REVOLUTIONIZING RAILWAY SAFETY: IOT-DRIVEN AUTOMATION OF RAILWAY CROSSING GATES

#1KOTICHINTHALA NEETHIKA,
Assistant Professor
#2ATHIKAM SAIMOUNITHA
#3CHILUVERI DEEKSHITHA
Department of Electronics & Communication Engineering,
SREE CHAITANYA INSTITUTE OF TECHNOLOGICAL SCIENCES, KARIMNAGAR, TS.

ABSTRACT: The "Internet of Things" (IoT) is a network of things linked together by technologies such as RFID and sensors. In a networking environment, these devices with unique addresses send and receive data via standard protocols such as User Datagram Protocol (UDP), Internet Control Message Protocol (ICMP), and Transmission Control Protocol (TCP). In this situation, technologies communicate without the need for human intervention. The purpose of this project is to design an automated train gate controller that may be deployed at level crossings to eliminate the requirement for a gatekeeper. This controller reduces the frequency of accidents caused by negligent drivers and guards. This improves road safety for everyone and reduces the time the gate is closed. Furthermore, an additional module has been introduced to make things easier for tourists. Guests must provide their phone number so that the website may send them notifications when they arrive at their location. This system is reasonably priced, operates in real time, and is entirely automated.
Keywords:*Sensor,IOT,Control*

I. INTRODUCTION

The train system is a low-cost and popular mode of transportation in India and many other nations. Currently, India boasts the world's largest train network. Every day, thousands of trains run along the tracks. Certain horrible difficulties or scenarios that occur while trains are in motion are beyond the railway network's control. Every year, around 40,000 people are killed at railroad crossings. Many countries still use outdated crossing systems, making new technology at train crossings unsafe, time-consuming, and difficult to prevent accidents. As a result, train accidents can have disastrous consequences, including fatalities, significant injuries, and damage to railroad infrastructure. The primary causes of these mishaps are train fires and strikes at railroad crossings. A railroad crossing is also known as a level crossing. It's where a road crosses a train track. Accidents can occur if people do not open and close the gates. These accidents can result in death, injury, or property damage. The purpose of developing a new IoT-based autonomous train gate control system is to reduce the number of mistakes that individuals make while operating the gates. The Internet of Things (IoT) is a global network of devices connected by radio frequency identification (RFID), motors, and sensors. The Internet of Things is currently employed in practically every industry, including business, manufacturing, agriculture, and environmental monitoring [7, 8]. It is also used in medicine to monitor patients' vital signs and diagnose disorders such as glaucoma [9, 10].

II. RELATEDWORK

Xishi et al. provided a comprehensive overview of the rail safety system. The authors of this work describe how a fault tolerance strategy was utilized to develop both the software and hardware components of ATSS. In Korea, automated train gates were gradually used. Accidents at level crossings decreased dramatically when Korea implemented a railway gate automation system with magnetic sensors. Magnetic devices were installed in the ground to maintain track of the trains. Still, this system does not provide passengers with destination alerts and is not cost effective.

Acy et al. address a timely issue. The authors of this study devised a novel and low-cost method of improving train level crossing safety. The approach described uses microcontrollers. The gate is controlled by infrared sensors and an ATmega 16A computer, which ensures that it opens and closes at the appropriate times per train. Passengers cannot receive destination-specific alerts using this way.

Ahmed et al. devised a mechanism to automate train gates at level crossings. The device was built using a microcontroller known as the 8052. The primary purpose of this study is to reduce the number of accidents at rail level crossings. The train's arrival was detected by two sensors, one on either side of the gate. There are two devices ahead of the train's path. They are referred to as the "fore-side sensor" and the "after-side sensor." As soon as the foreside sensor sensing train passes, the active sensor sends a signal to the microcontroller 8052. After that, the computer automatically closes the gate until the train reaches the side sensor. At that moment, it returns to being

DOI:10.48047/intjecse/v13i2.21217 ISSN: 1308-5581 Vol 13, Issue 02 2021

closed. When the side sensors detect the train, they alert the microcontroller that it is leaving. The gate opens when the computer turns the motor in the wrong direction.

Hnin et al. suggested a better technique to operate automatic railroad gates . The suggested system includes a DC motor, LCD screen, PIC 16F877A microprocessor, infrared sensors, an alarm, and a light indication. The LCD panel displays whether the railroad gate is open or closed. The lights and buzzers alert you when the train is approaching behind you. Infrared cameras monitor train arrivals and departures. These devices are located on both sides of the gate. Similarly, this method uses a DC engine to regulate the gates autonomously. DC motors may turn clockwise and counterclockwise.

Chellaswamy et al. demonstrated how detectors, GPS, and GSM can be utilized to operate train gates. The authors discussed how GPS and GSM can be utilized to control level crossings. The authors of this study combined a GPS monitoring system with a GSM (Global System for Mobile Communication) modem to improve gate shutting at level crossings. Detectors monitor train arrivals and departures and convey that information to the next crossing. The application results demonstrate the system's speed, precision, adaptability, and durability.

Karthik et al. described a method for controlling how gates at train level crossings open and close automatically. In most nations where guards are in charge of the gates, level crossing gates remain closed for extended periods of time due to late trains, causing a large amount of traffic to pile up around them. The researchers employed infrared obstacle recognition sensors to track the trains as they passed through the railroad level crossing. The authors utilized an Arduino board to regulate the gates' opening and closing.

ProblemStatementandObjectives

Here are several issues with the existing system:

Most authors employed microcontrollers to develop these systems. Unlike microprocessors, microcontrollers have a more sophisticated architecture.

2. System development takes longer as circuit boards and designs get more complex.
3. It's expensive, difficult to construct, and lacks location notification functions.
4. Be careful with the Arduino Board, as it is easily broken.

To address the issues raised above, we devised a novel solution that employs a Raspberry Pi 2 and an RFID reader to regulate train gates autonomously and notify passengers of their location. The Pi is a low-cost, fast quad-core ARM Cortex A7 (ARMv7 instruction set) microcontroller that operates at 900MHz. An RFID reader's job is to notify individuals of their current location. The inclusion of a computer to this system reduces its cost and improves its energy efficiency compared to its predecessor.

The recommended method was utilized to complete the following two jobs.

When there is no one to open or close the gates at a level crossing, automatic train gates take over.

2. When the passengers arrive at their chosen station, an automatic message is sent to the phones linked to their accounts.

III. SYSTEM DESIGN

Indian freight and passenger trains may reach speeds of up to 91 km/h and slow down to 59 km/h. As a result, the optimal location for infrared (IR) sensors to detect a train approaching is between 6 and 7 kilometers from the level crossing, with 2 to 3 kilometers between each sensor. As a result, the gate will not be closed for more than ten minutes.

The proposed system includes four infrared sensors that can detect the train, a servo motor that controls traffic, an RFID reader that delivers alerts or alarms, and LEDs that manage traffic. Figure 1 shows the Raspberry Pi board connected to a variety of devices. All of these components are managed and controlled by the Raspberry Pi's own application. After scanning the train's ID, the RFID reader transmits the time, date, and RFID number to a central computer via the internet. As soon as the central computer receives data from the Raspberry Pi, it calls each phone number registered for training based on the RFID number.

International Journal of Early Childhood Special Education (INT-JECSE)
DOI:10.48047/intjecse/v13i2.21217 ISSN: 1308-5581 Vol 13, Issue 02 2021

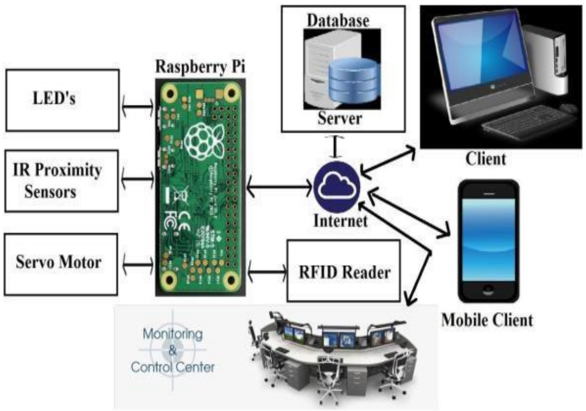

Fig.1. General Architecture of Proposed System

An infrared proximity sensor can detect whether a train or other object is nearby, even if they are not in contact. An infrared proximity sensor emits an electromagnetic field, commonly known as a beam of electromagnetic energy. It then checks to see if the field has changed, sending a signal if it has. Infrared sensors are used in the proposed system. There are two on the left, two on the right. The train's approach will be detected by sensors on the left. The distance between the first and second infrared cameras and the station or cross section is 10 and 7 kilometers, respectively. The two cameras are separated by three kilometers. Similarly, the train's departure time is determined by deploying the appropriate sensors. An LED is a light source built of semiconductors with two leads. When activated, this pn junction diode generates light. By providing the appropriate voltage to the leads, electrons and electron holes can recombine within the system, resulting in the release of energy in the form of photons. This is known as electroluminescence. The suggested design includes a pair of LEDs labeled red and yellow. When the train departs, yellow LEDs glow, and when the train comes, red LEDs illuminate.

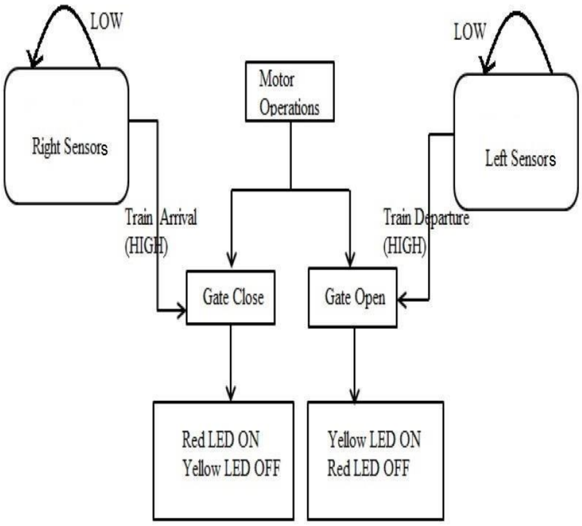

Fig.2. Data Flow Diagram for Gate Operations and LEDs Operations

Figure3showstheDataflowdiagramfordestinationsatiationnotification.RFIDreaderisplacedfewkilometersawayfromthestation.Initially,the details of journey entered by the passenger are stored in the database.When the trainis detected by RFID reader,the server fetches the all phone numbers registered to the upcomingstation then serverwill send the destination alertmessageto retrievedphone numbers.

The Algorithm for opening and closing of the gate is asfollows.

Step1: Start.

Step2: Activate all yellow LEDs and infrared sensors..

Step 3: Check the status of the right infrared sensors.

Step 4: Proceed to Step 5 if the train's two right infrared sensors are operational; otherwise, return to Step 3.

Step 5: After the red LED (vehicle cease signal) lights up and the yellow LEDs turn off, operate the motor to close the gate.

Step 6: Check the status of the left infrared sensors.

Step 7: If both left infrared sensors are illuminated in anticipation of the train's leaving, continue to Step 8; otherwise, return to Step 6.

Step 8: Communicate with the motor to open the gate. When the motor opens the gate, Pi illuminates the yellow LEDs used as the vehicle's turn signal. Continue with Step 3.

International Journal of Early Childhood Special Education (INT-JECSE)
DOI:10.48047/intjecse/v13i2.21217 ISSN: 1308-5581 Vol 13, Issue 02 2021

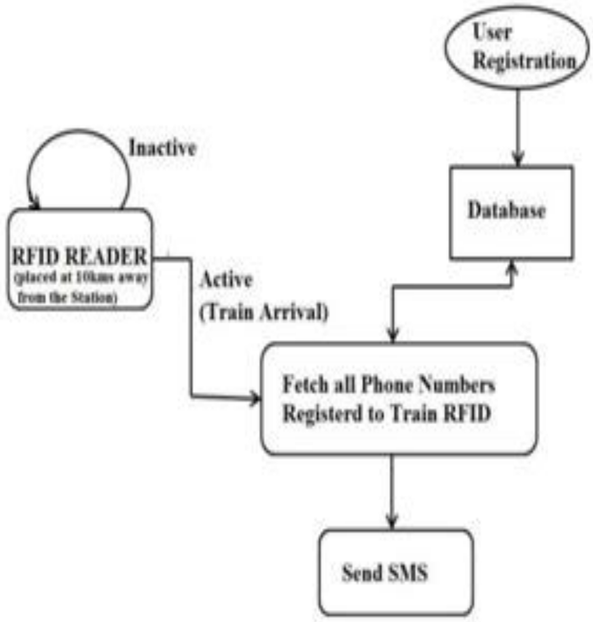

Fig.3. Data Flow Diagram for Destination Notification

Step1: Start.
Step 2: Accessing the online application requires only the traveler's name, phone number, email address, and password. A voyager can register for the destination alert system numerous times by using the same email address and password. If the registration procedure is successful, proceed to Step 3; otherwise, an error message will appear and you will be returned to Step 1.
Step 3: To log in, enter your email address or phone number, then your password.
Step 4: Step 5 is only accessible to individuals whose login credentials exactly match the information provided during registration. Failure to do so will result in the display of an error message and a return to Step 3.
Step 5: By entering the source and destination stations, the date of travel, and the train RFID number, one can generate a database record and send an alert message.
Step6: Stop.
The methodology described below is used to transmit the target station alert message.
Step1: Start.
Step 2: Configure the RFID reader (an RFID tag is attached to the train).
Step 3: Configure the RFID reader (an RFID tag is attached to the train).
Step4: Using the trip date and RFID number, the central computer obtains all phone numbers associated with the aforementioned train. Distribute the message to all phone numbers.
Step5: End.

IV.RESULT AND ANALYSIS

Figure 6 shows the created model. It consists of the following components: a Raspberry Pi, a level crossing, an RFID reader, a railway track, three handsets, left and right sensors, LEDs, and a gate controller. All of these devices are coordinated and managed by the Pi device. Each device connects to one of the Raspberry Pi's GPIO pins and is linked to a server or central system via a LAN.

DOI:10.48047/intjecse/v13i2.21217 ISSN: 1308-5581 Vol 13, Issue 02 2021

V. CONCLUSION

Implementing an automatic gate control system based on the Internet of Things is a cutting-edge and effective way to reduce the incidence of train accidents. This technique provides significant benefits to both railroad administration and road users. Every component of the system is automated. As a result, this technology can be used in remote areas where there are no line workers or station supervisors. Infrared sensors are installed at both ends of the gate. This system uses sensors to monitor train arrivals and departures. This method uses a stepper motor to automatically open and close the gates. Many passengers will be uninformed of the location of their last destination. As a result, prior to covering a few kilometers, the user receives updates about the destination station via the proposed destination alert system. Finally, it is determined that the suggested system performs better, is more reliable, and costs less than existing systems.

REFERENCES

1. XishiWang,NingBin,andChengYinhang.Anewmicroprocessor based approach to an automatic control system,International Sym- posium on Industrial Electronics, pp. 842-843,1992.
2. Acy M.Kottalil,AbhijithS,AjmalM M, AbhilashLJ, AjithBabu. Automatic Railway Gate Control System,InternationalJournalOfAdvancedResearchInElectrical,ElectronicsandInstrumentationEngineering,Volume 3,Issue2,February2014.
3. Ahmed Salih Mahdi, Al-Zuhairi. Automatic Railway Gate and Crossing Control based Sensors and Microcontroller,INInternationalJournalofComputerTrendsandTechnology(IJCTT)Volume4Issue7July2013.
4. Hnin Ngwe Yee Pwint, Zaw Myo Tun, Hla Myo Tun. Automatic Railway Gate Control SystemUsingMicrocontroller,InternationalJournalofScience,EngineeringandTechnologyResearch(IJSETR),Volume3,Issue 5,May2014.
5. Karthik Krishnamurthi, Monica Bobby, Vidya V, Edwin Baby.Sensor Based Automatic Control Of Railway Gates, International Journal of Advanced Research in Computer Engineering and Technology(IJARCET)Volume4Issue2,andFebruary2015.
6. ChandrappaS,DharmannaL,ShyamaSrivatsaBhattaUV,Sudeeksha Chiploonkar M, Suraksha M N, Thrupthi S,"Designand Development of IoT Device to Measure Quality of Water",International Journal of ModernEducationandComputerScience(IJMECS),Vol.9,No.4,pp.50-56,2017.DOI:10.5815/ijmecs.2017.04.06.
7. Chandrappa, Dharmanna Lamani “Segmentation of Retinal NerveFiber Layer in Optical Coherence Tomography (OCT) Images using Statistical Region Merging Technique for Glaucoma Screening” International JournalofComputerApplications(09758887)Volume128–No.10,October2015.