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# AUTOMATIC RAILWAY GATE CONTROL

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**ABSTRACT**

In place of the current system, which requires a human to operate the gates at level crossings, this study proposes an automated system that can identify when a train is halted, send out an alarm, and open or close the gate accordingly. A railway gate controller, an alarm module, a signal light module, a stuck detection module, a train detection module, and a controller module are all developed to give a solution. While the stuck detection module has one ultrasonic sensor, the train detection module only has four. The train detection and stuck detection modules use ultrasonic sensors to send out high-frequency signals; when these signals are reflected back to the sensors, they indicate the presence of an item. The controller unit then presses the appropriate buttons to activate the gate, alarm generator, and signal lights based on whether the obstruction is a train or stuck. The results of the experimental experiments demonstrate that compared to the current dominating work, the suggested technique produces a railway gate controller that is more cost-effective, dependable, and straightforward.

A level crossing alarm system that uses ultrasonic sensors to detect trains and other obstacles.

## I. INTRODUCTION

Because of the risks that could arise when train movements connect with those of vehicles and pedestrians, railway crossings provide serious obstacles to safety. To address these issues, an essential solution has been developed—the Automatic Railway Gate Control System—which uses ultrasonic sensors to improve efficiency and safety at railway crossings. By using state-of-the-art technology to identify incoming trains and enable the prompt closing of gates, this groundbreaking system signifies a sea change in the regulation of railway gates.

The system's nerve center is a network of ultrasonic sensors placed in close proximity to train tracks, which allow for long-range, pinpoint detection of train motion. These sensors keep a watchful eye on the railway environment and provide information on incoming trains in real time, like sentinels. The device saves lives by automatically closing railway gates the second it senses a train is about to arrive, protecting pedestrians and drivers from dangerous train accidents.

Using ultrasonic sensors allows the system to work reliably and accurately, responding quickly to train movements and reducing the likelihood of accidents at railway crossings. To further improve safety measures, the system may use real-time data processing to dynamically change the timing of gate closures according on the speed and closeness of incoming trains.

The Automatic Railway Gate Control System may also include feedback systems to make sure the gates were closed properly and then open them again when the train has safely gone through the crossing. Ensuring the smooth flow of railway traffic and prioritizing the safety of passengers and the general public is the goal of this iterative process.

Simply put, the Automatic Railway Gate Control System is a game-changer when it comes to railway safety technology. It takes a proactive stance in controlling railway crossings and reduces hazards. This system showcases the perfect combination of technological advancement and rail safety features, thanks to its use of ultrasonic sensors and automatic gate control systems. In order to

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maximize train traffic flow while maintaining the highest standards of public and passenger safety, the system is designed to run reliably and efficiently.

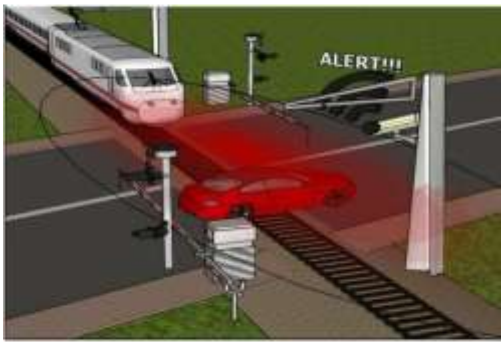


**Fig.1 : Vehicle stopped at a level crossing**

**1.1: Problem Statement:**

The problem statement for Automatic Railway Gate Control revolves around the safety challenges posed by railway crossings, where vehicular and pedestrian traffic intersect with train movements. Traditional manual gate control systems often suffer from inefficiencies and delays in responding to train arrivals and departures, leading to the increased risk of accidents and collisions at railway crossings. Additionally, the lack of real-time monitoring and automation mechanisms contributes to inconsistencies in gate closure timings, further exacerbating safety concerns. Furthermore, the growing volume of railway traffic and the complexity of managing multiple railway crossings simultaneously pose significant operational challenges for railway authorities. In light of these issues, there is a pressing need for an automatic railway gate control system that utilises advanced technologies such as ultrasonic sensors to detect train movements accurately and trigger timely gate closures, thereby enhancing safety and efficiency at railway crossings.

**1.2: Problem Scope**:

The scope of implementing an Automatic Railway Gate Control system using Ultrasonic sensors encompasses various aspects aimed at enhancing safety, efficiency, and reliability at railway crossings. Firstly, the system aims to address the critical safety concerns associated with railway crossings by automating the process of gate closure upon detecting approaching trains. By deploying ultrasonic sensors strategically positioned near the railway tracks, the system ensures accurate and timely detection of train movements from a distance, minimising the risk of accidents and collisions with vehicles and pedestrians. Additionally, the system's real-time data processing capabilities enable swift responses to train movements, ensuring efficient gate closure and reopening operations. Moreover, the scope extends to incorporating feedback mechanisms to verify successful gate closure and reopening once the train has passed safely, further enhancing the reliability and effectiveness of the system. Furthermore, the system's integration with modern technologies facilitates seamless operation and maintenance, contributing to overall operational efficiency and cost-effectiveness. By prioritising passenger and public safety while optimising railway traffic flow, the scope of the Automatic Railway Gate Control system using Ultrasonic sensors aims to revolutionise railway crossing management and ensure a safer transportation infrastructure for all stakeholders involved.

**Safety Concerns at Railway Crossings:**

- Railway crossings are critical points where vehicles and pedestrians intersect with railway tracks, posing inherent safety risks. Accidents, collisions, and fatalities can occur due to trains passing through unprotected crossings, especially in areas with high vehicular and pedestrian traffic.

**Manual Gate Operation Challenges:**

- Traditional railway gate control systems often rely on manual operation, requiring personnel to physically open and close the gates as trains approach and pass through. This manual process is prone to errors, delays, and human factors, leading to inefficiencies and safety hazards.

**Inadequate Detection Systems:**

- Existing detection systems at railway crossings may lack precision and reliability in detecting approaching trains. Inaccurate or delayed detection of train movements can result in untimely gate closures or failures to prevent vehicles and pedestrians from crossing the tracks safely.

**Traffic Congestion and Disruption:**

- Manual gate operation and unreliable detection systems contribute to traffic congestion and disruption at railway crossings. Delays in gate closure and reopening can lead to backlogs, delays, and gridlock on nearby roads, impacting overall transportation efficiency and public convenience.

**Limited Visibility and Awareness:**

- Poor visibility and inadequate warning signals at railway crossings pose challenges for drivers and pedestrians to perceive approaching trains. Insufficient awareness and signage may increase the likelihood of accidents and collisions, particularly in low-light conditions or adverse weather.

**Maintenance and Reliability Issues:**

- Traditional railway gate control systems require regular maintenance to ensure proper functioning and reliability. Mechanical wear and tear, environmental factors, and technical malfunctions can compromise system performance, leading to breakdowns and safety hazards.

**Regulatory Compliance and Standards:**

- Compliance with safety regulations and standards governing railway crossings is essential to ensure public safety and liability mitigation. Inadequate infrastructure, outdated technologies, and non-compliance with regulations may expose railway operators to legal and financial liabilities.

**Integration with Modern Technologies:**

- The integration of modern technologies, such as ultrasonic sensors and automated control systems, presents challenges in retrofitting existing railway gate control infrastructure. Compatibility issues, interoperability concerns, and the need for comprehensive system integration pose technical and logistical challenges for implementation.

**Cost and Budgetary Constraints:**

- Implementing automated railway gate control systems entails significant upfront costs for infrastructure upgrades, sensor deployment, and system integration. Limited budgets, funding constraints, and cost-benefit considerations may hinder the adoption of advanced technologies and safety enhancements at railway crossings.

**Community Engagement and Stakeholder Collaboration:**

- Engaging local communities, stakeholders, and regulatory authorities in the planning, implementation, and operation of automated railway gate control systems is crucial for ensuring public acceptance, support, and compliance. Collaboration with railway operators, transportation agencies, and government bodies is essential to address diverse stakeholder interests and concerns effectively.

**1.3: Advantages of Automatic Railway Gate control using ultrasonic sensors**

Automatic Railway Gate control using ultrasonic sensors offers several advantages:

**1. Enhanced Safety:**

By automatically closing railway gates upon detecting approaching trains, the system minimises the risk of accidents and collisions at railway crossings, ensuring the safety of vehicles, pedestrians, and train passengers.

**2. Real-time Detection:**

Ultrasonic sensors provide accurate and timely detection of train movements, allowing for

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swift response and gate closure to prevent unauthorised entry onto the railway tracks.

**3. Improved Efficiency:**

The automated operation of railway gates reduces reliance on manual intervention, leading to more efficient and streamlined traffic flow at railway crossings. This helps minimise delays and congestion, enhancing overall transportation efficiency.

**4. Remote Monitoring and Control:**

The system can be remotely monitored and controlled, allowing railway operators to manage multiple crossings from a centralised location. This improves operational flexibility and facilitates faster response to emergencies or system malfunctions.

**5. Cost-effectiveness:**

While initial implementation may require investment in sensor deployment and system integration, the long-term benefits of enhanced safety and operational efficiency outweigh the costs. Additionally, the reduction in accidents and associated liabilities can result in significant cost savings over time.

**6. Adaptability to Various Environments:**

Ultrasonic sensors are versatile and can be deployed in various environmental conditions, including adverse weather and low-light situations. This adaptability ensures reliable operation of the system under different circumstances.

**7. Integration with Other Systems:**

The automatic railway gate control system can be integrated with other railway infrastructure and signalling systems, further enhancing safety and coordination across the railway network.

**8. Compliance with Safety Regulations:**

By automating gate closure in accordance with train movements, the system ensures compliance with safety regulations and standards governing railway crossings. This helps mitigate legal and regulatory risks for railway operators.

**9. Public Confidence and Trust:**

The implementation of advanced safety measures, such as automatic gate control using ultrasonic sensors, instils confidence and trust among the public regarding the safety of railway crossings. This fosters positive perceptions of the railway system and encourages greater usage by commuters.

**10. Environmental Benefits:**

By reducing the likelihood of accidents and delays at railway crossings, the system contributes to the overall reduction of vehicle emissions and environmental pollution associated with idling vehicles waiting at crossings.

In summary, Automatic Railway Gate control using ultrasonic sensors offers numerous advantages, including enhanced safety, improved efficiency, cost-effectiveness, adaptability, compliance with regulations, and environmental benefits, ultimately leading to a safer and more reliable railway transportation system.

**1.4 Proposed Solution:**

The proposed solution for the Automatic Railway Gate Control system using Ultrasonic sensors integrates a combination of key components to ensure efficient and reliable operation. At the core of the system is the ultrasonic sensor network strategically positioned along railway tracks to detect approaching trains accurately. These sensors transmit ultrasonic waves and measure the time taken for the waves to reflect back, allowing for precise detection of train movements from a distance. Upon detection of an approaching train, the system activates a series of automated mechanisms orchestrated by the NodeMCU microcontroller. The NodeMCU processes real-time data from the ultrasonic sensors and triggers the operation of the servo motor to initiate the closure of railway gates swiftly. Additionally, the system incorporates LED indicators to provide visual feedback on gate status, alerting vehicles and pedestrians of impending closure. Furthermore, a buzzer can be integrated to emit audible warnings, enhancing safety measures at railway crossings. The feedback mechanism ensures gate closure verification, and once the train has safely passed, the gates can be reopened automatically. This comprehensive solution optimises railway traffic flow while prioritising passenger and public safety through its reliable and automated operation. By leveraging ultrasonic sensors, NodeMCU, servo motor, LED indicators, and buzzer, the system provides an effective means of managing railway crossings and minimising the risk of accidents, thereby enhancing overall safety and efficiency in railway transportation.

**1.5 Aim and Objectives:**

**Aim:**

This innovative system aims to enhance safety at railway crossings by promptly detecting approaching trains and initiating the closure of railway gates to prevent accidents and ensure the safety of vehicles and pedestrians crossing the tracks. By utilising a network of strategically placed ultrasonic sensors, the system accurately detects train movements from a distance, enabling swift responses to minimise the risk of accidents and enhance overall safety. Additionally, the system integrates real-time data processing capabilities to facilitate quick and efficient responses to train movements, optimising traffic flow and reducing congestion at railway crossings. Moreover, incorporating feedback mechanisms such as LED indicators and a buzzer enables the system to provide timely alerts and notifications to users about gate status, further enhancing safety and awareness. With its reliable and automated operation, this system aims to prioritise passenger and public safety while optimising railway traffic flow, ultimately providing a safer and more efficient transportation infrastructure.

**Objectives:**

The objectives of the Automatic Railway Gate Control system using Ultrasonic sensors are aimed at enhancing safety, efficiency, and reliability at railway crossings. By integrating ultrasonic sensors, NodeMCU microcontroller, servo motor, LED indicators, and buzzer, the system aims to achieve the following goals:

- **Enhance Safety:**

The primary objective is to ensure the safety of vehicles and pedestrians crossing railway tracks by promptly closing the railway gates upon detecting approaching trains. This proactive approach minimises the risk of accidents and enhances overall safety at railway crossings.

- **Optimise Traffic Flow:**

By automating the gate control process, the system aims to optimize traffic flow at railway crossings, reducing delays and congestion. Swift responses to train movements facilitate smoother traffic management and improve the efficiency of railway operations.

- **Provide Real-time Data Processing:**

Utilising real-time data processing capabilities, the system enables swift responses to train movements, ensuring timely gate closure and reopening as required. This enhances the reliability and efficiency of the gate control mechanism.

- **Incorporate Feedback Mechanisms:**

The system incorporates feedback mechanisms such as LED indicators and a buzzer to provide visual and audible alerts to vehicles and pedestrians about gate status. This enhances awareness and contributes to safer crossings.

- **Verify Successful Gate Closure:**

The system aims to incorporate feedback mechanisms to verify successful gate closure and reopen the gates once the train has passed safely. This ensures that the gates are properly closed and reopened in a timely manner, further enhancing safety and efficiency.

- **Prioritise Passenger and Public Safety:**

Ultimately, the system aims to prioritise the safety of passengers and the public by implementing a robust and efficient railway gate control system. By ensuring timely gate closure and reopening, the system minimises the risk of accidents and provides a safe environment for railway users.

In summary, the objectives of the Automatic Railway Gate Control system using Ultrasonic sensors focus on enhancing safety, optimising traffic flow, providing real-time data processing, incorporating feedback mechanisms, verifying successful gate closure, and prioritising passenger and public safety at railway crossings. Through the integration of advanced technologies and automated mechanisms, the system aims to revolutionize railway gate control and contribute to safer and more efficient railway operations.

## II. LITERATURE SURVEY

The literature on Automatic Railway Gate Control using Ultrasonic Sensors encompasses a wide range of studies, research papers, and practical implementations aimed at enhancing railway safety and efficiency. Researchers and engineers have explored various aspects of this technology, including sensor placement, real-time data processing, feedback mechanisms, and system reliability.

One key area of focus in the literature is the design and deployment of ultrasonic sensors for train detection. Studies have investigated the optimal placement of sensors along railway tracks to ensure accurate and timely detection of approaching trains. Researchers have examined factors such as sensor range, angle of detection, and environmental conditions to maximise the effectiveness of sensor-based detection systems.

Real-time data processing capabilities have also been a significant focus of research. Literature in this area highlights the importance of processing sensor data quickly and efficiently to trigger automatic gate closure mechanisms. Advanced algorithms and signal processing techniques have been explored to enable swift responses to train movements, thereby minimising the risk of accidents at railway crossings.

Additionally, the literature discusses the integration of feedback mechanisms into automatic gate control systems. Studies have explored the use of LED indicators, audible alarms, and other notification methods to inform vehicles and pedestrians about gate status. This feedback helps to enhance safety and awareness at railway crossings, reducing the likelihood of accidents.

Case studies and field trials have provided valuable insights into the practical implementation and effectiveness of automatic railway gate control systems. Researchers have documented successful deployments of these systems in various railway networks, demonstrating their ability to optimise traffic flow and prioritise passenger safety.

Overall, the literature on Automatic Railway Gate Control using Ultrasonic Sensors highlights the importance of leveraging advanced technologies to improve railway safety and efficiency. Through a combination of sensor technology, real-time data processing, and feedback mechanisms, these systems play a crucial role in ensuring the safety of vehicles and pedestrians at railway crossing.

## III. BLOCK DIAGRAM

The methodology for the Automatic Railway Gate Control system using Ultrasonic sensors involves several key steps to ensure its effective implementation and operation. Firstly, the ultrasonic sensors are strategically placed along the railway tracks, covering critical areas where train detection is required. These sensors are calibrated to accurately detect approaching trains from a distance, ensuring early detection and timely response.

Once the ultrasonic sensors detect the presence of a train, the data is transmitted to a central control unit, typically implemented using a NodeMCU microcontroller. The NodeMCU processes the incoming sensor data in real-time, analysing train movements and determining the appropriate actions to be taken.

Based on the processed data, the NodeMCU triggers automatic mechanisms to close the railway gates promptly upon train detection. This ensures the safety of vehicles and pedestrians crossing the tracks by preventing access to the railway crossing during train transit.

Additionally, the system incorporates feedback mechanisms to verify successful gate closure and reopen the gates once the train has passed safely. LED indicators and buzzers are utilised to provide visual and audible alerts to users about gate status, enhancing safety and awareness at railway crossings.

The components used in the system, including the ultrasonic sensors, NodeMCU microcontroller, servo motor for gate operation, LED indicators, and buzzer, are carefully integrated to ensure seamless communication and reliable operation.

Throughout the implementation process, rigorous testing and validation procedures are conducted to verify the system's accuracy, reliability, and responsiveness. Field trials are performed to assess the system's performance under various conditions, such as different train speeds and environmental factors.

Overall, the methodology for the Automatic Railway Gate Control system using Ultrasonic sensors prioritises safety, efficiency, and reliability. By leveraging advanced technologies and careful integration of components, the system optimises railway traffic flow while ensuring the safety of passengers and the public at railway crossings.

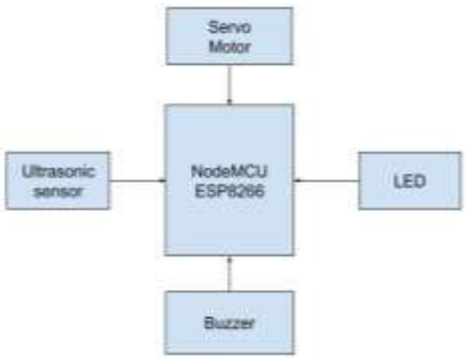


Figure.2: Block Diagram of Automatic Railway Gate control using ultrasonic sensor

## IV. HARDWARE COMPONENTS

### 4.1 NodeMCU (ESP8266 )

The NodeMCU ESP8266 is a powerful and versatile platform designed for Internet of Things (IoT) development. The ESP8266 is a cost-effective Wi-Fi microchip known for its capability to enable wireless communication in IoT applications. NodeMCU, on the other hand, is an open-source firmware and development kit that simplifies the process of prototyping and programming the ESP8266. With built-in Wi-Fi connectivity, the NodeMCU ESP8266 allows devices to connect to the internet wirelessly, making it suitable for a wide range of IoT projects. One notable feature is its support for the Lua scripting language, providing a high-level programming environment for developers. Additionally, it is compatible with the Arduino IDE, allowing those familiar with Arduino to use the NodeMCU platform. Equipped with General Purpose Input/Output (GPIO) pins, the ESP8266 facilitates interfacing with various electronic components, making it ideal for applications such as home automation and sensor networks. The NodeMCU ESP8266 has garnered significant community support, resulting in an extensive collection of libraries and documentation, making it a popular choice for rapid IoT prototyping and development.

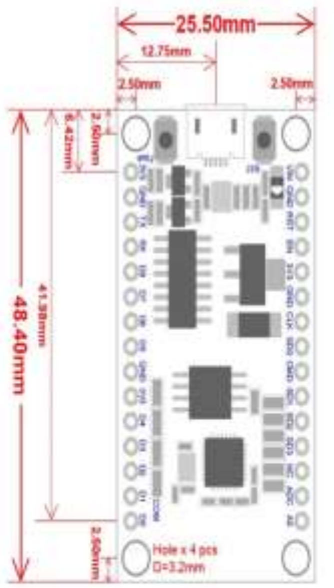


Figure.3: NodeMCU 2D View

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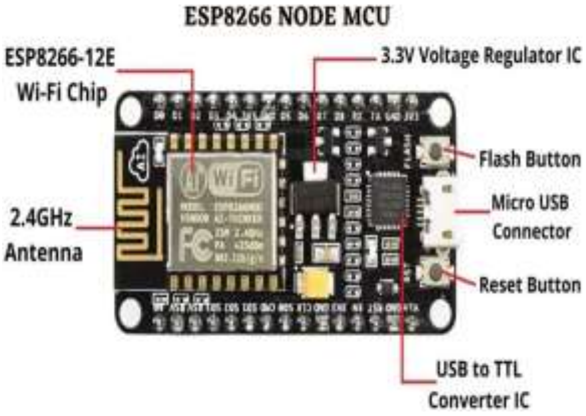


Figure.4: NodeMCU Parts

The NodeMCU ESP8266 development board typically has GPIO (General Purpose Input/Output) pins that can be used for various purposes, including interfacing with sensors, actuators, and other electronic components. Below is a common pinout configuration for the NodeMCU development board

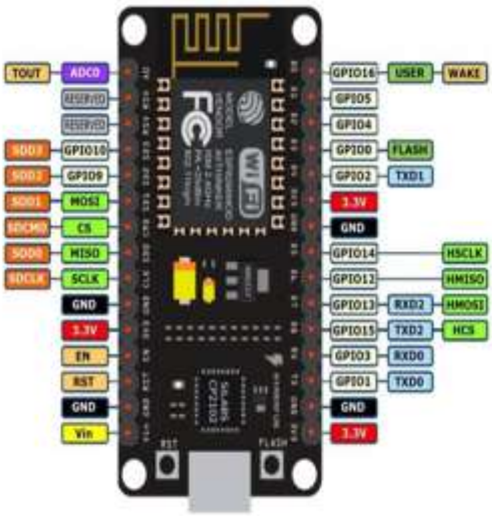


Figure.5: NodeMCU ESP8266 Pinout

**4.2 Ultrasonic Sensor:**

An ultrasonic sensor is a device that emits ultrasonic sound waves and detects their reflection to determine the distance to an object or surface. These sensors are commonly used in various applications, including distance measurement, object detection, and obstacle avoidance.The operation of an ultrasonic sensor is based on the principle of sound wave propagation. The sensor emits a high-frequency sound wave, typically in the ultrasonic range (above 20 kHz), and then listens for the echo reflected off nearby objects. By measuring the time it takes for the sound wave to travel to the object and back, the sensor can calculate the distance to the object using the speed of sound in air.Ultrasonic sensors consist of a transducer, which generates the sound waves, and a receiver, which detects the reflected waves. The transducer typically contains one or more piezoelectric elements that convert electrical energy into mechanical vibrations to produce the sound waves. When the sound waves encounter an object, they are reflected back to the sensor and detected by the receiver.One of the key advantages of ultrasonic sensors is their ability to work in various environmental conditions, including darkness, dust, and fog, where optical sensors may struggle. They also offer non-contact operation, making them suitable for applications where contact with the object is not feasible or desirable.Ultrasonic sensors are used in a wide range of industries and applications, including robotics, automotive parking assistance systems, industrial automation, and medical devices. Their versatility, accuracy, and reliability make them essential components in many sensing and detection systems.


Figure.6: Ultrasonic Sensor

**4.3 Servo Motor:**

A servo motor is a type of rotary actuator that enables precise control over angular position, velocity, and acceleration. It consists of a motor coupled with a feedback mechanism, typically a potentiometer, encoder, or resolver, which continuously monitors the motor's position and provides feedback to the control system. This feedback loop allows for closed-loop control, ensuring accurate positioning and motion. Servo motors are widely used in applications requiring precise and controlled movement, such as robotics, CNC machines,

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3D printers, and industrial automation. They offer a high torque-to-inertia ratio, enabling them to provide significant torque output while maintaining low inertia for fast response times. Additionally, servo motors can operate at variable speeds, allowing for smooth acceleration and deceleration profiles and precise velocity control. With their compact design, low electrical noise, and easy integration into existing systems, servo motors are essential components in electromechanical systems where accurate motion control is paramount. Moreover, servo motors are known for their high efficiency, which results in minimal energy wastage during operation, making them environmentally friendly and cost-effective.

Figure.7: Servo Motor

**4.4 Buzzer:**

A buzzer is a simple yet versatile electromechanical device used for producing audible alerts, notifications, or alarms in electronic systems and devices. It typically consists of a piezoelectric element or a magnetic coil and a diaphragm. When an electrical current is applied to the buzzer, it causes the piezoelectric element to vibrate or the magnetic coil to create a magnetic field. These vibrations or magnetic fluctuations cause the diaphragm to rapidly oscillate, generating sound waves in the surrounding air. Buzzer sounds can vary in frequency, duration, and intensity depending on the design and application requirements. They are commonly employed in various applications, including electronic gadgets, household appliances, industrial machinery, automotive systems, and security alarms, to provide auditory feedback and alert users to specific events or conditions. Buzzer technology continues to evolve, with advancements in design, materials, and manufacturing techniques enabling the development of smaller, more efficient, and higher-performance buzzers suitable for a wide range of applications.


Figure.8: Buzzer

**4.5: LIGHT-EMITTING DIODE**

Light Emitting Diodes (LEDs) are semiconductor devices that emit light when an electric current passes through them. They are widely used in various applications due to their energy efficiency, longevity, and compact size. LEDs consist of a semiconductor chip mounted on a reflective material within a transparent housing, typically made of plastic. When current flows through the semiconductor material, it releases energy in the form of photons, producing visible light. LEDs offer several advantages over traditional incandescent or fluorescent lighting sources, including lower power consumption, longer lifespan, and greater durability. Additionally, LEDs are available in a wide range of colours and can be easily dimmed or controlled to achieve desired lighting effects. Their small size and low heat emission make them ideal for use in electronic displays, indicator lights, automotive lighting, decorative lighting, and general illumination applications. With ongoing advancements in LED technology, such as improved efficiency and colour rendering capabilities, LEDs

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continue to play a significant role in shaping the future of lighting and illumination solutions across various industries.

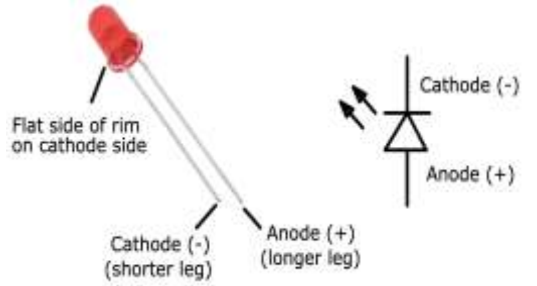


Figure.9: LED

**Principal of operation:**

The principle of operation of Light Emitting Diodes (LEDs) is based on a phenomenon called electroluminescence.

Electroluminescence occurs when a semiconductor material is subjected to an electric current and emits light as a result. LEDs are constructed using semiconductor materials, typically composed of layers of doped semiconductors, such as gallium arsenide (GaAs), gallium phosphide (GaP), or gallium nitride (GaN). These materials are arranged in a structure known as a p-n junction. When a forward voltage is applied across the p-n junction of an LED (by connecting the anode to the positive terminal and the cathode to the negative terminal of a power source), free electrons from the n-type semiconductor layer combine with holes (positively charged vacancies) from the p-type semiconductor layer within the junction region. As these electrons recombine with holes, energy is released in the form of photons (light particles). The energy of the photons emitted corresponds to the energy bandgap of the semiconductor material, determining the color of the emitted light. The emitted photons escape from the semiconductor material, producing visible light. The intensity and color of the light emitted depend on the semiconductor material used in the LED's construction and the current flowing through it. The key principle behind LED operation is the conversion of electrical energy into light energy through the process of electroluminescence within the semiconductor material. This efficient and direct conversion process is what makes LEDs highly energy-efficient and widely used in various lighting applications.

## V. CONCLUSIONS

The problem of the present period of science and technology is to prevent horrible train accidents that claim the lives of people and automobiles. The functioning model was constructed on the lab's grounds. The findings demonstrate that it is a practical solution for a safe railway system. Rapidly detecting the train and becoming caught on the level crossing, the ultrasonic sensors alert the control unit. In order to prevent collisions, the control unit moves the train and other vehicles in the appropriate directions, either forward or backward. As a result, technology has the potential to significantly improve railway gate automation at a reduced cost and with greater dependability. In the future, this constructed functioning model will use GPS to traverse the track and the location of the train to prevent train collisions.

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