Smart Railway Platform Control using IR Sensors

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ABSTRACT

Nowadays, public safety is of utmost importance in human life, and technology can play a significant role in achieving it. Smart Railway Platform (SRP) is an innovative automation technique that aims to minimize accidents caused by overcrowding in overhead bridges, elevators, and other modes of transportation. Poor construction quality, heavy crowds, and adverse weather conditions are the main reasons behind such accidents.

Unfortunately, many people violate railway rules by crossing tracks in a risky manner. While it may seem quicker to cross the tracks, it is highly dangerous and can cost lives. To address this issue, we propose the development of a sliding platform fixed under the main platform, which can be used to cross the tracks safely. However, this platform needs to be developed extensively.

To ensure that the tracks are in good condition, we have installed cameras that constantly surveil the rail network in real-time. However, the disadvantage of using image processing in real-time is that it cannot be used during bad weather conditions. Therefore, to overcome this limitation, we have researched and developed an array of IR transmitters and receivers that can detect obstacles. If there is a break in the signal, it indicates the presence of an obstacle. When the IR sensor detects a train, it activates a motor that moves the sliding platform. The entire system is controlled by an Arduino, and the motor is operated by a relay circuit board. To prevent system failure, the station master can control the system.

This system is especially beneficial for disabled individuals who can now cross the tracks without assistance. In conclusion, this innovative technology has the potential to revolutionize the future of railway platforms, leading to a safer and more convenient experience for everyone.

Keywords: Arduino, IR Sensor, DC Motor, Channels, Relay, Circuit Board

I. INTRODUCTION

The current railway systems in India are not fully automated and rely heavily on manual operations. Moving from one platform to another in railway stations often requires using bridges or staircases, which can be challenging for handicapped or elderly individuals. Lifts and escalators are present, but they may not be convenient or time-efficient for older people or those with disabilities. Some people even cross the railway tracks directly, which is risky and dangerous. Additionally, there is often a gap between the train door and the platform, which can result in accidents, as it is influenced by construction tolerances, track movement, and train type.

To address these issues, we propose the idea of an artificial bridge that can be used by older individuals and those with disabilities to move between platforms easily. This artificial bridge would eliminate the issue of the gap between the train door and the platform by using a smart door system, allowing passengers to exit the train safely. The proposed system would be based on microcontroller technology and a gear motor mechanism to operate the platform bridge. The recent social analytics survey indicated that climbing overhead steps is a significant disadvantage for physically challenged individuals in Indian railways, and our proposed system aims to rectify this issue.

The existing system relies on direct braking applied to trains, which can cause delays due to the time it takes for the poles to interchange. Manual braking is used to avoid collisions, but it may not be effective if not noticed by the train driver. Additionally, switching tracks and adjusting train timings is a time-consuming process. There is currently no artificial platform to minimize the distance traveled between platforms, adding to the inconvenience for passengers.

We propose the use of three IR sensors, a servo motor, and an Atmega16 microcontroller for controlling and executing the artificial railway platform system. By implementing this system, we aim to improve the accessibility and safety of railway stations for physically challenged individuals and older passengers.

II. PROBLEM STATEMENT

Nowadays, people are crossing railway platforms by jumping over railway tracks because they believe it's a quicker way to cross. Unfortunately, many people who try to cross this way end up getting injured in various ways. This issue isn't just limited to those who try to cross the tracks but also affects elderly people who need to use the skywalks, which take more time to cross the platforms. It has been observed that building or constructing skywalks requires a significant capital investment, which doesn't guarantee the quality of the infrastructure. As a result, many people climb these structures and risk their lives by jumping from them.

III. WORKING PRINCIPAL

A. OPERATION:

In railway systems, bridges are often used to cross tracks. However, it can be very difficult for elderly or handicapped individuals to use these bridges. The proposed system uses sensors to detect when a train is approaching, which is then used to automatically close or open the platform. Sensors are placed on both sides of the tracks to detect the motion of the train. This eliminates the need for people to use stairs, making it easier for elderly individuals to cross.

The microcontroller uses IR sensors to detect the presence of trains. When a train is detected on one path, the controller sends pulses to the motor to close the slide automatically. The slide has a red/green signal indication so that pedestrians can know whether or not they can use the bridge. The signal automatically turns red when a train is approaching and turns green once the train has left the station.

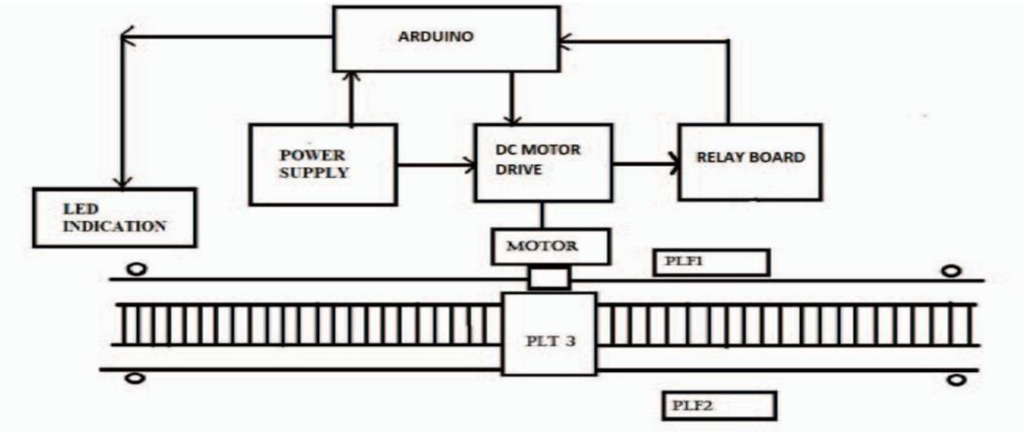

Figure 1: Block diagram of proposed model

B. IR PHOTO DIODE SENSOR:

An IR sensor is a device that detects infrared radiation that falls on it. It consists of both an IR LED and a photodiode, which together are commonly referred to as a photo coupler or an opto-coupler. The IR LED emits IR radiation, and the sensor's output is determined by whether or not this radiation is received by the photodiode. There are various factors that may affect whether or not the radiation is able to reach the photodiode.

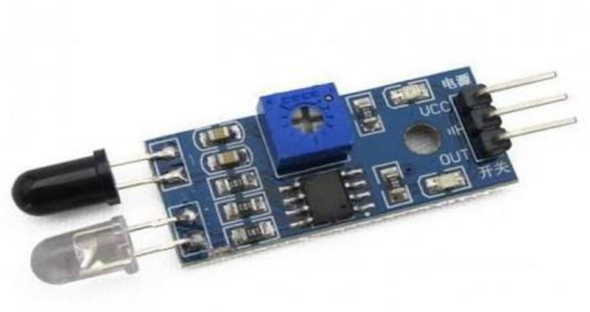

Figure 2: IR Sensor

C. DC MOTORS:

DC motors, or direct current motors, are electric motors that convert direct current electrical energy into mechanical energy. They operate through the interaction between the magnetic field of the motor's rotor and the magnetic field of a fixed stator. DC motors are commonly used in a wide range of applications, including in vehicles, industrial equipment, robotics, and consumer electronics. They come in various sizes and types, including brushed and brushless DC motors, each with their own advantages and disadvantages. Brushed DC motors are generally simpler and less expensive, but they require regular maintenance, while brushless DC motors are more efficient and durable, but are typically more expensive.

Figure 3: DC Motor

D. MICROCONTROLLER:

The Intel 8501 microcontroller is a type of microcontroller that operates on 8 bits, meaning that most of its operations are limited to 8 bits. There are three different sizes available for the 8501: short, standard, and extended. The short and standard models are often available in a DIP (dual in line package) form, while the extended models may have a different shape and may not be compatible for direct replacement. All these models can be programmed using the 8501-assembly language. Some of the reasons for the 8501's popularity are its 4kb on-chip program memory and 128 bytes on-chip data memory (RAM).

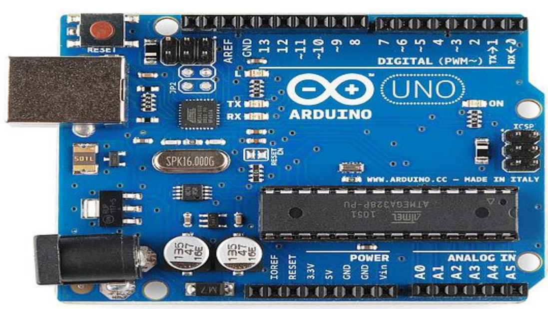

Figure 4. Microcontroller

E. BATTERY:

This circuit is designed to charge a 12V battery by regulating the voltage to a specific level, known as the absorption voltage. Once the battery reaches the maximum charging voltage, the charger adjusts the output voltage to maintain the battery at a steady voltage, which is referred to as the float voltage. This helps to prevent overcharging and damage to the battery, ensuring that it remains charged and ready for use. The power source for this charging circuit can be either a battery or an external power supply.

Figure 5: Battery

F. FLOW CHART:

i) Operation A

The data flow diagram shows how data is transmitted from the hardware to the user interface. The user starts the application, connects to a Wi-Fi network, and the sensors transmit their values to the server and cloud. The data is then accessible to the user via a web application for monitoring and management of the system.

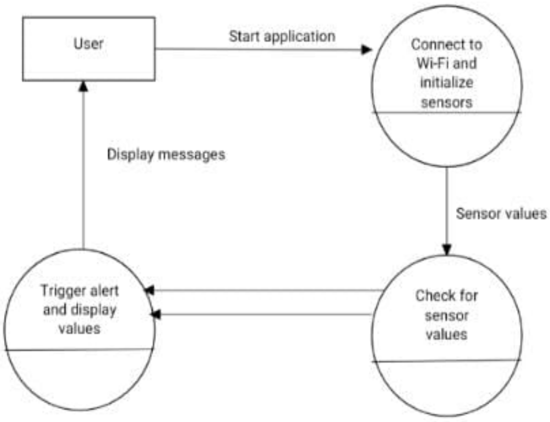

Figure 6: Flow chart 1-Dataflow Diagram

ii) Operation B

1) The IR sensor is triggered when the train moves on the railway track.
2) The system detects the arrival of the train on the railway track.
3) The motor is activated, and it blocks the path for people to cross the track.
4) The motor stays turned off until the other IR sensor detects the train moving away from the track.

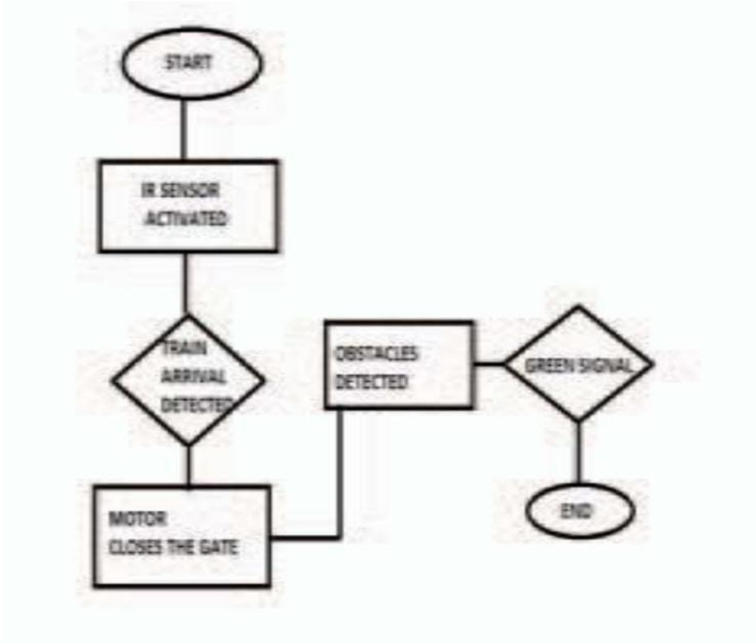

Figure 7: Flow chart 2-opening of gate

iii) Operation C:

1) The IR sensor on the opposite side of the railway station senses when a train moves on the railway track.

2) Once the train has left the station, the motor is controlled by the Arduino. The motor then opens the pathway for people to move between platforms.

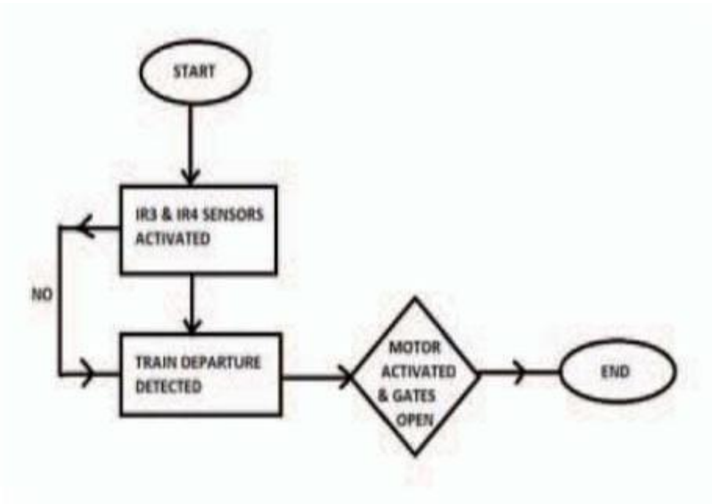

Figure 8: Flow chart 3-Closeing of gate

IV. IMPLEMENTATION

1. Initial signal display

At a railway crossing, there are two signals, S1 and S2, placed 5 kilometers on either side of the gate. Near the gate, there are two servo motors to automatically open the gate. To indicate that the gate is open and vehicles are passing through, all four signals are made red, regardless of the direction of the approaching train. The signals for road users are made green to allow them to move through the gate safely.

2. Train arrival detection

To detect the arrival and departure of a train, two IR sensors are needed: Infrared1 for detecting the train's arrival and Infrared2 for detecting its departure. Once the arrival of the train is detected, the system will close the gate immediately.

3. Gate closing operation

When there are no vehicles inside the gate, the sensor near the servo motor detects this and sends a signal to operate the motor through the circuit. This causes the gate to close to allow the train to cross. However, if an obstacle is detected, the controller signals the presence of the obstacle and the path is cleared. Once the path is cleared, the servo motor closes the gate.

4. Signal for train

When there are no obstacles detected inside the gate or the path is clear, a GREEN signal is used for the train. However, if an obstacle is detected, a RED signal is used to signal the train to slow down its speed before reaching a distance of 5 km from the gate. Another signal is placed at a distance of 180 meters before the gate, and if it is still showing RED when the train approaches, it should come to a complete stop.

5. Gate operation

When the sensors detect the arrival or departure of a train, a signal is sent to the microcontroller. The microcontroller then operates the servo motor in the opposite direction, causing the gate to open. Once the gate is open, a green signal is displayed for road users, indicating that they can safely pass through the gate.

V . CONCLUSION

The proposed system is highly reliable and can prevent loss of life by using Internet of Things technology and an IR sensor-based system. The system is designed to automatically open and close the gate without any human intervention, and it can also detect faulty railway tracks automatically without human involvement. The proposed system has many advantages over the traditional system, including lower cost, higher accuracy, lower power consumption, shorter analysis time, and the ability to centrally manage everything using Internet of Things technology. Additionally, the system can help to locate the exact location of the faulty track using a hosted website, thereby helping to save many live

VI. REFERENCES

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