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System for Automatic Gate Control on Railways

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ABSTARCT:
Considering that railroads place a high priority on passenger safety, this study aims to replace human gate control at level crossings with automation control during train arrival and departure. The gate is automatically closed by a sensor when a train approaches the crossing. When a train approaches or departs, a pair of infrared (IR) sensors monitoring the tracks immediately inform the operator. The gate will be opened and closed by servo motors that will be controlled by an Arduino Uno. The motorman will also be alerted of the gate's status immediately, lowering the possibility of a mishap. Buzzers are provided to those attempting to cross the gate to warn them when it is closing. It might be said that this system contributes to the increase in accidents at level crossings in India. As hardware support, Arduino C code is used. The proposed system is more approachable and cost-effective than current methods.

Key Words: Arduino Uno, Sensors and Servo Motors.

I. INTORDUCTION

Nowadays, every area with a railway network places major priority on rail safety. It is well known that trains are the most economically feasible form of transportation, yet since they require human interaction, accidents frequently occur. 3,048 "level" crossings, or railroad crossings, are part of the Indian Railways network. Just 18785 out of the 303048 level crossings are manned, leaving 11563 uncontrolled. Regional divisions of the Indian Railways have taken down 4,792 hazardous level crossings in the last five years. The Indian Ministry of Railways has decided to eliminate all level crossings by adopting automatic controls due to the availability of railway resources. The proposed method will help make automated level crossings safer [1][2]. An automated railway gate control system can be utilised in circumstances where there is a higher danger of accidents and a requirement for reliable performance, like during uncontrolled level crossings. The automatic system implied by the suggested model will be used as a source that is extremely trustworthy while also lowering human error. Because of the arrangement made with an Arduino and a servo motor, the proposed technique of automatic gate control at level crossings is highly cost-effective and can be used in practically all non-man handled, that is, automated, railway crossings.The model offers a setup for using an Arduino controller and a servo motor to operate a railway level crossing. Arduino can control the railway gate by connecting to the motor with a driver IC. Two infrared (IR) sensors track the arrival of the train, while another pair of IR sensors tracks the departure of the train. Infrared sensors keep an eye on gate closure [3].

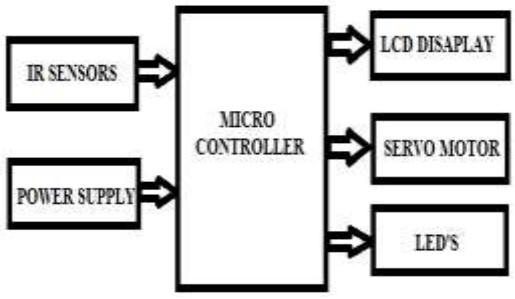

Fig: Block diagram

The proposed system uses sensors to track train movement. The system uses information from three different sensors to control train arrivals and departures. The code for the sensors is written on an Arduino microcontroller. The schematic representation of our proposed model is presented in Fig. The resources and parts listed below are utilised by the proposed method for automatic gate control. The block schematic in Fig.shows how our suggested system works,in which an IR sensor or

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servo motor, for instance, might be connected to an Arduino [4]. The gateway opens or closes in accordance with the suggested model's detection of a train or the motion of any other vehicle close to the crossing. The servo motor is used to monitor the crosswalk, and the infrared (IR) sensors are used to detect motion in the area around the crossing.

II. FUNCTIONAL BLOCKS OF PROPOSED SYSTEM

ARDUINOUNO:

Based on the ATmega328, the Arduino Uno is a microcontroller board (datasheet). It contains six analogue inputs, a 16 MHz crystal oscillator, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; to get started, just plug in an AC-to-DC adapter or batteryor use it to power a computer via USB[5].

The Uno is unique from all earlier boards in that it doesn't make use of the FTDI USB-to-serial driver chip. Rather, it has an Atmega8U2 that has been coded to function as a USB to serial converter. Since Arduino 1.0 would soon be released, the name "Uno," which translates to "one," was chosen. The Arduino reference versions going forward will be the Uno and version 1.0.

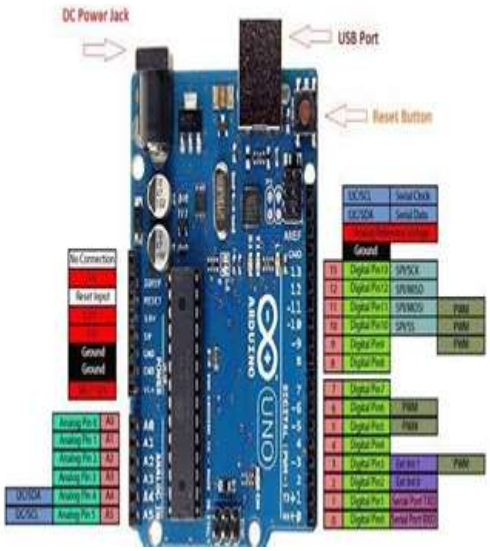

Fig: Arduino Uno with pin description

LIQUID CRYSTAL DISPLAY (LCD):

The uno is the most recent in a line of USB Arduino boards and the platform's benchmark; for a comparison with earlier iterations, see the index of Arduino boards.Either an external power source or the USB connection can be used to power an Arduino Uno. The power source is selected automatically. An AC-to-DC adapter (wall wart) or battery can provide external (non-USB) power. The adapter can be connected by inserting a 2.1mm center-positive connector into the board's power jack. The Gnd and Vin pin headers of the POWER connection can accept battery leads for installation[6].

There are 8-bit and 4-bit LCD modes, based on the number of connections used to connect to the microcontroller. In a stage referred to as "initialization," the suitable mode is chosen at the start of the procedure. As was already said, the data in the first scenario is sent through outputs D0-D7. There are only 4 upper bits (D4-D7) used for communication in the 4-bit LED mode, with the other bits being left disconnected to conserve valuable microcontroller I/O pins.

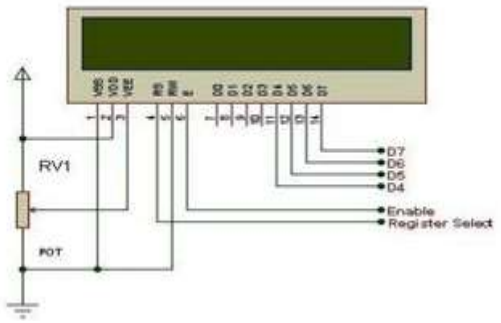

Fig: Pin Connection of LCD

As a result, each bit of data is sent to the LCD twice: the first time, the four upper bits (which would typically be delivered through lines D4–D7) are sent, and the second time, the four lower bits. With the aid of initialization, the LCD will appropriately connect to and interpret each piece of data it receives (delivered through lines D4–D7) and, the second time, the four lower bits. With the aid of initialization, the LCD will appropriately connect to and interpret each piece of data it receives. Furthermore, considering the fact that data are typically conveyed rather than read from the LCD by simply connecting the R/W pin to the ground, one additional I/O pin (from the microcontroller to the LCD) may be conserved. Savings like this have a price to pay. Even if message showing is carried out regularly, it won't be possible to read from the busy flag because it won't be feasible to read from the display.

INFRARED SENSOR:

An electrical device that monitors and detects infrared radiation in its environment is called an infrared (IR) sensor [7][8]. William

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Herchel, an astronomer, made the unintentional discovery of infrared radiation in 1800. He saw that the temperature was highest just beyond the red light as he measured the temperatures of each colour of light (separated by a prism).

As infrared has a longer wavelength than visible light, it cannot be seen by the human eye (though it is still on the same electromagnetic spectrum). Infrared radiation is produced by everything that emits heat (that is, everything that is warmer than five degrees Kelvin).

Infrared sensors come in active and passive varieties. Infrared radiation is both produced and detected by active infrared sensors. A light-emitting diode (LED) and a receiver are the two components of an active IR sensor. The receiver detects the infrared light from the LED that reflects off an object as it gets close to the sensorve infrared sensors. A light-emitting diode (LED) and a receiver are the two components of an active IR sensor. The receiver detects the infrared light from the LED that reflects off an object as it gets close to the sensor. Active IR sensors serve as proximity sensors, and obstacle detection systems frequently employ them (such as in robots).

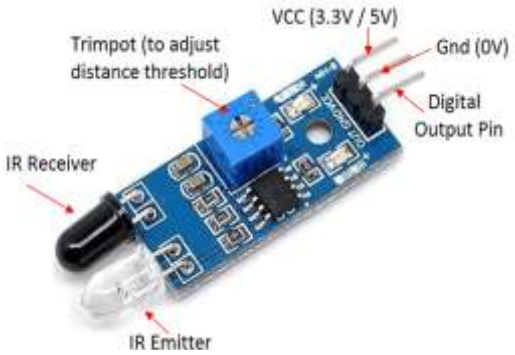

Fig: IR Sensors

SG90 SERVO MOTOR:

There are many different servo motors on the market, and each one has a unique expertise and set of uses. The next two sentences will assist you in choosing the appropriate servo motor type for your project or system[9][10].

The majority of hobby servo motors run between 4.8 and 6.5 volts; however, they are often operated at +5 volts. The higher the voltage, the more torque is produced. Due to their gear arrangement, almost all hobby servo motors can rotate only from 0° to 180°.

The torque at which the motor runs is the next and most important factor. There are several options here as well, but the most widely used one is the 2.5 kg/cm torque that comes with the Towerpro SG90 Motor. The motor can move a weight of 2.5kg when it is hanging at a distance of 1cm thanks to its 2.5 kg per cm torque. Hence, if you suspend a load at 0.5 cm, the motor can pull a load of 5 kg, but if the load is suspended at 2 cm, it can only pull 1.25 kg.The motor with the right torque can be chosen based on the load that you use in the project [11]. The image below serves as an illustration of this.

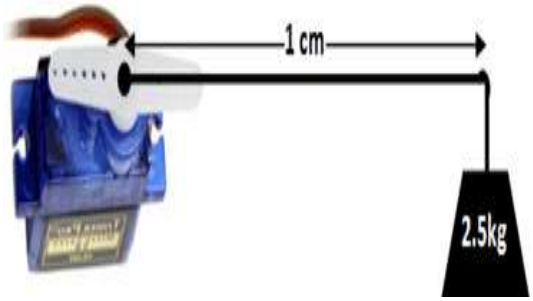

Fig: SG90 Servo Motor

LED:

Electrical equipment frequently uses light-emitting diodes (LEDs) as a conventional source of illumination. It can be used for a variety of things, including mobile phones and huge billboards for advertising. They are typically used in gadgets that display various forms of data and display the time.

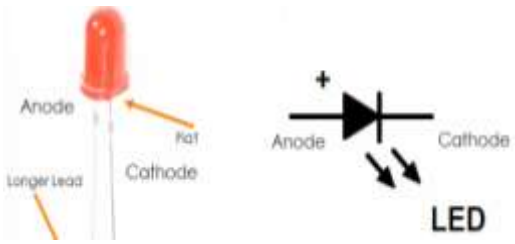

Fig: LED

When an electric current passes through a semiconductor device called a light-emitting diode (LED), the LED emits light. When current flows through an LED, the electrons and holes recombine and produce light. LEDs only let current flow in one direction—forward—and stop it from going the other way.

III. PROPOSED SYSTEM

First, designers place each component in its proper location to ensure proper operation. Two IR sensors, two servo motors, and a distance dependent on the length of the train are installed on either side of the railway track. The track railway gates are initially in the open position.

First, an IR sensor will detect the arrival of a train on the railway track and provide an output signal. If no trains are arriving on the opposite side, the sensor will not generate a signal. If there is any signal produced when the Arduino

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receives two signals from two sensors, the PWM signal is sent to the servo motors. The gate closes as a result of the servo motors turning on. The buzzer's beep-beep sound and the RED LED's activation at this point indicate that a train is approaching.

The second sensor will generate the output signal when the train approaches the level crossing and passes in front of it, but the first sensor will not do so because there are no train detections on the other side. The Arduino will send the servo motors a PWM signal when it receives data from two sensors. The servo motors return to their initial position as a result, and the gate opens on its own. This time, the buzzer will stop and the LED will glow in a yellow signal. That indicates the train has left.

Two IR sensors are not detected if neither of them produces any signal. The gates are in the open position in this situation, and the buzzer will cease while the yellow LED turns on.

IV. HARDWARE EXPERIMENTAL RESULT

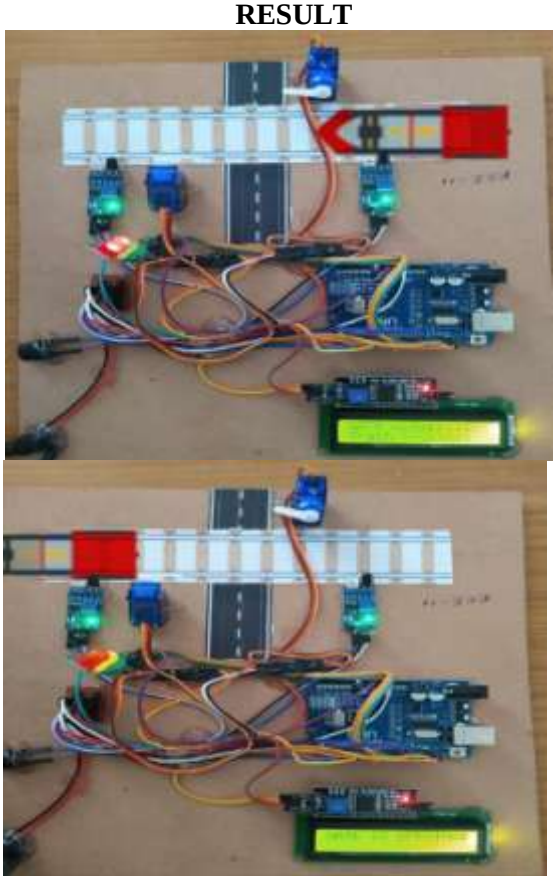

Fig: Working Condition

V. CONCLUSION

The suggested methodology has made sure that people are safe in places like train crossings in urban and rural locations. Servo motors and sensors, such as infrared and ultrasonic detectors, operate in concert to detect when an object, vehicle, or train passes the gateway and take the necessary action, such as opening or closing the gate, in order to decrease accidents at railroad crossings. The sensors are positioned at a realistic distance from the gateway so that there is adequate warning before the arrival or departure of the train. At this point, a servo motor can be used to close or open the gateway[12].

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