata2 == LOW)
   {
    myservo1.write(0);     // sets the servo at 0 degree position
    myservo2.write(0);     // sets the servo at 0 degree position
    digitalWrite(Gled, HIGH); // turn on Green LED
    digitalWrite(BUZZER, LOW); // turn off buzzer
    delay(3000);
   }
  else
   {
    myservo1.write(0);     // sets the servo at 0 degree position
    myservo2.write(0);     // sets the servo at 0 degree position
    digitalWrite(Gled, HIGH); // turn on Green LED
    digitalWrite(BUZZER, LOW); // turn off buzzer
   }
}
```

ADVANTAGES

- Reliable machine, which operates the railway gate even without gatekeeper which makes it useful for operation at unmanned crossings.
- An Automatic Railway Gate Control is implemented with very simple hardware and easy control.
- Minimizes the waiting time of the road users at the crossing.
- Provides Safety and it is automated.
- High speed operations.

APPLICATIONS

- This circuit can be used in Railway near Railway Gate.
- This can be also used in safe room in Banks and Car parking areas.
- Used for security purposes in military and also in the own apartment.

CONCLUSION

This paper we presented is based on Automated Railway Gate opening system using Arduino. Technologies like these have been already done but still they haven't implemented yet and in process especially in India and in some other countries. We have studied it thoroughly and made a working model for the same, but with some modifications. We have found that as compared to the existing system which have been made already, our system works much efficiently and it is reliable because the whole system is automated.

In this project, we have used simple equipment that is more economic rather than the system which is available in the current railway gate controlling system. Since the design is completely automated it can be used in remote villages where no station master or line man is present. Railway sensors are placed at two sides of gate. It is used to sense the arrival and departure of the train. Automatic gate control system offers effective way to reduce the occurrence of railway accidents. This system can contribute a lot of benefit either to the road users or to the railway management.

FUTURE SCOPE

The extension of our project is advanced railway gate crossing system using webcam and mat lab. With thehelp of webcam, we can know how far away the train is and calculate the speed of train.

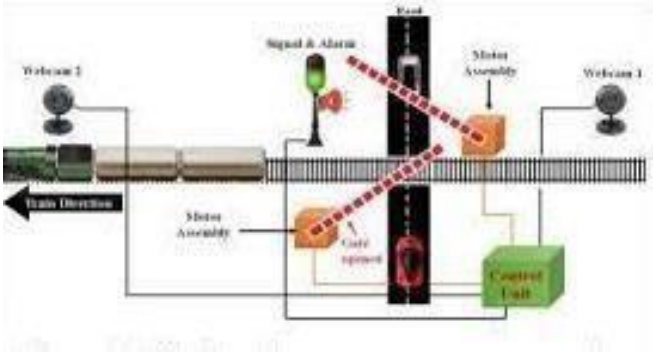

Fig 16: Gates Controlling using web camera

Two webcams are installed across the railway gate crossing. Webcam numbered one is facing towards arrival direction and webcam 2 is installed at opposite side sensing departure of the train. As soon as the webcam1 senses arrival of the train, the software control enables the gate control mechanism to close the gate by actuating the stepper motor to rotate the gate arm. This action is also accompanied with signalling

sound and light alert for the public at the crossing. When the train leaves the gate, webcam2 senses its departure. Immediately the software control enables the gate control mechanism to open the gate again with signaling sound and light alert.

Appropriate and quick opening and closing of the gate enables to keep the gate closed only during passing of the train at the crossing. This keeps the gate closed for minimum time and thus minimizes the waiting time of the road users at the crossing. The audible and visible signaling provides alerts to the road users that guides them for appropriate use of the crossing and provides safety to them. This work provides basic concepts and information to undertake safety and security concerned measuresto protect railway properties and human lives by adopting advanced technologies. But still the power supplyfor the motor operation, signal and lights indicators for large scale implementation should be planed properly. This can be achieved by tapping renewable energy sources such as wind, solar, tidal and many other sources. This project is developed in order to help the Indian Railways in making its present workingsystem a better one. This proposed work can be further extended to meet the demands according to the future situations. The automation in the railway transportation leads major energy savings, as it has large scope for energy conservation, which in turn provides safety and security to the mankind and railway properties.

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