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Smart Railway Gate Level Crossing System

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I. INTRODUCTION

In the current context, railway safety has emerged as the global railway industry's most crucial factor. Considering that trains are operated by humans, accidents are likely to occur even if they are the least expensive form of transportation. Indian Railways has 30348 level crossings all around the nation. Out of the 303048 level crossings, 18785 are man-handled and 11563 are not. The corresponding Zonal railways of Indian Railways have removed 4792 level crossings in the last five years in order to prevent accidents. The Indian Ministry of Railways decided to focus on removing all level crossings in order to provide automatically regulated railway revenues. At level crossings, the suggestedtechnique aids in achieving safety and preventing accidents.

Railway safety is currently the most important factor in the entire rail industry worldwide. Although it is well known that trains are the most financially feasible mode of transportation, accidents frequently occur due to the requirement for human intervention. The Indian Railways have 30348 level crossings spread throughout the country. 18785 level crossings out of a total of 303048 require human intervention, while 11563 do not. Indian Railways' regional divisions have removed 4,792 hazardous level crossings in the last five years. The Indian Ministry of Railways decided to eliminate any level crossings that could be operated automatically because railway funds were available. The suggested technique can help prevent accidents and guarantee the security of unattended level crossings. It is always preferable to enhance the signaling system and the manner in which individuals are alerted to potentially hazardous situations when it comes to both public and private safety. When deciding which tracks to assign trains to, the current conventional signaling system frequently uses oral communication from telephone and telegraph conversations as input. A significant opportunity for misinterpretation exists because human intervention in the system is more prevalent. The old railway system warns people about an approaching train at railway crossings by using human-operated gates and warning lights. When the train departs the station, the station agent uses the telegraph and phone to notify the gatekeeper of the train's arrival. One transitional mode that is crucial for transferring both people and freight is the railroad. However, compared to other transportation incidents, railroad-related accidents are more deadly. Consequently, greater work is required to increase its safety. This system uses a microprocessor to control the railway gate control system. In order to reduce railroad-related accidents and increase safety, the primary goals of this system are the level crossing between the train and the highway and the railway gate control system. Additionally, it increases road user safety by lowering the number of accidents that typically result from negligent drivers and mistakes made by gatekeepers. The least expensive kind of transportation was the one that railroads favoured over all others. The PIC16F877A microcontroller is used in this system's architecture to prevent railway

II. EXISTING SYSTEM

The railway gate operator in India operates the railway crossing stations by hand. It is the duty of the railway gate operator to operate the gates in accordance with the arrival and departure of trains. Through the use of communication equipment, the gate operator receives information about the arrival and departure of trains. The current approach is incredibly prone to error, which increases the number of accidents at railroad level crossings. When a train departs a crossing station, information about the train is transferred across crossing systems. Due to several flaws in the current system that the Indian Railways use, level crossings see over 50% of train accidents. The Indian railway system's approach is unsafe and is leading to an increase in accidents every year.

III. PROPOSED SYSTEM

Our suggested system is dependable and has the potential to decrease the frequency of accidents at railway level crossings as well as the amount of time that cars must wait at crossing stations. We use infrared sensors in our system; one pair of these sensors is used to detect train arrival in both directions, while the other pair detects train departure in both directions. In India, a variety of rail types, including express, cargo, and passenger trains, operate on the railway tracks on a regular basis. A train's top speed is roughly 97 km/h, and its lowest speed is about 50 km/h. Taking into account all train types and speeds, the ideal distance to detect the train.

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IR sensors, motors, LED signals, a buzzer, and an Arduino Uno make up the system. additionally, the arrival and departure of the train is detected by the IR sensors. The railway gates are opened and closed byservo motors. At railroad crossings, LED lights serve as traffic signals, and buzzers alert passing cars to the approaching train. The proposed system uses an ultrasonic sensor to detect train arrivals, which is placed seven kilometres from the railway crossing. The arrival sensor sends a signal to the microcontroller, which then proceeds to perform the following operations sequentially. A buzzer alerts passengers at the level crossing.

IV. BLOCK DIAGRAM

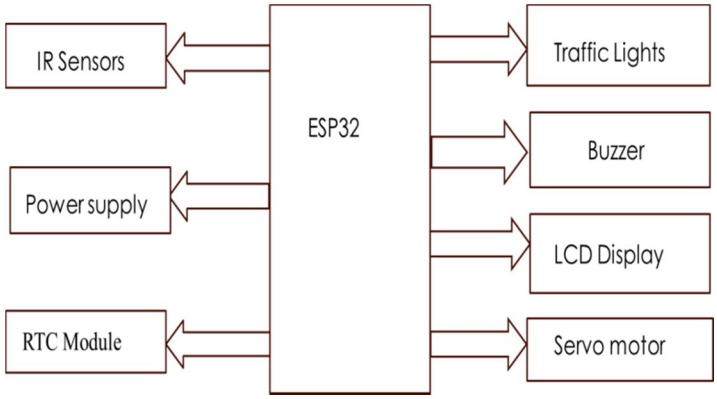


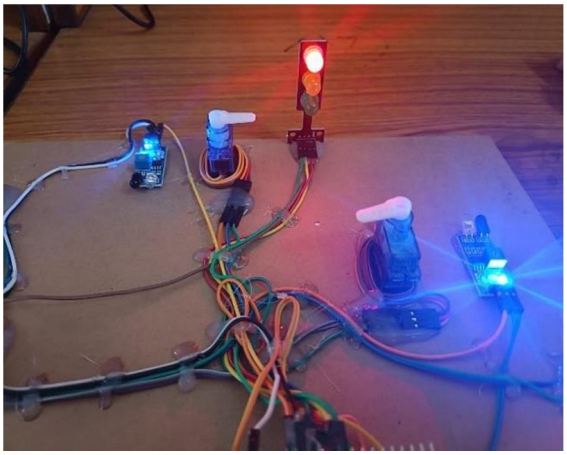
Fig 1 Block diagram

The planned system uses sensors to identify when the train arrives and departs.To regulate the arrival and departure oftrains, the system makes use of three separate sensors. The sensors areprogrammed using Arduino. as displayedin Fig. 1, the functional diagram of oursuggested model. The automatic gateway control system that is being suggested usesthe following materials and parts. The block diagram in Fig. 1 illustrates how our suggested system operates. wherein a Servo Motor and an IR sensor are connected via an Arduino. The servomotor in the proposed model monitors the crosswalk, and infrared sensors are utilizedto track anything moving in the vicinity of the crosswalk. When the sensors pick up motion or a train.

V. IMPLEMEMTATION RESULTS

1) Case: 1 When train arrival is detected.Train Detection

Ir sensor detected the train and it sendsmessage to ESP 32 to close the gates .The yellow led is enabled indicating the closingof gates flowed by the red led light and thegates are closed.The buzzer is also enabledindicating the closing of gates.


Fig: 2 Detecting of an trainDisplay on LCD Screen

Intially the lcd screen diaplays the time butthe gates are close it diaplays the gate closing message and the precautions to notcross the gates when they are closed.



Fig:3 Gate is closing

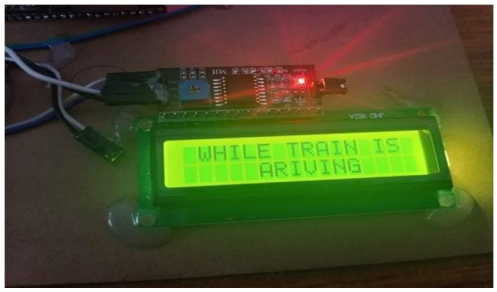


Fig: 3 Train Arrival



Fig:4 Instructions

2) Case 2: When the Train Departure isDetected

a) Train Departure Detection

The IR Sensor at the other side of the levelcrossing detects the departure of the train and it sends message to ESP 32 to open the gates . The green led light is enabled indicating the opening of gates and thegates are opened. The buzzer is alsoenabled indicating of opening of gates.

b) Display on LCD Screen

The LCD Screen displays the gates opening message and after that it displays a happy journey message creating positive environment.



Fig:4.6: Opening of Gate



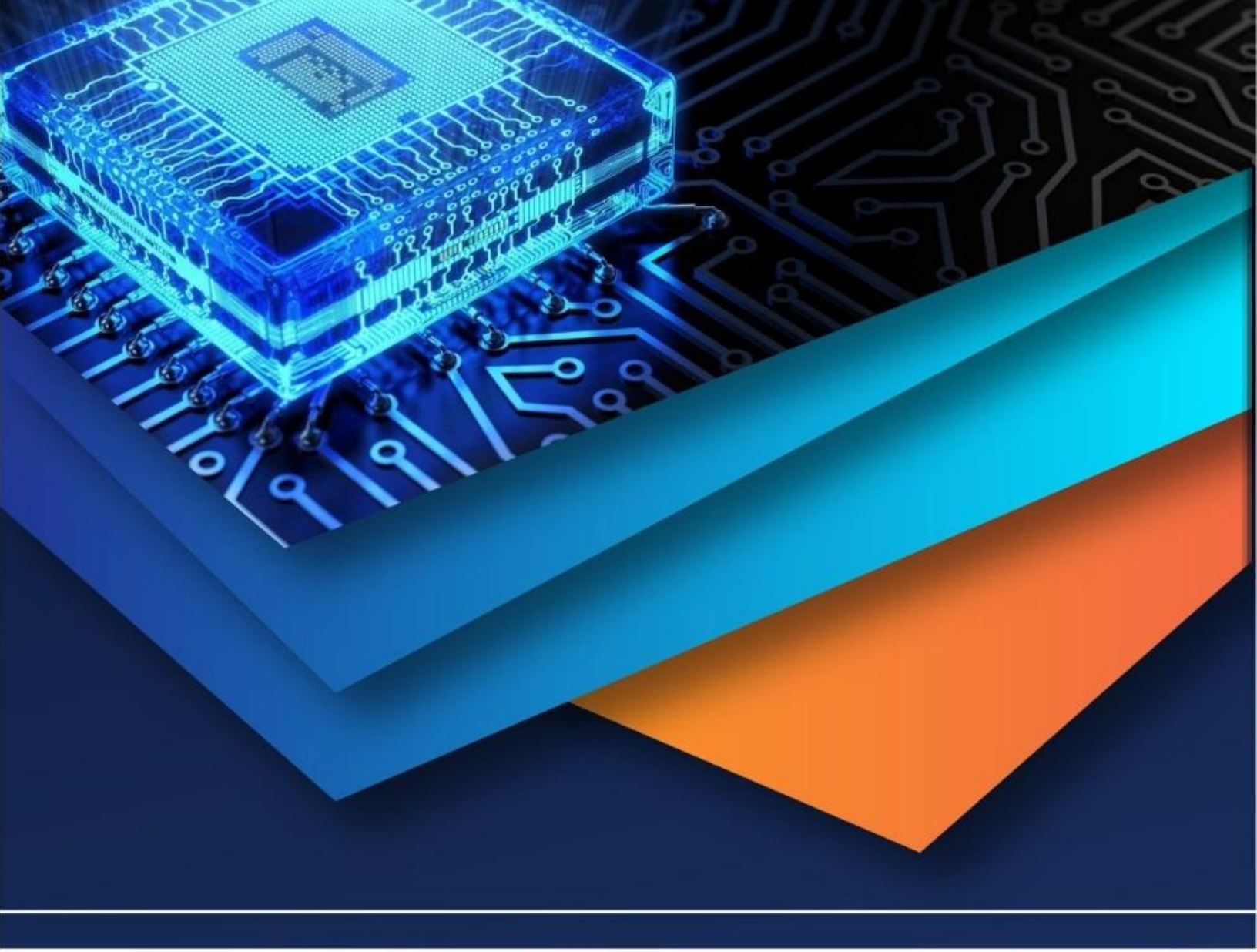
Fig: 4.7: Train Departure

VI. CONCLUSION

The proposed model successfully made human safety possible in areas like railwaycrossing nearby rural as well as urban areas. The servo motor and sensor like IR Sensor processes combinable to make asystem 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.

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