A Project Report
on

AUTOMATIC RAILWAY GATE CONTROL SYSTEM AND OBSTACLE DETECTION

Submitted in partial fulfillment of the requirements

for the award of degree of

BACHELOR OF TECHNOLOGY

in

Information Technology

by

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(NAAC ‘A’ Grade & NBA Accredited- ECE, EEE, CSE & IT)

June, 2023

DECLARATION

We hereby declare that the work presented in this project entitled " **AUTOMATIC RAILWAY GATE CONTROL SYSTEM AND OBSTACLE DETECTION**" submitted towards completion of Project in IV year II sem of B.Tech IT at "BVRIT HYDERABAD College of Engineering for Women", Hyderabad is an authentic record of our original work carried out under the esteemed guidance of Mr.Ch.Anil Kumar, Assistant Professor, Department of Information Technology.

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CERTIFICATE

This is to certify that the Major-Project report on **"AUTOMATIC RAILWAY GATE CONTROL SYSTEM AND OBSTACLE DETECTION"** is a bonafide work carried out by **B. Madhvika (19321A1237), B. Deepika (19WH1A1217), B. Harika (19WH1A1229), M. Laxmi Thirupathamma (20WH5A1202)** in the fulfillment for the award of B.Tech degree in **Information Technology, BVRIT HYDERABAD College of Engineering for Women, Bachupally, Hyderabad** affiliated to Jawaharlal Nehru Technological University, Hyderabad under my guidance and supervision.

The results embodied in the project work have not been submitted to any other university or institute for the award of any degree or diploma.

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ABSTRACT

The objective of the project is to provide an automatic railway gate at a level crossing , replacing the gates operated by the gatekeeper. This deals with two major things. Firstly, it deals with the reduction of time for which the gate is being kept closed, and secondly, to provide safety to the road users by reducing the accidents. By the presently existing system once the train leaves the station, the stationmaster informs the gatekeeper about the arrival of the train through the telephone. Once the gatekeeper receives the information, they closes the gates depending upon the train arrival time. Hence, if the train is late due to certain reasons, then gate remain closed for a longer time causing traffic near the gates. By employing the automatic railway gate control at the level crossing the arrival of the train is detected by the sensor placed near to the gate. The sensor used are IR sensors. Hence, the time for which the gate closed is less compared to the manually operated gates and also reduces the human labor .And obstacle detection is also done for prevention of train accidents . Obstacle detection is done using Ultrasonic sensor and ESP-32 camera for prevention of train accidents. If obstacle detected the loco pilot will be alerted with buzzer and LED the distance between the train and obstacle is displayed on 16*2 LCD screen.

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1. INTRODUCTION

Railway is one of the oldest ways of transport across the world. It is widely used for passenger and goods transportation. Railway is a very large network that connects the remote locations. There are large number of people who depend on railways for their daily transport for longer distance at a cheaper tariff. It is not always the fault of the railways. There can be many factors involved in personal injury cases arising from a serious or deadly train accidents due to derailments, unprotected railroad crossings, human distraction, mechanical failure, etc. Even though there are many modern techniques that prevent railroad accidents, still there is lagging in railway safety

Figure 1.1: The prototype of the proposed system

The term railway crossing (also called as level crossing) is a crossing of railway gates without recourse to a bridge or tunnel by a road or by a pathway. Earlier level crossings had a gateman with the flag in a nearby booth. On the arrival of a train gateman waves a red flag or lantern to stop all traffic and clear the tracks. Manual or electrical closable gates that barricaded the roadways were later introduced and it also paved the way for many railway accidents. Thus, crossing gates, when closed to road users leads to unwanted deaths happening in gates. When opened to allow road users to cross the line, the electric gates were swung across the width of the railway, preventing any pedestrians or animals getting onto the line.

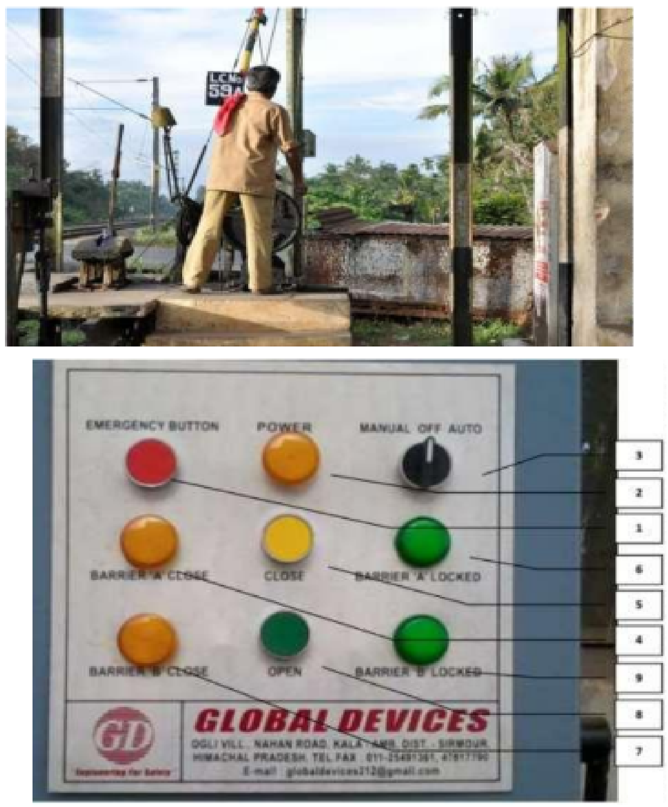

Figure 1.2: Existing mechanism for operation of gates

In the early days, delay in opening and closing of the gates leads to manual error causing many railway accidents. In 2017-2018 till March there were 75 accidents. In between of April and December it got reduced to 45.In 2014 to 2015 the count is 50 at rural and urban level crossings, In the year 2015 to 2016 the count got reduced to 20.And also during this period 59 were killed and about 100 were injured because the train has entered into the people who were standing near the railway gate watching the dasara festival. After days the accidents have been drastically reduced due to the improvement of technology and scientific technologies.
Automatic railway gate control system is a sophisticated technological solution designed to enhance the safety and efficiency of railway operations. It is an integral part of modern railway infrastructure, ensuring the smooth and secure movement of trains at level crossings or intersections with roads.

The primary objective of an automatic railway gate control system is to prevent accidents and collisions between trains and vehicles or pedestrians at railway crossings. Traditionally, railway gates were manually operated by gatekeepers, which posed various challenges such as human error, delays, and the potential for accidents due to negligence or miscommunication.

To address these issues, automatic railway gate control systems were developed. These systems utilize advanced sensors, electronics, and communication technologies to automate the process of opening and closing the railway gates based on the presence or approach of a train.

The system typically consists of various components, including train detection sensors, gate control units, warning signals, and communication systems. Train detection sensors, such as infrared sensors or track circuits, are installed near the railway tracks to detect the presence of an approaching train. When a train is detected, the gate control unit receives the signal and activates the gate-closing mechanism.

Simultaneously, warning signals such as flashing lights, sirens, and barriers are activated to alert road users about the approaching train and the closing of the gates. This ensures that vehicles and pedestrians are aware of the impending train and allows them to safely clear the railway tracks.

Additionally, the automatic railway gate control system often incorporates communication systems to transmit information between the gate control unit, trains, and nearby stations. This allows for efficient coordination and synchronization of gate operations, ensuring the gates open promptly once the train has passed and it is safe to do so.

The advantages of an automatic railway gate control system are numerous. Firstly, it minimizes the risk of accidents and collisions at railway crossings, safeguarding the lives of both train passengers and road users. Secondly, it enhances the efficiency of railway operations by reducing the waiting time for trains caused by manual gate operation. Moreover, it eliminates the need for gatekeepers, thereby reducing labor costs and ensuring consistent gate control without human errors.

The automatic railway gate control system plays a crucial role in ensuring safety and efficiency at railway crossings. By automating the gate operation process and utilizing advanced technologies, this system significantly reduces the risk of accidents and improves the overall functioning of railway networks.

Obstacle detection in railway systems in India is a critical aspect of ensuring safe and efficient train operations. Various technologies and systems are employed to detect and mitigate obstacles on railway tracks. Here are some common methods used in India:

Track Patrolling: Regular track patrolling is conducted by railway staff to visually inspect the tracks for any obstacles, such as fallen trees, debris, or unauthorized encroachments. Patrolling teams are responsible for identifying and removing obstacles manually.

Trackside Sensors: Modern railway systems use trackside sensors to detect obstacles on the tracks. These sensors can include infrared sensors, ultrasonic sensors, or laser-based sensors. They are installed along the track and can detect the presence of obstacles in real-time. Whenever an obstacle is detected, an alert is sent to the control center, and appropriate actions are taken to remove the obstacle.

Level Crossing Protection Systems: Level crossings, where the railway tracks intersect with roads or pedestrian paths, are prone to accidents and obstruction by vehicles or pedestrians. To mitigate this risk, various level crossing protection systems are employed. These systems can include automated barriers, warning lights, and sirens. They are activated whenever a train approaches the level crossing, ensuring that vehicles and pedestrians are aware of the approaching train and preventing any obstruction.

CCTV Surveillance: Closed-circuit television (CCTV) cameras are installed at various strategic locations along the railway tracks, such as stations, level crossings, and critical sections. These cameras provide real-time video monitoring, allowing railway authorities to detect any obstacles or unauthorized activities on the tracks. If an obstacle is identified, immediate action can be taken to remove it and prevent any potential accidents.

Unmanned Aerial Vehicles (UAVs): In recent years, Indian Railways has started utilizing unmanned aerial vehicles, commonly known as drones, for obstacle detection. Drones equipped with cameras and sensors can provide an aerial view of the tracks and identify any obstacles or encroachments. They can cover large areas quickly and efficiently, aiding in the early detection and removal of obstacles.

It's important to note that the specific systems and technologies employed may vary depending on the railway zone, infrastructure, and operational requirements. The Indian Railways continuously strives to enhance safety measures and adopt new technologies to ensure obstacle-free railway operations

In early days we don't have a concept of obstacle detection so to reduce the accidents we are using obstacle detection in this we are using ultrasonic sensor for object detection and ESP-32 camera for live streaming and a 16*2 LCD to mention the distance between train and object for intimating the loco pilot regarding obstacle detection.

The proposed devices in this study may not be attractive-looking, but focus is given in the development of Internet of Thing (IoT) system using a smartphone module that is able to detect obstacles and water puddles. The system is designed with a combination of hardware and software that can detect static and moving obstacles. The system developed in this study is integrated with an ESP32 microcontroller and HC-SR04 PIR sensor. The sensors gather information from the surroundings, and the ESP32 microcontroller detects the obstacle by processing the information. The communication between ESP32 microcontroller and the smartphone is carried out through the MIT App Inventor. The IoT-based system for detecting obstacles and water puddle makes the navigation for visually impaired person more convenient.

The purpose of this report is to provide an overview and analysis of an Automatic Railway Gate Opening System with Obstacle Detection. The report aims to explore the functionalities, benefits, and challenges of implementing such a system. The system's primary objective is to enhance railway safety by automating the process of opening and closing railway gates based on train movement while also detecting and responding to obstacles on the tracks.

This report will delve into the design, components, and working principles of the automatic railway gate opening system with obstacle detection. It will cover various aspects, including the system's architecture, hardware and software components, communication protocols, and algorithms used for obstacle detection. Furthermore, the report will discuss the potential benefits of implementing such a system, including improved safety, reduced accidents, and smoother traffic flow at railway crossings. In the subsequent sections, the report will examine the key features and functionalities of the system. It will outline the process of detecting trains and obstacles, analyzing the data collected, and triggering the gate opening or obstacle alert mechanisms. Additionally, the report will highlight the integration of the system with other railway infrastructure components, such as signaling systems and train management systems, to ensure seamless operations.

Moreover, the report will discuss the challenges and considerations associated with implementing an automatic railway gate opening system with obstacle detection. It will address factors like system reliability, power backup, maintenance requirements, and scalability to accommodate varying railway infrastructures and traffic conditions. The report will also analyze the cost implications, potential risks, and regulatory aspects that need to be considered during the implementation phase.

Furthermore, the report will provide a comprehensive evaluation of the system's performance, considering factors like accuracy of obstacle detection, response time, gate opening/closing reliability, and user interface usability. It will present the results of simulations, tests, and real-world implementations, showcasing the effectiveness and efficiency of the system in different scenarios.

Lastly, the report will conclude with a summary of the findings and recommendations for the future development and enhancement of the automatic railway gate opening system with obstacle detection. It will highlight areas for improvement, possible research directions, and potential advancements in technology that could further enhance the system's capabilities and overall railway safety.

Overall, this report aims to serve as a comprehensive guide and reference for stakeholders, including railway authorities, engineers, researchers, and policymakers, who are interested in implementing an automatic railway gate opening system with obstacle detection. By providing an in-depth analysis of the system's design, functionalities, benefits, and challenges, this report strives to contribute to the advancement of railway safety and the efficient management of railway crossings.

1.1 Objective

This project deals with one of the most common problems of gate controlling system at the railway crossings. since the existing system are operated manually ,accidents at rail road crossing are increasing day by day.The objective for our work is to reduce accidents and manual effort :

1)Implementing automatic railway gate controlling system along with count down system using 16*2 LCD Display for intimating train arrival to the road users.

2)Detecting the obstacle Infront of train and alerting the loco pilot using 16*2 LCD Display and Buzzer.

3)The system provides live streaming of track for loco pilot to show the obstacles on track path.

4)This deals with the reduction of time for which the gate is being kept closed, and also provides safety to the road users by reducing the accidents.

1.2 Problem Definition

Road accidents at railway gate is a leading cause of death and injury worldwide. Surveys conducted by Indian Railway found that about 17 percentage of total railway accidents in India is crossing accidents of which majority occurs at passive railway crossings. The operation of railway gates at level crossings is not so reliable nowadays. This deals with the reduction of time for which the gate is being kept closed, and also provides safety to the road users by reducing the accidents.

INTERNET OF THINGS

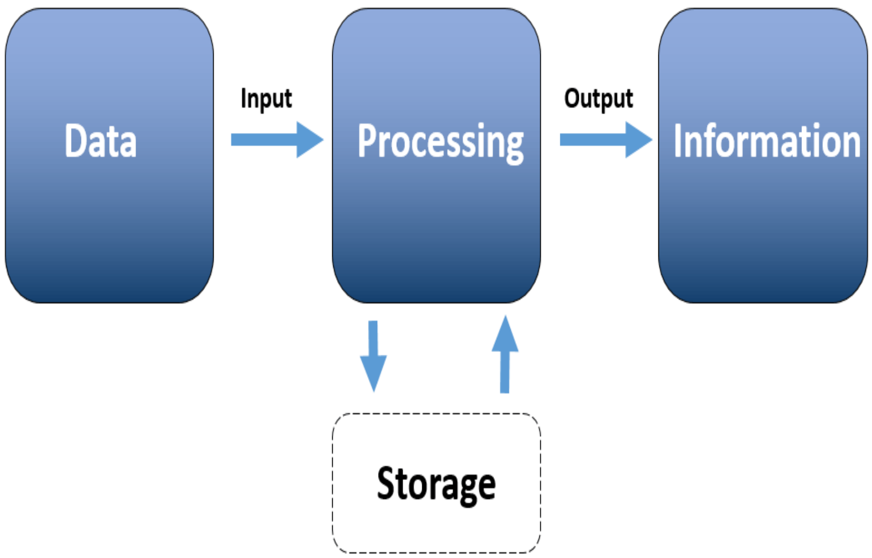

Figure 1.3: Internet of Things Process

1.1 Internet of Things

The Internet of Things (IoT) is the networking of physical objects that contain electronics embedded within their architecture in order to communicate and sense interactions amongst each other or with respect to the external environment. It is non-standard devices that connect wirelessly to a network with each other and able to transfer the data. It is an advanced automation and analytics system which deals with artificial intelligence, sensor, networking, electronic, cloud messaging etc. to deliver complete systems for the product or services. The system created by IoT has greater transparency, control, and performance.

The IoT as a whole consists of different modules and devices which include various embedded systems, sensors, processors, and other information-sharing devices to provide efficient communication. These devices work as the backbone for an IoT system in collecting data and analyzing them either by sending them to the cloud or analyzing them logically, depending on the requirement of the end-user. These act according to the functions or the operations that are given to them in the setup. As said earlier, the main advantage of using an IoT system is to operate without people's intervention. However,the entire preliminary setup is to be done by people interacting with the devices. A lightbulb that can be switched on using a smartphone app is an IoT device, as is a motion sensor or a smart thermostat in your office or a connected streetlight. An IoT device could be as fluffy as a child's toy or as serious as a driverless truck. Figure specifies the basic block diagram and working of IoT.

The Internet of Things(IoT) is a methodology that refers to the millions of physical devices across the world that are now connected to the internet. These devices collect and share data over the cloud. We can also say that Internet of things or IoT is a giant network of connected devices. These Physical devices or objects consists of some built in sensors that are connected to internet of things platform.

The Internet of Things (IoT) refers to the network of physical devices, vehicles, appliances, and other objects embedded with sensors, software, and connectivity capabilities that enable them to connect and exchange data over the internet. IoT projects involve deploying these interconnected devices to collect, transmit, and analyze data, enabling automation, remote monitoring, and intelligent decision-making.

The fundamental concept behind IoT is the ability of these connected objects to communicate with each other and with users or applications, enabling data sharing and intelligent decision-making. IoT devices are typically equipped with sensors to gather data about their environment, processors to process the data, and connectivity modules to transmit the data to other devices or to the cloud.

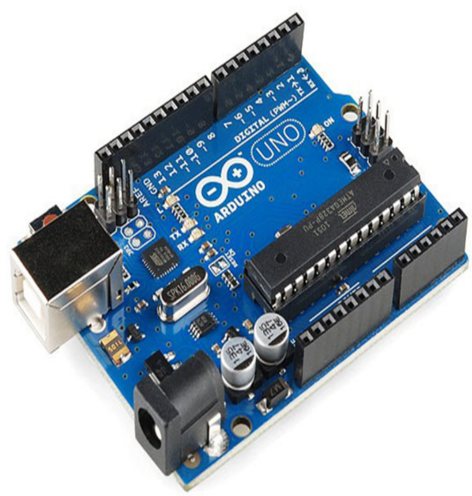

Figure 1.4: Arduino UNO

Automatic Railway Gate Control System

An automatic railway gate at a level crossing replacing the gates operated by the gatekeeper. It deals with two things. Firstly, it deals with the reduction of time for which the gate is being kept closed. And secondly, to provide safety to the road users by reducing the accidents.By the presently existing system once the train leaves the station, the stationmaster informs the gatekeeper about the arrival of the train through the telephone. Once the gatekeeper receives the information, he closes the gate depending on the timing at which the train arrives. Hence, if the train is late due to certain reasons, then gate remain closed for a long time causing traffic near the gates.

By employing the automatic railway gate control system at the level crossing the arrival of the train is detected by the sensor placed near to the gate. Hence, the time for which it is closed is less compared to the manually operated gates and also reduces the human labour. This type of gates can be employed in an unmanned level crossing where the chances of accidents are higher and reliable operation is required. Since, the operation is automatic, error due to manual operation is prevented .Automatic railway gate control is highly economical microcontroller based arrangement, designed for use in almost all the unmanned level crossings in the country.

Obstacle Detection

In existing system there are no obstacle detection systems so by proposed system obstacle detection is done using Ultrasonic sensor and ESP-32 camera for prevention of train accidents. If obstacle detected immediately alerting the loco pilot using 16’2 LCD display and buzzer, the LCD screen displays the distance b/w the train and the obstacle. The ESP 32 camera is used for live streaming of the track..

2. LITERATURE SURVEY

The automatic railway gates operation has been projected using various methods. As proposed by Vishesh Rai , the process of developing fault tolerance method has been applied for both the hardware and the software components. Magnetic sensors placed underground to detect the train are less affected by environmental changes and recognizes the direction of movement of vehicles.

Dinesh Kumar S ,Prem Kumar R, Venkatesan G, Vinston Raja R - has proposed to overcome the about defects we have Sound vibrator detector which will sense the arrival of the train by its vibration. So, no circuit is needed here. The ZigBee will act as a transceiver here. The Server will interact with the sound vibrating sensor and the ZigBee sensor. It is applicable for multiple trains. It is quite simple to implement.The advantages of the proposed system are: There is no need for a gatekeeper. We can also calculate the time at which the train would reach the destination. We can also calculate the current speed of the train. The sound vibrator sensor will detect the vibration of the track and the ZigBee will transmit the signal to the gate and the alarm in the gate will get activated. The proximity sensor which is fixed in the gate will check for the object in-between the gates. When there is no object the gate will get closed automatically. When there is an object is detected inside the of the proximity sensor the sensor will send the information straight to the train to stop the train. When the train crosses the gate, there is another sound vibrating sensor is fixed in the track and it will send back the signal to the gate and the gate get opened.[1]

Shweta Pandit, Dipali Kutmure, Ugvata Hamabarde, Vaishnavi Lipane gave details of an automatic railway gate control at unmanned level crossings replacing the gates operated by gatekeepers and also the semi-automatically operated gates. It deals with two things. Firstly, it deals with the reduction of time for which the gate is being kept closed. And secondly, to provide safety to the road users by reducing the accidents that usually occur due to carelessness of road users and at times errors made by the gatekeepers. By employing the automatic railway gate control at the level crossing the arrival of the train is detected by the sensor placed on either side of the gate at about 5km from the level crossing. Once the arrival is sensed, the sensed signal is sent to the micro controller and it checks for the possible presence of a vehicle between the gates, again using sensors. Subsequently, buzzer indication and light signals on either side are provided to the road users indicating the closure of gates.[2]

Deva Rajan anticipated an intelligent railway crossing control system for multiple tracks that features a controller which receives messages from incoming and outgoing trains by sensors. These messages contain detail information including the direction and identity of a train. Depending on those messages the controller device decides whenever the railroad crossing gate will close or open. But this technique has the issue of high maintenance cost.Railways being one of the safest and cheapest modes of transportation are preferred over all the other means of transport. So, it is essential to maintain and improve the current level of safety. A safe railway is more efficient and also a more attractive transport choice, enabling society to address the environmental and economic challenges of the 21st century. Railway safety is a crucial aspect of rail operation over the world. When we go through newspapers, we come across many railway accidents occurring at different railway level crossings and many people are dying. The place where rail track and highway/road intersects each other at the same level is known as “level crossing”.[3]

Al Ameen Nizamudeen and Syam Krishn KS are proposed the system to save human life and vehicles from miserable train accidents is a challenge of the era of modern science and technology. The above proposed system is introduced. The results exhibit that it is one of the expedient approach for secure railway system. The IR sensors detect the train and stuck on the level crossing very quickly and communicate with the control unit. The control unit takes proper steps which lead the train and vehicles movements either to move forward or to stop to avoid collision. Consequently, this is able to play a great contribution to the railway gate automation with reliability and lower cost.[4]

Danijela Ristic-Durrant,Muhammad Abdul Haseeb,Milan Banic are done work on framework of the Shift2Rail project SMART. The objective of the work was the development of an autonomous obstacle detection system for railways, for mid (up to 200 m) and long distance detection (up to 1000 m). The achieved results represent a contribution to the development of autonomous rail freight systems, as necessary for the implementation of the EU transport strategy.Object detection is a key technology behind advanced driver assistance systems (ADAS) that enable cars to detect driving lanes or perform pedestrian detection to improve road safety. Object detection is also useful in applications such as video surveillance or image retrieval systems.[5]

Saifuddin Mahmud concentrated on unmanned level crossing which caused frequent accident. For this, they proposed a Microcontroller based Railway Gate and Crossing Control system. In their system they used IR sensor and Microcontroller. In their system IR sensor sense the presence of trainand send the signal to Microcontroller. Based on the signal Microcontroller controls the gate of the crossing. The main limitation of this system is low accuracy. The performance of IR sensor is not adequate at open place and light.[6]

Taslim Ahmed,Imran Chowdhury proposed the system works as a standalone solar powered low-cost, power efficient automatic railway gate controller with some important findings to remark. Two different inputs taken from distantly separated IR sensors interfaced with ADC ports of ATmega16 to ensure an automatic railway gate opening and closing operation along with siren and traffic signals; which demonstrates a robust control in greater precision and accuracy (approx. 100railway crossing accidents. The system required maximum current and power of 4.824 A and 58.08 W respectively and at standby mode, is only 24 mA and 0.288 W in absence of Rail. Motors consumed 1.2 A current and 14.4 W on load and, at Idle condition only 0.12 uA and less than 1.44 uW. And, Buzzer had 5.26 pA current at idle state and 14.17 mA at operating state. Further scopes may include, GPS-GSM based integrated communication in-between Trains by automating the cross rail tracks and implementing preventive measure of track continuity to avoid any accident due to uprooted or disjoint rail track, etc.[7]

Akheeb khan, Laxshmi G defined the railway auto control system using OSGi and JESS. The state of railway cross has been estimated using JESS in the technique. The issues in the technique are the insufficient inline citations and also multiple issues related to OSGi. The different methods used by locomotive pilots which can avoid the accidents and the safety measures while crossing the level crossings are also discussed.[8]

Sukruti Taori, Vishal Kakade, Simran Gandhi, Digmbar Jadhav proposed a system which reduces the accidents Nowadays in railway systems, it is more necessary to have safety in order to avoid accidents. One of the causes that can provoke serious accidents is the existence of obstacles on the tracks. To avoid accidents, a multi-sensory barrier consisting of infrared (IR) and ultrasonic (US) sensors- and a vision system, is proposed in order to inform the monitoring system of the existence of obstacles. The multi-sensory system is used where the safety and reliable environments is needed. Principal Components Analysis is applied to the data obtain from the barrier and from the vision system. If there are obstacles on the tracks; and with the vision system information about moving objects is obtained from this technique. A multi-sensor obstacle detection system for the use on railway track was specified, implemented and tested. The applied look-ahead sensors are: Video cameras (optical passive) and LIDAR (optical active). The objects delivered by the sensors were fused, classified and their description is sent to the central vehicle unit.Locomotives are at risk to collisions and derailment due to obstacles on the track. Trains do not have the ability to steer around obstacles, they are confined to the track and depend on stopping to avoid hazards. These accidents often result in loss of life and revenue. Due to the great momentum of the locomotives stopping distance required exceeds the operator's sight distance.In order to achieve increased flexibility automated trains would be a promising step ahead. Automated train control is not a technical challenge any more. The only task .which have not been automated yet is surveying the railway track with respect to obstacles and crack. Today a human train driver reduces the risk of an accident by visual perception, triggering appropriate system reactions like whistling and/or braking. Asking for fully automated train operation thus means requiring a technical system, capableof surveying the track in the same way as the human driver does and guaranteeing at least the same integral reduction of risk. In fact, this requires a very high performance in detection and a wide detection range. At the same time an extremely low false alarm rate is required.[9]

Vishesh Rai,vijay singh verma Dr.Aprna Tripathi gave a detailed intrduction about the need of the hour to safeguard the people from railway accidents and ensuring the safety throughout the journey. There are many people are using trains as their mode of transportation and train can carry many passengers at a time . The growing population needs more trains for the transportation where in which safety is the main criteria. The developed communication system can pass reliable information to the train well in advance. The engine driver can control the train based on the information passed by the communication system. The Digitalization of railways and ensuring safety features using fast and reliable communication system makes railway a better mode of transport than the others.[10]

Rohan D.Dudan, Mander gave a detailed introduction about the present railway technology and also discussed the disadvantages of manually activated railway signals and the railway warnings at the level cross. The train detectors act as the major component in the train automation system. The same arrangement is made at the foreside. A pair of IR LED and laser light is used as sensor. When train comes from aft side and the beam of light falling on both the IR LEDs are disturbed by the train then only a signal goes to the micro controller and then micro controller is activated and the program installed in the controller memory is executed. After receiving signal from aft side sensor, micro controller activates buzzer alarm. Buzzer remains active for 2 sec so that people find time to clear the gate. After 2 sec the gate across the road is closed with the help of servo motor and a red signal at the road forthe passengers is activated. The gate and the signals are controlled by the instructions stored in the controller. After crossing the gate area when the train reaches to the foreside sensor and the light falling on both the IR LED are disturbed then it sends a signal to the controller. Then controller again executes the instructions to lift up the [11]

Jatinder Singh, Harmanpreet Kaur, and Jaspinder Sing gave a detailed introduction about working of ultrasonic sensor ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves.An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object’s proximity.Ultrasonic sensors work by sending out a sound wave at a frequency above the range of human hearing. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound. Our ultrasonic sensors, like many others, use a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse.The working principle of this module is simple. It sends an ultrasonic pulse out at 40kHz which travels through the air and if there is an obstacle or object, it will bounce back to the sensor. By calculating the travel time and the speed of sound, the distance can be calculated.Ultrasonic sensors are a great solution for the detection of clear objects. For liquid level measurement, applications that use infrared sensors, for instance, struggle with this particular use case because of target translucence.For presence detection, ultrasonic sensors detect objects regardless of the color, surface, or material (unless the material is very soft like wool, as it would absorb sound.)[12].

Christofer N. Yalung, Cid Mathew S. Adolfo proposed Automation of the car braking system is an important feature in the development of the smart car. The ability of a smart car to detect and classify an obstruction that is in varying proximities from it play a vital role in the system's design. In this study, EV3 Lego Mindstorm equipped with an ultrasonic sensor was used as a model of a large scale vehicle. EV3 Lego MIndstorm was programmed to slow down when it is at a certain distance from the obstruction, and to stop when it is 15 cm away from the obstruction. There were five obstructions: wood, paper, cloth, plastic and metal. The distance measurement of the ultrasonic sensor and the Neural Network was used for the classification of the obstruction and Multiple Correlation was used for obstacle detection. There were 250 samples taken from the distance measurements of five different types of obstruction, each with a different cross sectional area, and a total recording time of 8 seconds. Overall, there is a high correlation coefficient in the distance measurement of the different types of obstruction materials. It is concluded that the ultrasonic sensor was able to detect the five given types of obstruction. Classification performance was very poor, which means that on the basis of distance measurement, the ultrasonic sensor cannot effectively classify the types of obstructions.[13]

ikash Kumar, Prajit Paul,Nishantkumar,PratikkumarSinha,Sumant Kumar Mahato proposed the aim of the paper is to avoid the railway accidents happening at unattended railway gatesby using ATMEGA16 microcontroller, if implemented in spirit.The model of railway track controller is designed byusing four laser light sources as transmitters and four LDR as receivers; two pair of transmitters and receivers are fixed at upside (from where the train comes) at a level higher than a human being in exact alignment and similarly the other pair is fixed at down side of the train direction. The collision of two trains due to the same trackalso can be happened. This model is implemented using sensor technique. We placed the sensors at a certain distance from the gate detects the approaching train and accordingly controls the operation of the gate. Also an indicator light has been provided to alert the motorists about the approaching train. One more feature of this circuit is detecting a train accurately i.e, there may be chance that some obstacle (for e.g some animal) may cut the sensor then in such a case the counter is made to run for certain period of time (this time period is set considering the possible lowest speed of train) if the obstacle does not cut the 2nd sensor before this predefined time then this obstacle is not considered as train and gates remain opened.[14]

3. SYSTEM DESIGN

3.1 UML Diagram

Use Case Diagram of User

we are using 3 IR sensors to senses the arrival of train whenever the train arrives to IR1 orange led will be switched on and the IR1 is connected to LCD It displays the countdown to close the gate. When the train reaches to IR2 the Red light will be switched on the IR2 is conne

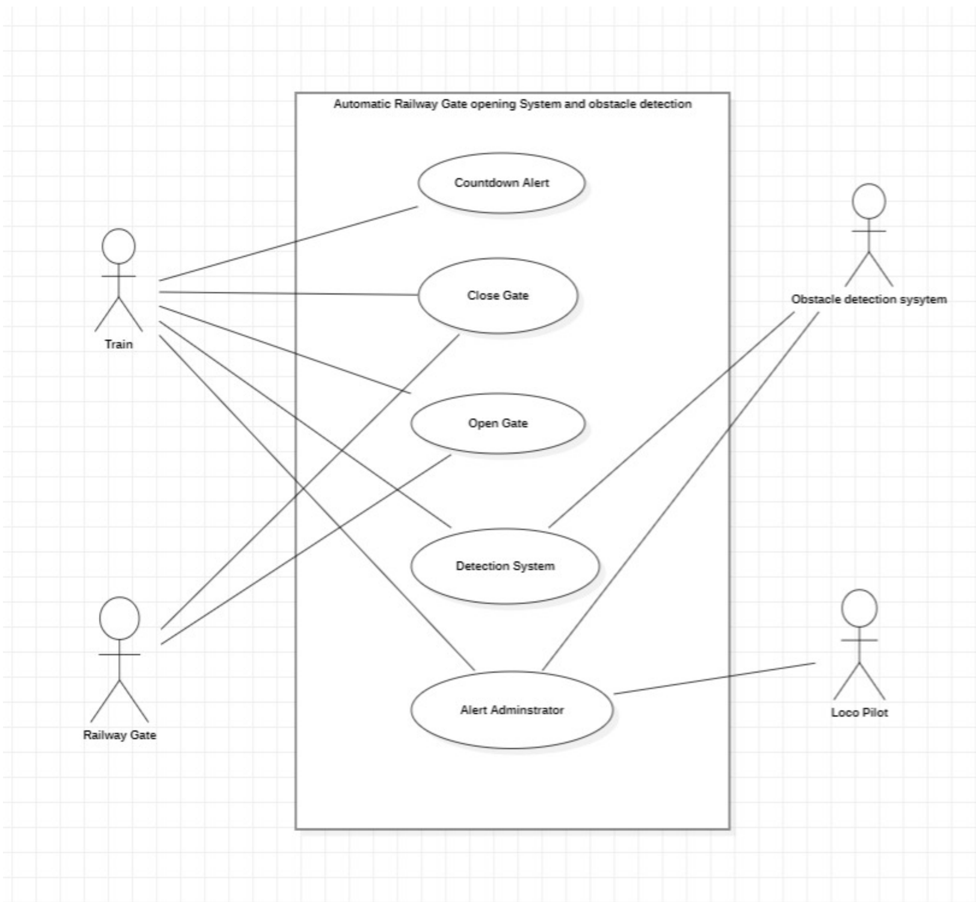

Figure 3.1: Use case diagram of user

Activity Diagram

The behavior of a system is described by the activity diagram. The activities taken step wise and the actions taken place in the system are defined by the activity diagram.

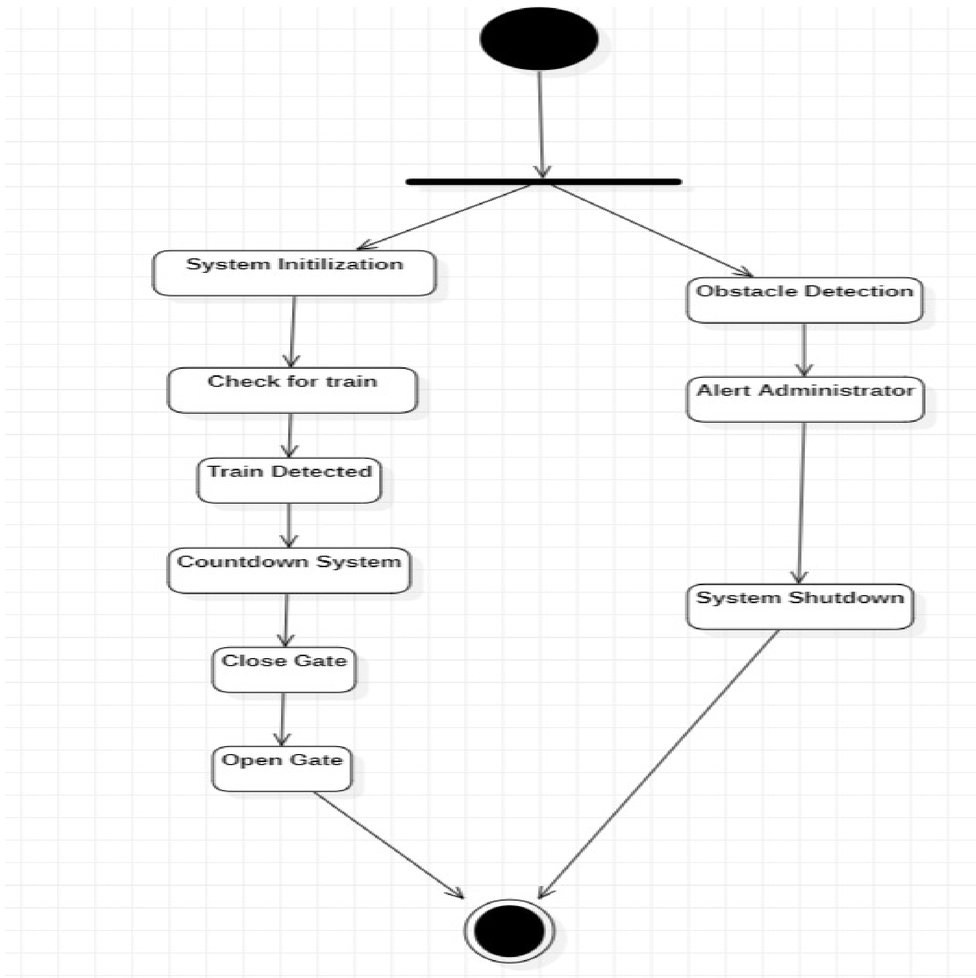

Figure 3.2: Activity Diagram

Class Diagram

In object oriented modelling, the most important building block is the class diagram. The va objects present in the system and the attributes of these objects and the relationship between the cts is described by the class diagram.

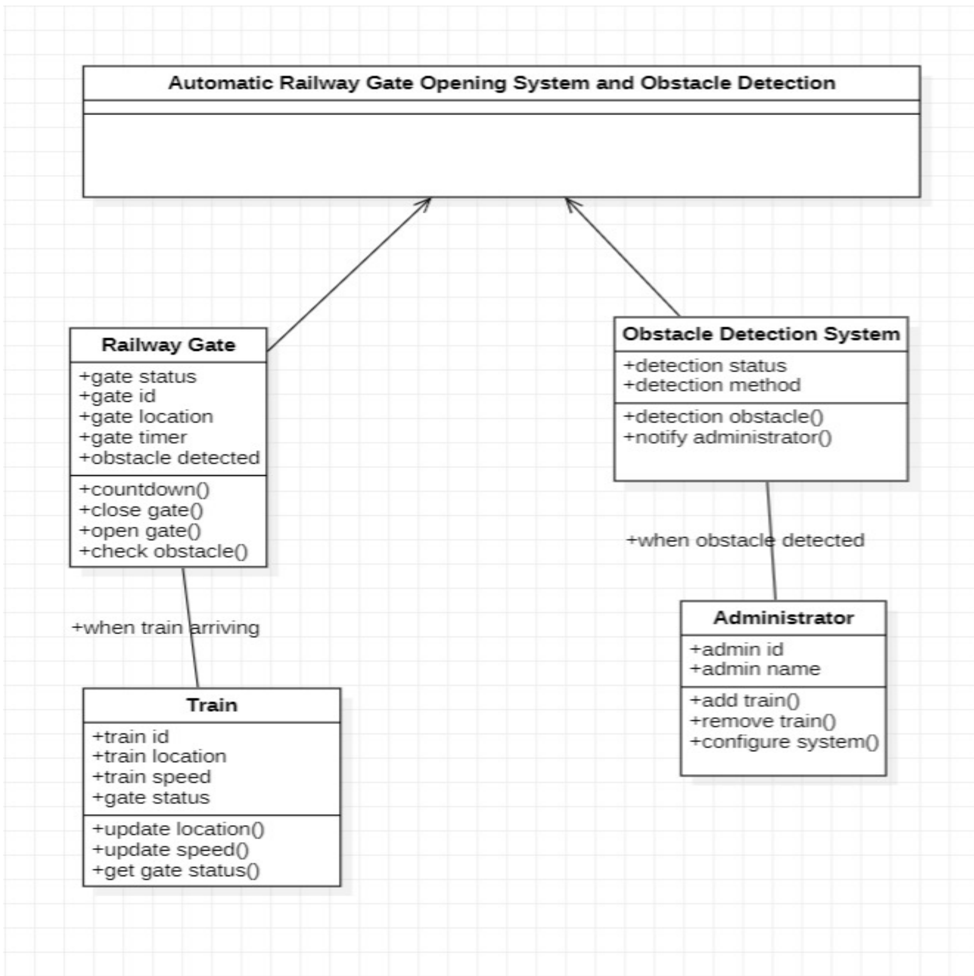

Figure 3.3: Class Diagram

Sequence Diagram

The interactions of an object with another object is described with the help of the sequence diagram. It is a period situated perspective on the association between items to achieve a conduct objective of the framework.

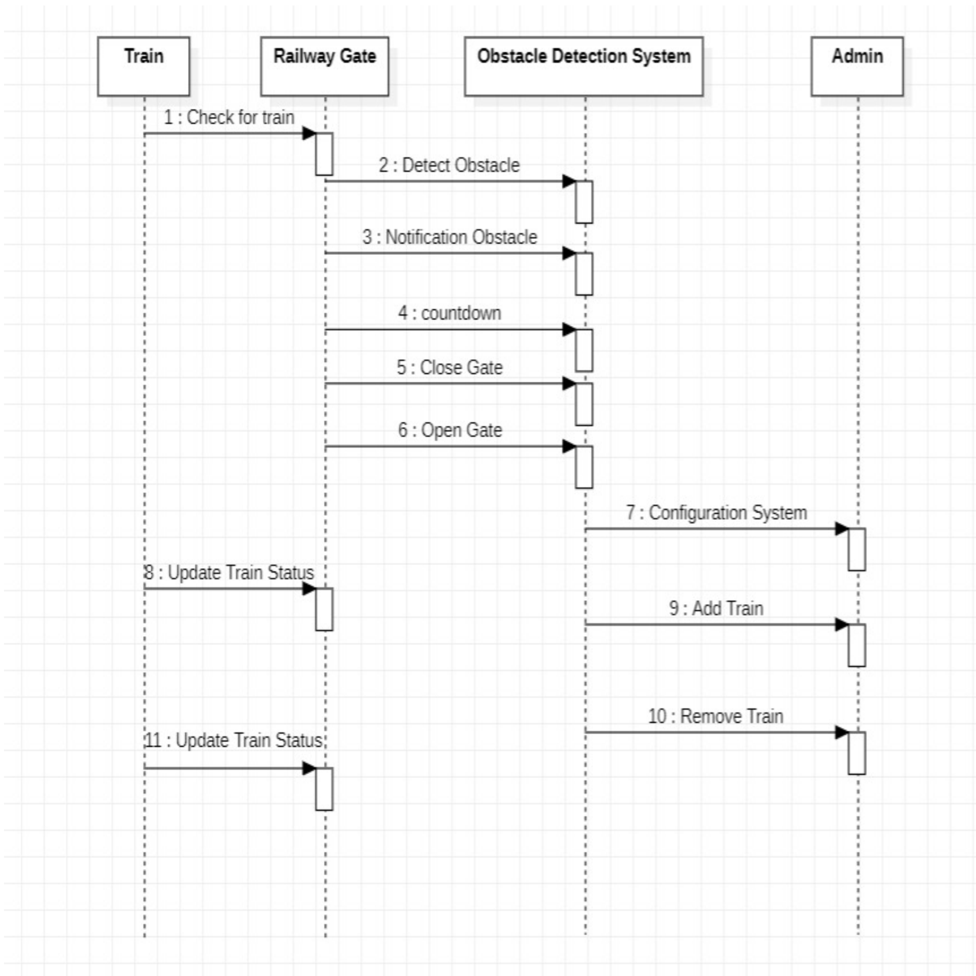

Figure 3.4: Sequence Diagram

Component diagram of user

The physical components of a system are visualized with the help of the component diagram. The components can be files, packages, libraries, etc. The purpose of the component diagram is to construct the executable by using forward and reverse engineering.

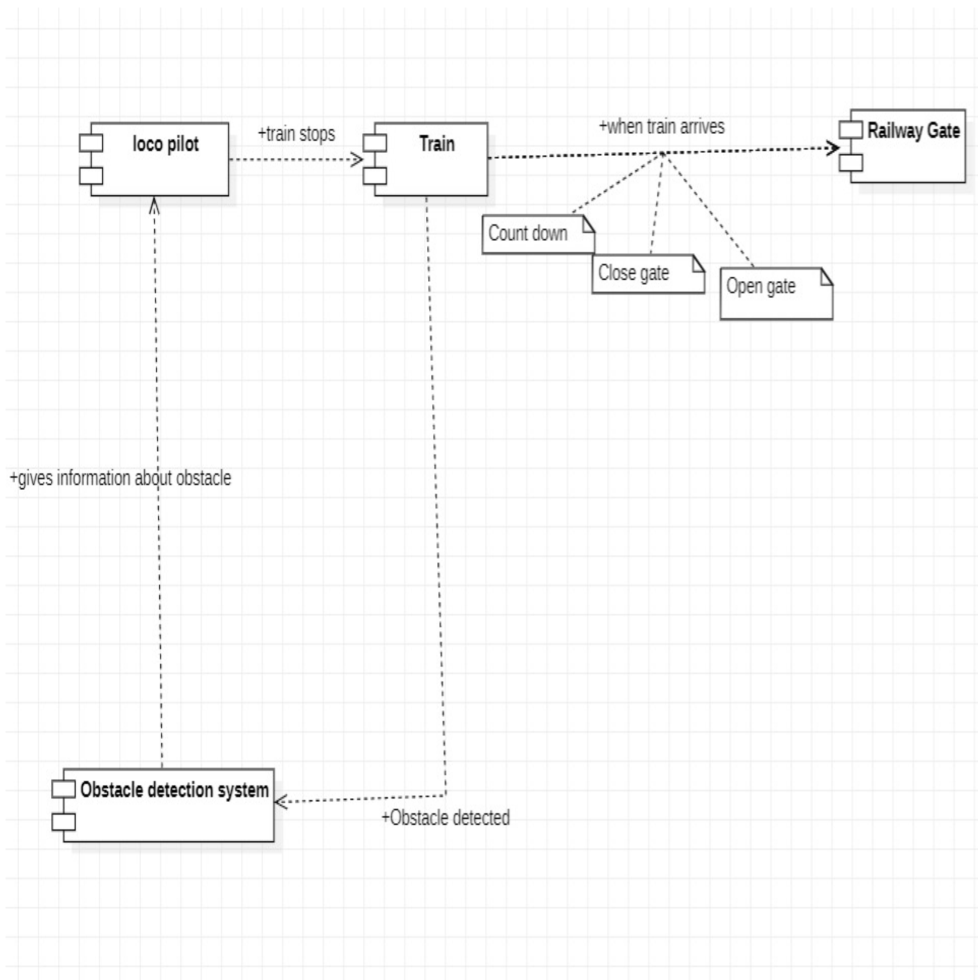

Figure 3.5: Component diagram of user

3.2 Hadrware and Software Components

The main Hardware components used in this project are :

1)Arduino UNO Board

2)IR Sensor

3)Servo Motor

4)Bread Board

5)Light Emitting Diode

6)Resistor

7)Jumping Wires

8)Ultrasonic Sensor

9)LCD

10)ESP32 Camera

11)Buzzer

1. Arduino UNO Board

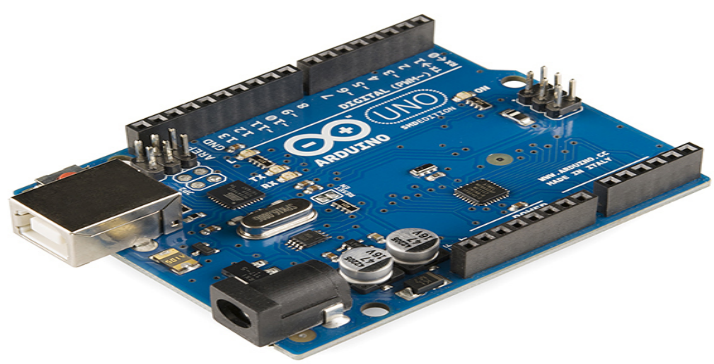

Figure 3.6: Arduino UNO Board

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your Uno without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

Üno”means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

2. IR Sensor

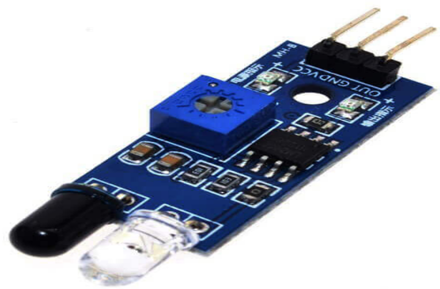

Figure 3.7: IR Sensor

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herchel in 1800. While measuring the temperature of each color of light (separated by a prism), he noticed that the temperature just beyond the red light was highest. IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum). Anything that emits heat (everything that has a temperature above around five degrees Kelvin) gives off infrared radiation.

There are two types of infrared sensors: active and passive. Active infrared sensors both emit and detect infrared radiation. Active IR sensors have two parts: a light emitting diode (LED) and a receiver. When an object comes close to the sensor, the infrared light from the LED reflects off of the object and is detected by the receiver. Active IR sensors act as proximity sensors, and they are commonly used in obstacle detection systems (such as in robots)

3. Servo motor

Figure 3.8: Servo Motor

A servomotor (or servo motor) is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor, although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system.

A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a servo mechanism. If motor is powered by a DC power supply then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor.

4. Bread Board

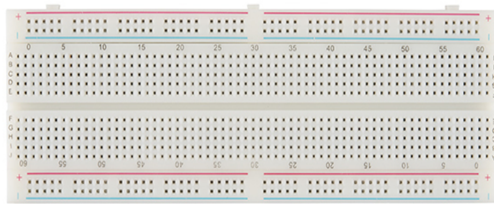

Figure 3.9: Bread Board

A breadboard, solderless breadboard, or protoboard is a construction base used to build semi-permanent prototypes of electronic circuits. Unlike a perfboard or stripboard, breadboards do not require soldering or destruction of tracks and are hence reusable. For this reason, breadboards are also popular with students and in technological education.

A breadboard is used to make up temporary circuits for testing or to try out an idea. No soldering is required so it is easy to change connections and replace components. Parts are not damaged and can be re-used afterwards. Almost all the Electronics Club website projects started life on a breadboard to check that the circuit worked as intended.

5. Light Emitting Diode

Figure 3.10: LED

A Light Emitting Diode (LED) is a semiconductor device, which can emit light when an electric current passes through it. To do this, holes from p-type semiconductors recombine with electrons from n-type semiconductors to produce light. The wavelength of the light emitted depends on the bandgap of the semiconductor material. Harder materials with stronger molecular bonds generally have wider bandgaps. Aluminum Nitride semiconductors are known as ultra-wide bandgap semiconductors.

Light is produced when the particles that carry the current (known as electrons and holes) combine together within the semiconductor material. Since light is generated within the solid semiconductor material, LEDs are described as solid-state devices. The term solid-state lighting, which also encompasses organic LEDs (OLEDs), distinguishes this lighting technology from other sources that use heated filaments (incandescent and tungsten halogen lamps) or gas discharge (fluorescent lamps).

6. Resistor

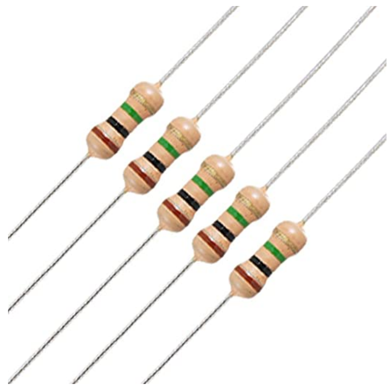

Figure 3.11: Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implemented within integrated circuits.

7. Jumping Wires

Figure 3.12: Jumping Wires

jump wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply ”tinned”), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering. Individual jump wires are fitted by inserting their ”end connectors ïnto the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

There are different types of jumper wires. Some have the same type of electrical connector at both ends, while others have different connectors. Some common connectors are:

Solid tips – are used to connect on/with a breadboard or female header connector. The arrangement of the elements and ease of insertion on a breadboard allows increasing the mounting density of both components and jump wires without fear of short-circuits. The jump wires vary in size and colour to distinguish the different working signals.

Crocodile clips – are used, among other applications, to temporarily bridge sensors, buttons and other elements of prototypes with components or equipment that have arbitrary connectors, wires, screw terminals, etc.

8. Ultrasonic sensor

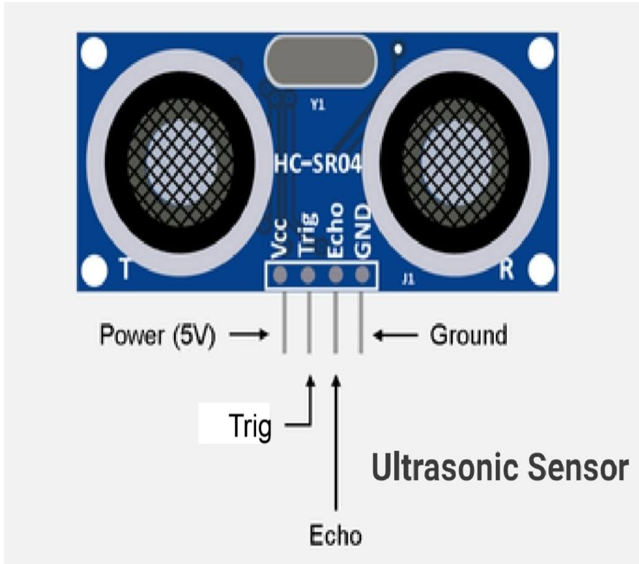

Figure 3.13: Ultrasonic sensor

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves.An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity.Ultrasonic sensors work by sending out a sound wave at a frequency above the range of human hearing. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound. Our ultrasonic sensors, like many others, use a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse.

The working principle of this module is simple. It sends an ultrasonic pulse out at 40kHz which travels through the air and if there is an obstacle or object, it will bounce back to the sensor. By calculating the travel time and the speed of sound, the distance can be calculated.

9. 16*2 LCD Display

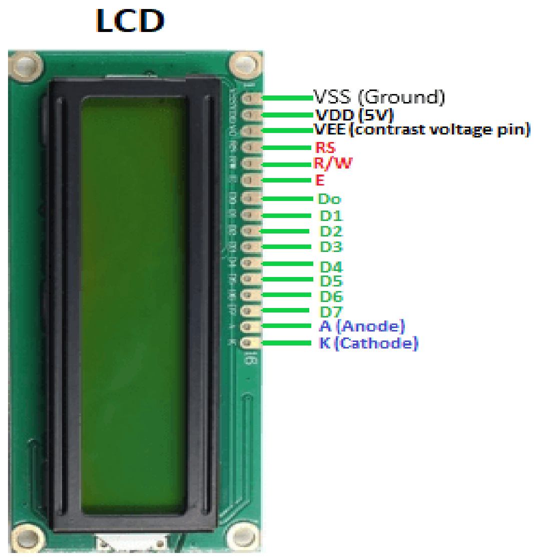

Figure 3.14: LCD

The LCD (Liquid Crystal Display) is a type of display that uses the liquid crystals for its operation.Here, we will accept the serial input from the computer and upload the sketch to the Arduino. The characters will be displayed on the LCD.The library that allows us to control the LCD display is called Liquid Crystal Library.

The Liquid Crystal Display has a parallel interface. It means that the microcontroller operates several pins at once to control the LCD display.The process includes putting the data (to be displayed on the LCD screen) into the data registers. The instructions in the Register Select are kept in the instruction register. The liquid crystal library has simplified process to display the characters on the LCD.The LCD library allows you to control LCD displays that are compatible with the Hitachi HD44780 driver. There are many of them out there, and you can usually tell them by the 16-pin interface.

10. ESP32 Camera

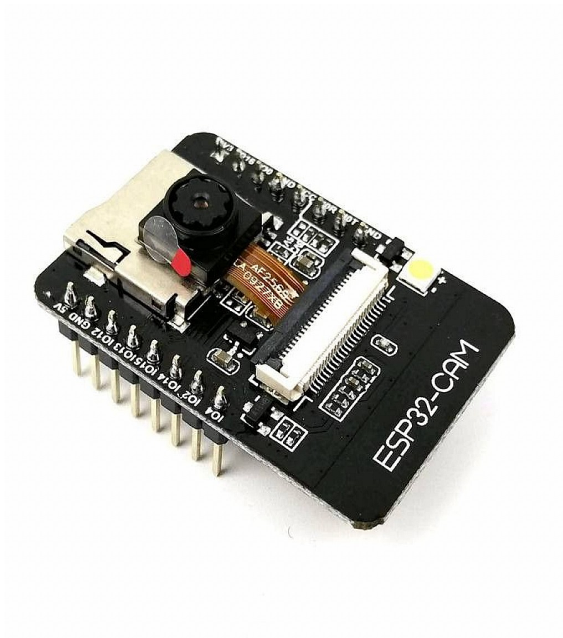

Figure 3.15: ESP-32 camera

ESP32 can perform as a complete standalone system or as a slave device to a host MCU, reducing communication stack overhead on the main application processor. ESP32 can interface with other systems to provide Wi-Fi and Bluetooth functionality through its SPI / SDIO or I2C / UART interfaces.ESP32 supports up to four 16 MiB external QSPI flashes and SRAMs with hardware encryption based on AES to protect developers' programs and data. ESP32 can access the external QSPI flash and SRAM through high-speed caches.

ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. It is a successor to the ESP8266 microcontroller.

11. Buzzer

Figure 3.16: Buzzer

A buzzer is an electronic device that generates sound or an audible tone when activated. It is a simple and commonly used component in various electronic circuits and applications. Buzzer modules are available in different forms, including electromagnetic buzzers and piezo buzzers.A buzzer typically consists of a housing or casing, an electromagnet (in the case of an electromagnetic buzzer), a diaphragm, and a contact mechanism. When an electrical signal is applied to the buzzer, the electromagnet creates a magnetic field that causes the diaphragm to vibrate, producing sound waves. These buzzers use an electromagnet to create vibrations in a diaphragm, which generates sound. They are commonly used in applications where a loud and continuous sound is required.

Buzzers are commonly used in security systems, fire alarms, and other safety devices to provide audible warnings and alerts.

12. FTDI232 Module

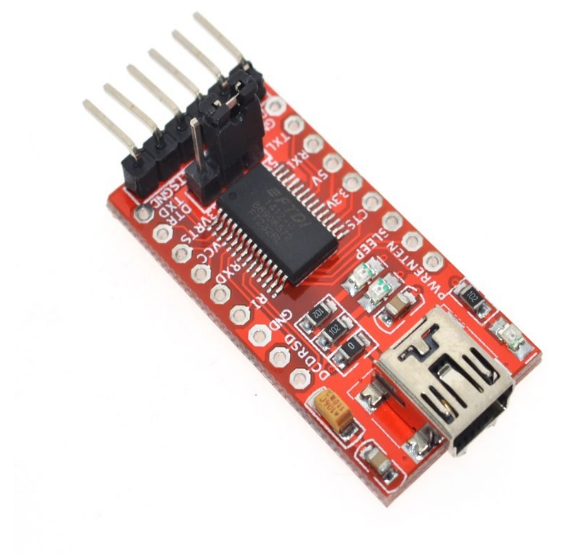

Figure 3.17: FTDI232 Module

The FTDI USB to TTL serial converter module is a UART (universal asynchronous receiver-transmitter) board used for TTL serial communication. It is a breakout board for the FTDI FT232R chip with a USB interface, can use 3.3 or 5 V DC and has Tx/Rx and other breakout points. FTDI USB to TTL serial converter modules are used for general serial applications. They are popularly used for communication to and from microcontroller development boards such as ESP-01s and Arduino micros, which do not have USB interfaces. The chip also incorporates FTDIChip-ID functionality (giving each chip a unique identifier for security) and USB termination resistors. Cloned boards (with a cloned chip) will likely exclude the unique ID functi

Software Reqirements

Arduino IDE

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment.

The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuino and Arduino board with the IDE to upload the sketch written in the Arduino IDE software.

The icons displayed on the toolbar are New, Open, Save, Upload, and Verify.

The Upload button compiles and runs our code written on the screen. It further uploads the code to the connected board. Before uploading the sketch, we need to make sure that the correct board and ports are selected.

The Open button is used to open the already created file. The selected file will be opened in the current window.

The save button is used to save the current sketch or code.

It is used to create a new sketch or opens a new window.

The Verify button is used to check the compilation error of the sketch or the written code.

The Open Recent button contains the list of the recent sketches.

The New button opens the new window. It does not remove the sketch which is already present.

The serial monitor button is present on the right corner of the toolbar. It opens the serial monitor.

Arduino IDE

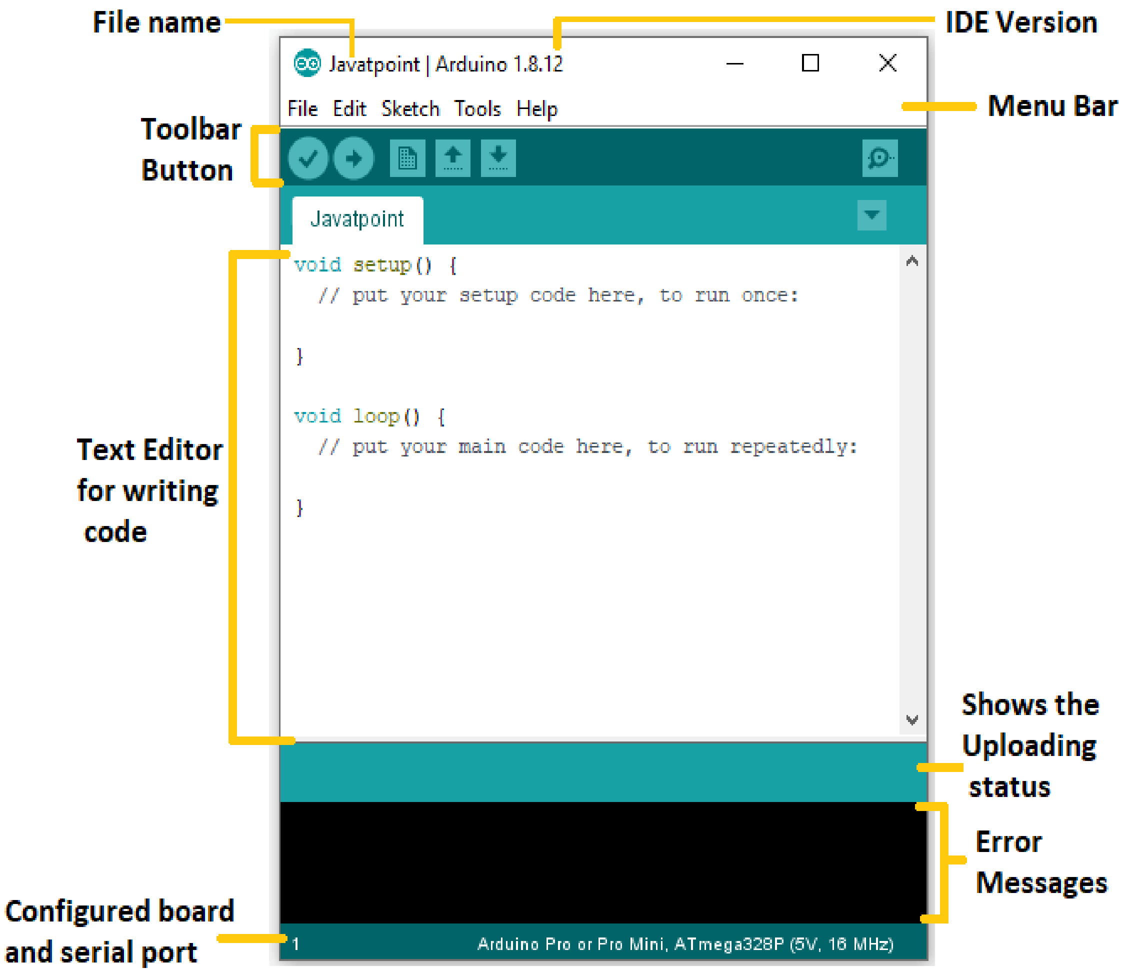

Figure 3.17: Arduino IDE

Steps install Arduino IDE on Windows

Step 1 : First you must have your Arduino board and a USB cable

In case you use Arduino UNO, Arduino Duemilanove, Nano, Arduino Mega 2560, or Diecimila, you will need a standard USB cable (A plug to B plug), the kind you would connect to a USB printer.

Step 2 Download Arduino IDE Software

You can get different versions of Arduino IDE from the Download page on the Arduino Official website. You must select your software, which is compatible with your operating system (Windows, IOS, or Linux). After your file download is complete, unzip the file.

Step 3 Power up your board

The Arduino Uno, Mega, Duemilanove and Arduino Nano automatically draw power from either, the USB connection to the computer or an external power supply. If you are using an Arduino Diecimila, you have to make sure that the board is configured to draw power from the USB connection. The power source is selected with a jumper, a small piece of plastic that fits onto two of the three pins between the USB and power jacks. Check that it is on the two pins closest to the USB port.Connect the Arduino board to your computer using the USB cable. The green power LED (labeled PWR) should glow.

Step 4 Launch Arduino IDE

After your Arduino IDE software is downloaded, you need to unzip the folder. Inside the folder, you can find the application icon with an infinity label. Double-click the icon to start the IDE.

Step 5 Open your first project.

Once the software starts, you have two options :

1)Create a new project.

2)Open an existing project example.

To create a new project, select File → New.

To open an existing project example, select File → Example → Basics → Blink.

Step 6 Select your Arduino board

To avoid any error while uploading your program to the board, you must select the correct Arduino board name, which matches with the board connected to your computer.

Go to Tools → Board and select your board.

Step 7 Select your serial port

Select the serial device of the Arduino board. Go to Tools → Serial Port menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your Arduino board and re-open the menu, the entry that disappears should be of the Arduino board. Reconnect the board and select that serial port.

Step 8 Upload the program to your board

click the Üpload”button in the environment. Wait a few seconds; you will see the RX and TX LEDs on the board, flashing. If the upload is successful, the message ”Done uploading”will appear in the status bar.

4. Methodology

4.1 Architecture

The structure and the behaviour and other view of an application or system are identified with the help of system architecture. The components of the system and the sub-systems of a system are developed and they work together forming the entire system.

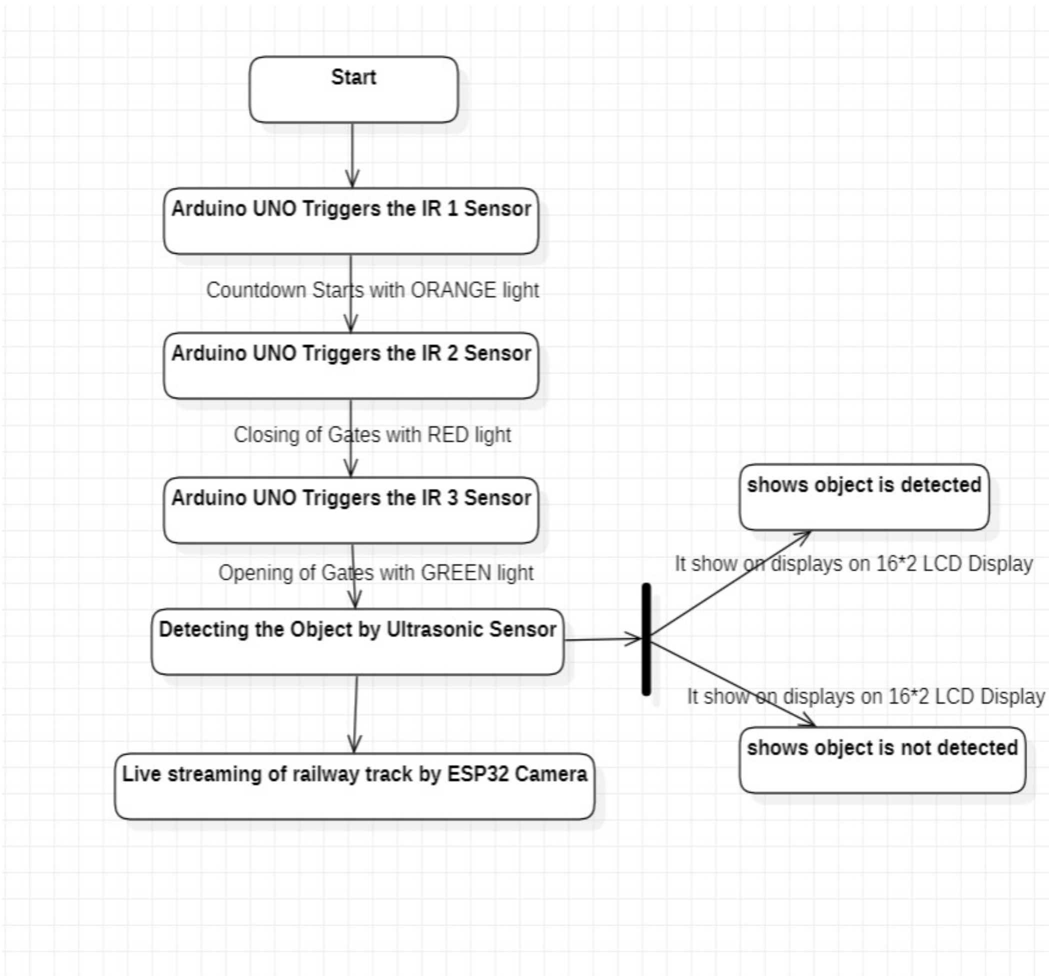

Figure 4.1: Architecture

4.2 Modules

4.21 Opening and Closing of Gates

In this Module we are using 3 IR sensors to senses the arrival of train whenever the train reaches to first IR Sensor, the orange light is indicated when the train reaches to the second IR Sensor Red will be indicated and gate will be automatically closed using Servo motor and when the train reaches the third IR sensor which is palced after the road level crossing the green light is indicated and Gate Opens automatically.

4.22 Countdown System for Closing Gates

In this module implementation of count down is executed a sensor is placed before the sensor at the gates to indicate the countdown and alerting the road countdown System for Closing Gates users regarding the arrival of Train and a Yellow Light is Displayed.

4.23 Obstacle Detection

In this module we are implementing Obstacle detection the Obstacle Detection is done using Ultrasonic sensor and ESP-32 camera for prevention of train accidents It shows th live Streaming . If obstacle detected the loco pilot will be alerted with buzzer and LED the distance between the train and obstacle is displayed on 16*2 LCD screen.

5. IMPLEMENTATION

5.1 Implementation

As part of the initial implementation of the project, we implemented the Closing and Opening of Gates with the countdown system . which is the integration of module 1 and module 2 of the project and we implemented the Obstacle Detection System which is module 3 of our project.

The main components used to Closing and Opening the Gates with the countdown system are Arduino UNO, IR Sensor, Servo Motor, Bread Board, LED'S, Resistors, Jumping Wires , LCDs. This IR sensor is used to detect the object. Servo Motor is used for Opening and Closing the Gates. Arduino UNO is a microcontroller board . It has 14 digital input/output pins , 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. Jumping Wires are used to connect the Components. Bread Board is used to make up temporary circuits for testing. LED'S is semiconducter device which can emit light when an electric current passes through it. Resister is used to control overflow of a electric current in a electronic circuit.LCD is used to display the countdown before closing the gates.

The main Components used for Obstacle Detection are Ultrasonic Sensor,Esp32 Camera, 16*2LCD,LED,Buzzer,Jumping Wires. Ultrasonic is used to detect the object.Esp32 Camera is used to get live Streaming . 16*2 LCD is used to display the distance between the train and the object. LED is used to indicate the loco pilot , Buzzer is used to indicate the loco pilot.Jumping Wires are used to connect the Components.

we are using 3 IR sensors to senses the arrival of train whenever the train arrives to IR1 orange led will be switched on and the IR1 is connected to LCD It displays the countdown to alert the people. When the train reaches to IR2 the Red light will be switched on the IR2 is connected to servo motor to close the gate automatically. When train is departure from IR3 the Green light will switched on the IR3 is also connected to servo motor to open the gate automatically.

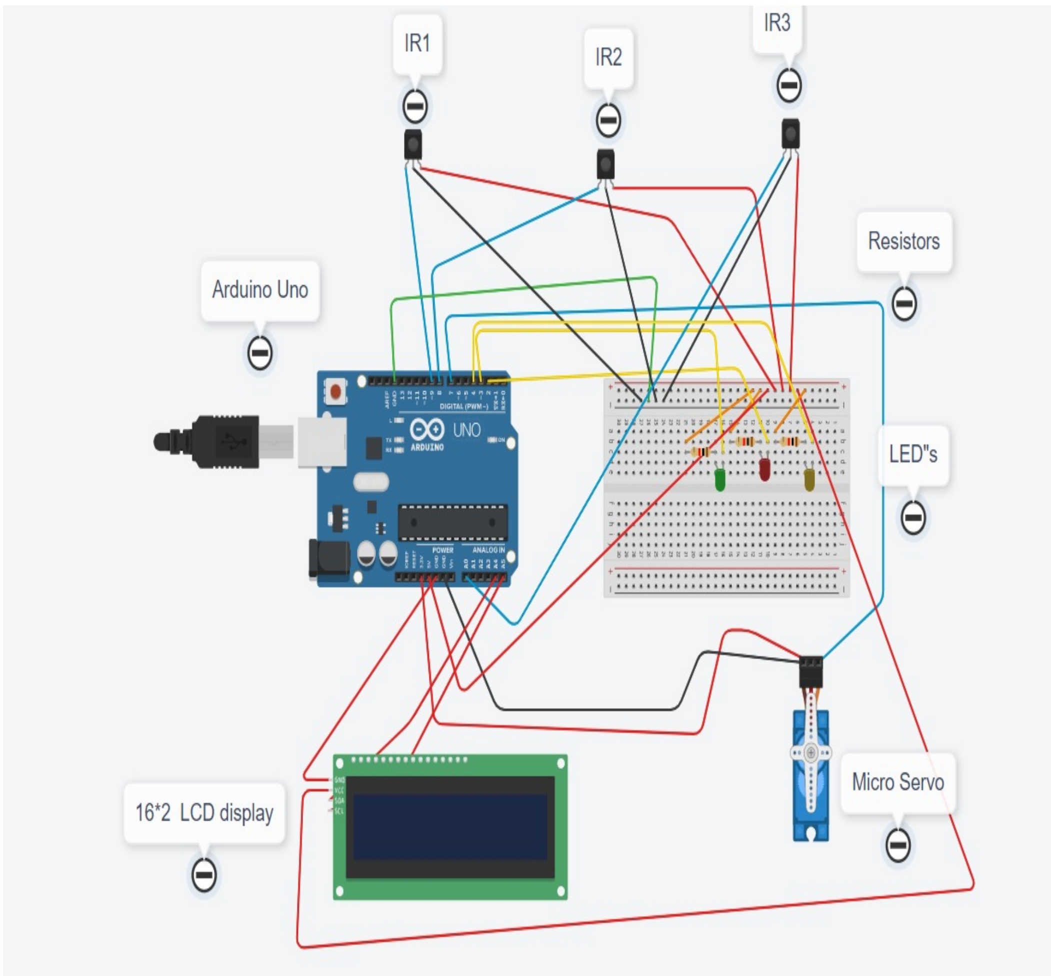

Figure 5.1: Components Setup1

Obstacle detection is done using Ultrasonic sensor and ESP-32 camera for prevention of train accidents. If obstacle detected the loco pilot will be alerted with buzzer and LED the distance between the train and obstacle is displayed on 16*2 LCD screen.

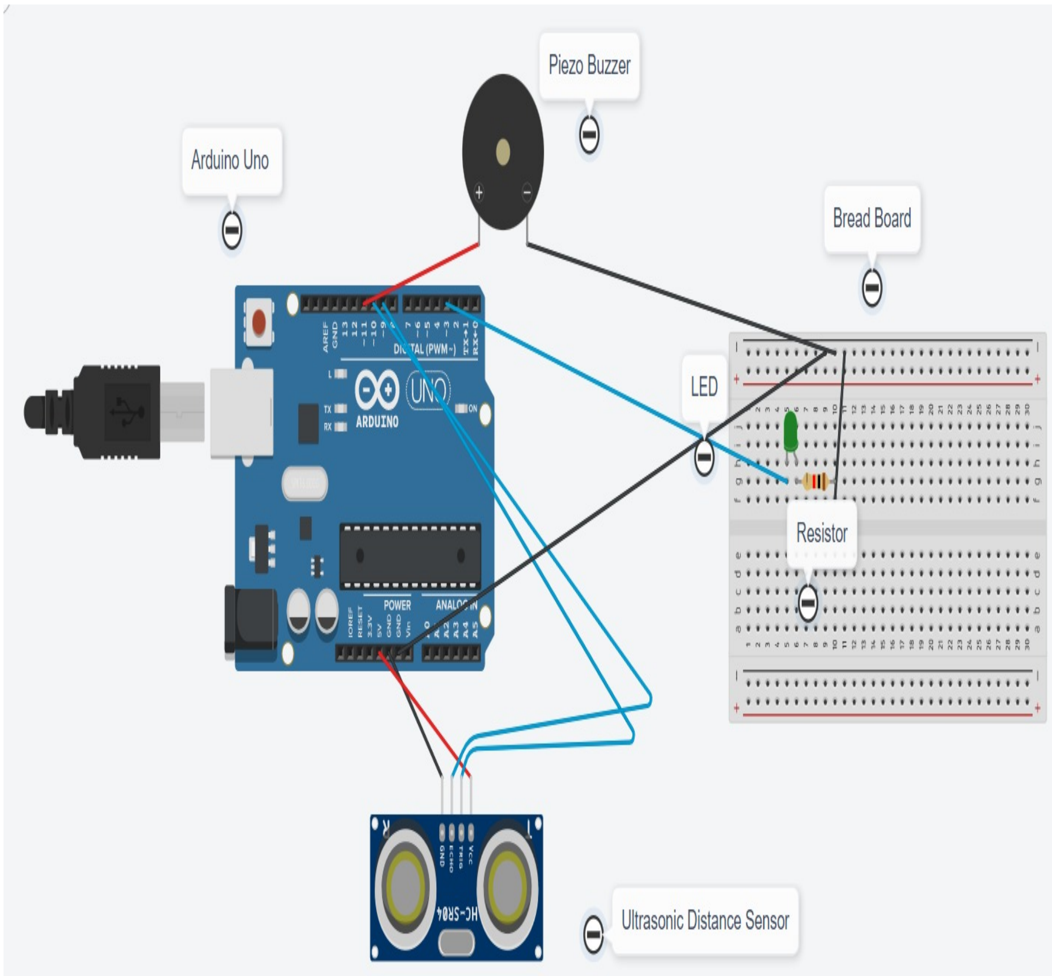

Figure 5.2: Components Setup2

5.2 Code for Implementation

We are importing the package Servo.h and IR Sensor 1 and IR Sensor 2 is connected 8th and 9th pins of Arduino UNO Board, LED 1 and LED 2 is connected to 2nd and 3rd pins of Arduino UNO Board . We are setting the PinModes of 2 sensors to Input and 2 led's are set to Output Mode, Servo Motor is connected to 7th pin of Arduino, whenever the IR Sensor 1 is low then LED 1 is High and the IR 2 is LOW then LED 2 is High and LED 1 is Low.

Code of Integration of Module 1 and Module 2

```
include <Wire.h >
include <LiquidCrystal _I2C.h >
include<Servo.h >
Servo motor;
int ir = 10;
int ir1 = 8;
int ir2 = 9;
int led1 = 2;
int led2 = 3;
int led3 = 4;
LiquidCrystal_I2C lcd(0x27, 16, 2);
void setup()
{
lcd.init();
lcd.init();
lcd.backlight();
lcd.setCursor(3,0);
lcd.print(Çount Down”);
pinMode(ir,INPUT);
pinMode(ir1,INPUT);
pinMode(ir2,INPUT);
motor.attach(7);
pinMode(led1,OUTPUT);
pinMode(led2,OUTPUT);
pinMode(led3,OUTPUT);
}
```

```
void loop()
{
if(digitalRead(ir) == LOW)
{
digitalWrite(led3,LOW);
digitalWrite(led2,HIGH);
digitalWrite(led1,HIGH);
int count;
for( count=20;count>=0;count–)
{
lcd.setCursor(3, 1);
lcd.print(”Time Left ”);
lcd.setCursor(13, 1);
lcd.print(count);
delay(500);
lcd.clear();
lcd.setCursor(3, 0);
lcd.print(Çount Down”);
}
lcd.clear();
}
else if(digitalRead(ir1) == LOW)
{
lcd.clear();
motor.write(115);
digitalWrite(led2,LOW);
digitalWrite(led3,HIGH);
```

```
digitalWrite(led1,HIGH);
lcd.setCursor(3, 0);
lcd.print(”GATE OPENED ”);
lcd.setCursor(5, 1);
lcd.print(”GO”);
}
else if(digitalRead(ir2) == LOW)
{
motor.write(10);
digitalWrite(led2,HIGH);
digitalWrite(led3,HIGH);
digitalWrite(led1,LOW);
lcd.clear();
lcd.setCursor(3, 0);
lcd.print(”GATE CLOSED”);
lcd.setCursor(5, 1);
lcd.print(”STOP”);
delay(1000);
}
}
```

Code for Implementation of Module 3

```
include <LiquidCrystal_I2C.h >
LiquidCrystal_I2C lcd(0x27, 16, 2);
const int trigPin = 9;
const int echoPin = 10;
const int buzzer = 11;
const int ledPin = 13;
defines variables
long duration;
int distance;
int safetyDistance;
void setup()
{
pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
pinMode(echoPin, INPUT); // Sets the echoPin as an Input
pinMode(buzzer, OUTPUT);
pinMode(ledPin, OUTPUT);
lcd.init();
lcd.backlight();
lcd.print (”NO Obstacle”);
delay(2000);
lcd.clear(); // Starts the serial communication
}
void loop()
{
Clears the trigPin
```

```
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
Calculating the distance
distance= (duration*0.0347/2);
safetyDistance = distance;
if (safetyDistance ¡= 100)
digitalWrite(buzzer, HIGH);
digitalWrite(ledPin, LOW);
lcd.clear();
}
{
digitalWrite(buzzer, LOW);
digitalWrite(ledPin, HIGH);
distance = 0;
if(distance == 0)
{
lcd.setCursor(0,0);
lcd.print(”NO OBSTACLE”);
delay(500);
lcd.clear();
}
}
if(distance ¿ 0)
```

```
lcd.setCursor(0,0);
lcd.print(.ºBJECT DETECTED”);
lcd.setCursor(0,1);
lcd.print(distance);
lcd.setCursor(3,1);
lcd.print(çms”);
delay(1000);
lcd.clear();
}
}
```

6. Result

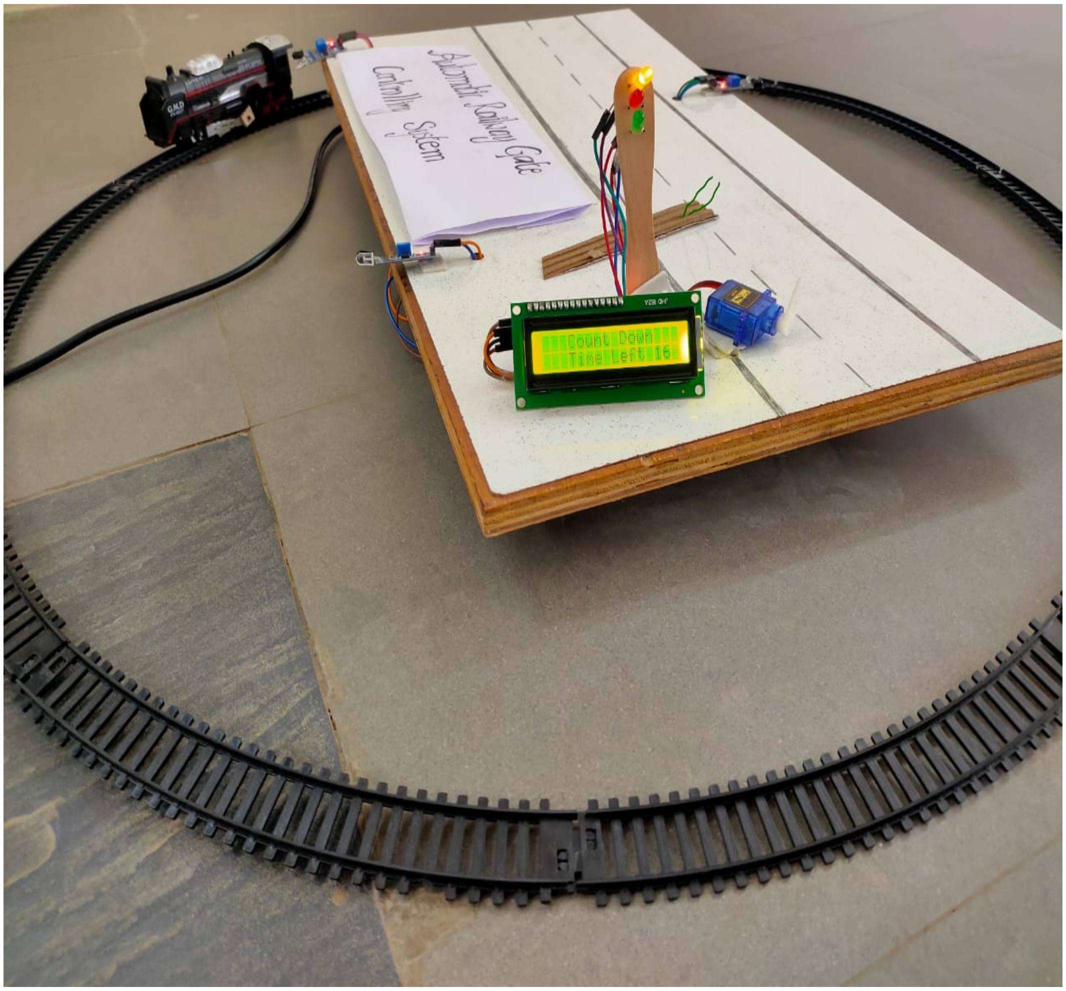

Figure 6.1: Train Detected at IR1

In fig 6.1 : whenever the train arrives to first Infrared Sensor orange led will be switched ON and the IR1 is connected to LCD It displays the countdown to close the gate. When the countdown is completed the gate will be closed.

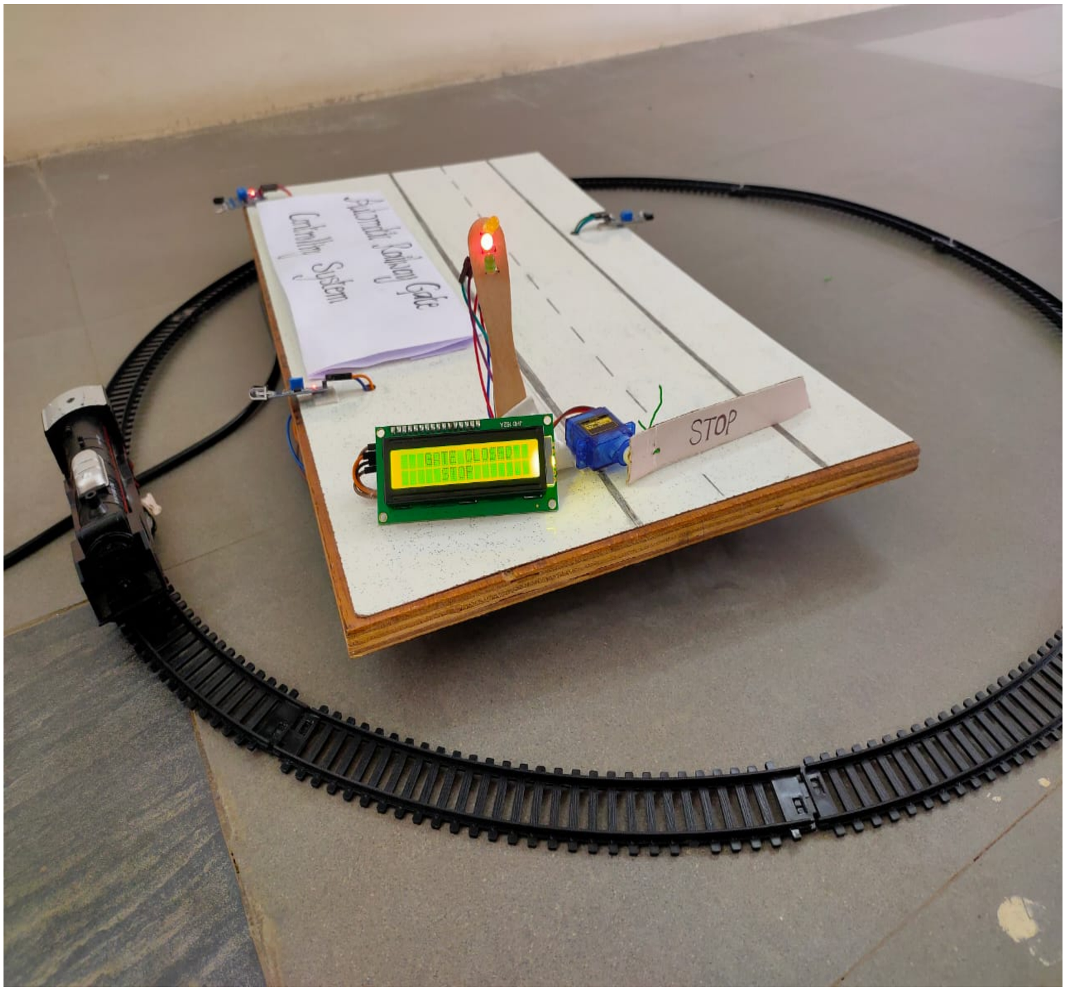

Figure 6.2: Train Detected at IR2

In fig 6.2 : When train reaches the second Infrared sensor the Red light will be Switched ON and the gate will be closed and the countdown will be completed and it displays ”gate closed stop”. the second Infrared Sensor is connected to sevo motor so by using servomotor the gates will be closed.

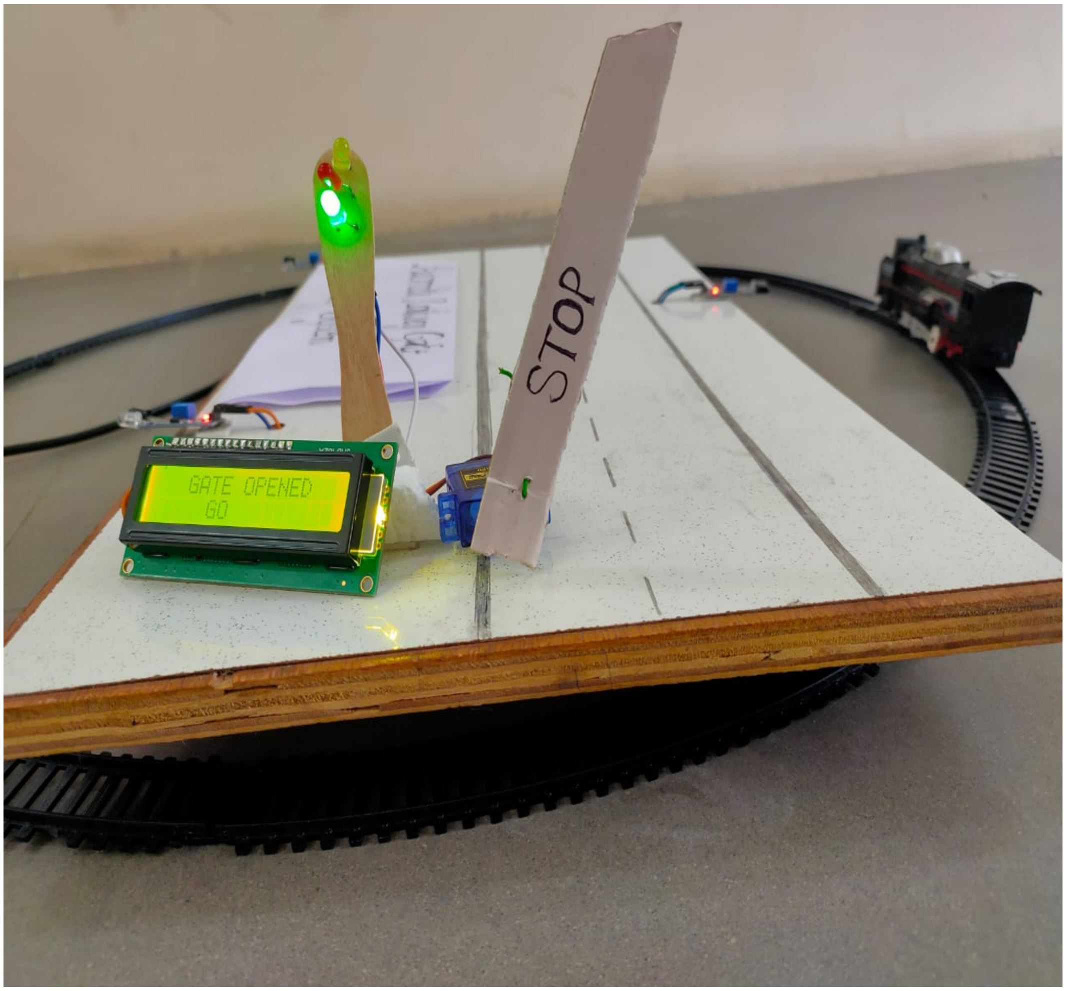

Figure 6.3: Train Detected at IR3

In fig 6.3 : when train departure from third Infrared Sensor the gate will be opened and the Green light will be ON and the third infrared sensor is connected to servo motor by using servo motor the gate will be opened automatically and the LCD displays ”Gate opened Go”.

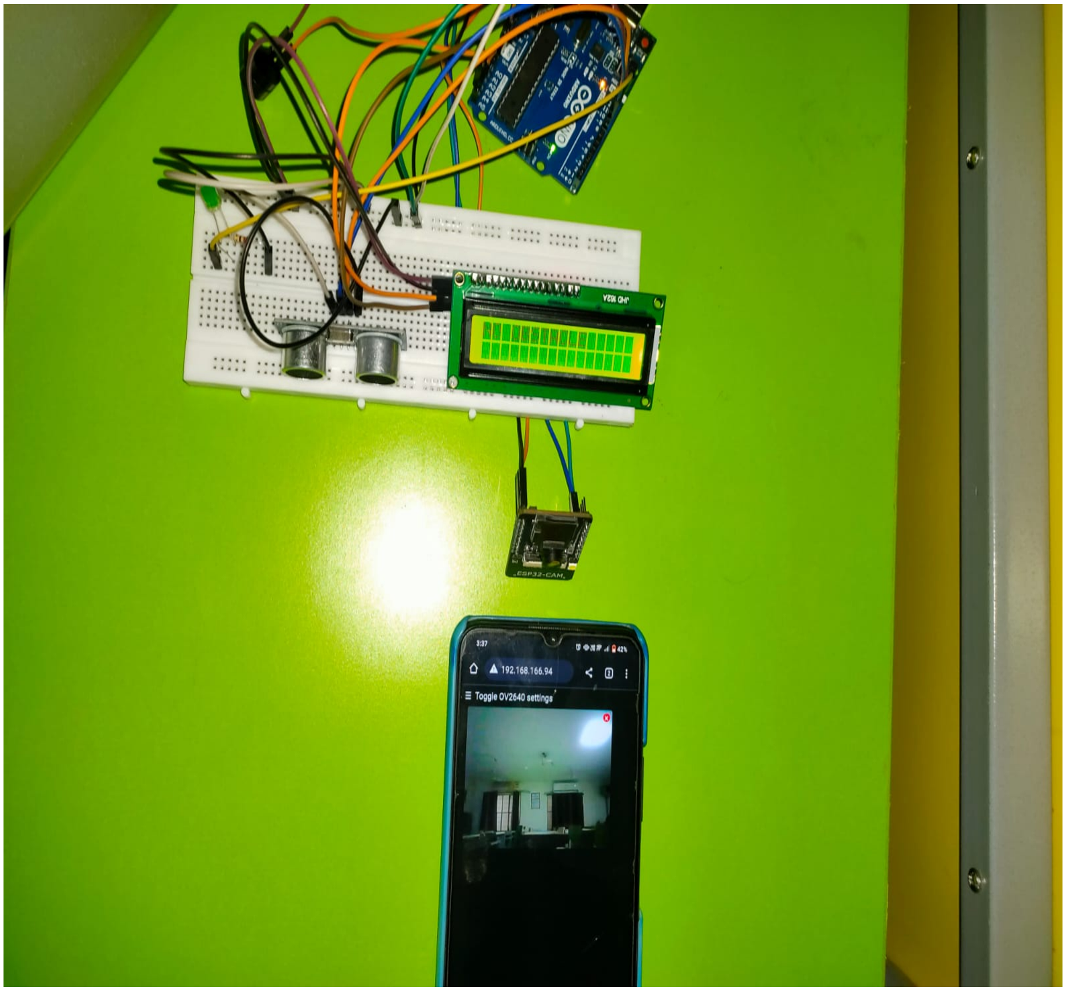

Figure 6.4: No Object Detected

In fig 6.4 : In obstacle detection we are using Ultrasonic sensor to detect the object. we use LCD to display the distance between the train and object.we use ESP32 camera for live streaming. when there is no object the LCD will display”NO OBSTACLE”.

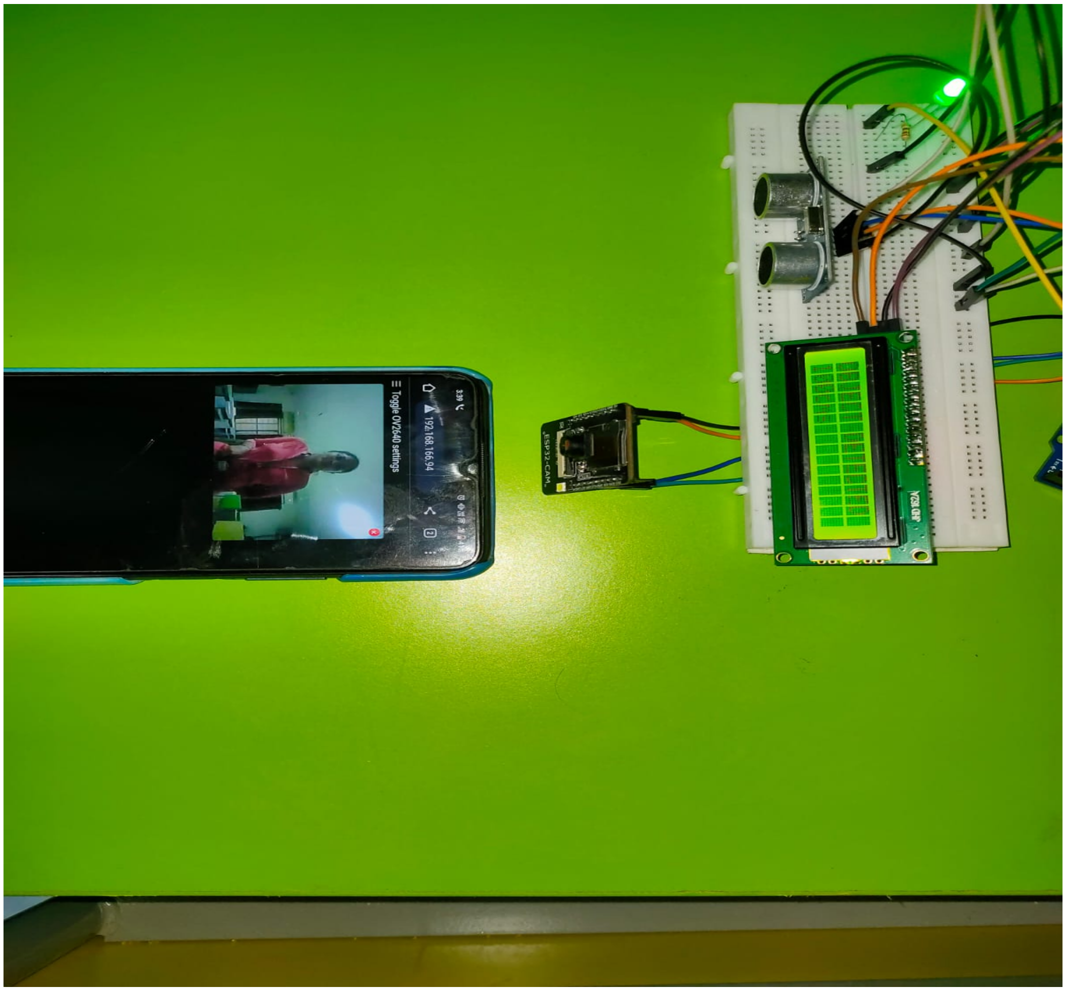

Figure 6.5: Object Detected

In fig 6.5 : In obstacle detection we are using Ultrasonic sensor to detect the object. we use LCD to display the distance between the train and object.we use ESP32 camera for live streaming. when there is object the LCD will display distance between the train and object and the object will be displayed in mobile or some digital sreecn.

7. Conclusion and Future Scope

Automatic gate control system an effective way to reduce the occurrence of railway accidents. This system can contribute a lot of benefit either to the road users or to the railway management. Since the design is completely automated it can be used in remote villages where no station master or line man is present. Railway sensors are placed at two sides of gate. It is used to sense the arrival and departure of the train and a count down system is executed .A sensor is placed before the gates to indicate the countdown and alerting the road side people regarding the arrival of Train and a Yellow Light is Displayed. And we implemented Obstacle detection the Obstacle Detection is done using Ultrasonic sensor and ESP-32 camera for prevention of train accidents It shows the live Streaming for the loco pilot. If obstacle detected the loco pilot will be alerted with buzzer and LED the distance between the train and obstacle is displayed on 16*2 LCD screen.

In extension to the project for further implementation adding a pair of Pressure sensor increases the chance of fault triggering of gate by the gate after receiving signals from both IR and Pressure sensor. Intimation of the obstacle detected on track to the next station master along with the GPS location of train for better service

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