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AUTOMATIC RAILWAY CROSSING USING EMBEDDED SYSTEM

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ABSTRACT:

Transportation has become an essential medium in today's life, it has become a daily routine of many people. One among those transportation medium is railways, this project mainly focuses on the automation in the field of railways, and i.e. the automatic railway gate control using Arduino UNO, Buzzer, LED, IR Sensor etc. for further safety purpose a GSM module is used. As the need for transportation increases accidents are also increasing day by day, this project helps in eradicating the railway accidents gradually. An arduino is used to feed a program that works according to the desire of our project, when the gate operates i.e. (opens or closes) a message is sent through GSM to a registered mobile number for safety. Main purpose of this project is to make sure that the accident rate is decreased while crossing a railway gate. This project can also be implemented in real world with some upgraded equipment but the working principle of this project always remain the same. This project aims to provide an automatic railway gate control at the level l crossing replacing the manual gate control. The railway gate is to be closed automatically when a train is done by using two IR sensors. The opening and closing of the gate is to be done using stepper motors and this stepper motor is controlled by Arduino. Additionally the status of the gate will be given to the motorman well in advance. This insures more protection from the accident. LCD and alarm are used to indicate the closing of gate for the people who are trying to cross the gate. IR sensor are used for the proper closing of the gate.

At present people go for various modes of transportation such as by buses, flights, car, train etc. Out of this majority depend on railway, people opt this because they always seek for the service with more comfort with cheaper rates. In spite of this safety measures followed, everyone could see a lot of accidents took happened in this sector; knowingly or unknowingly it may take away lives of many ones. The occurrences of these accidents are mainly because of defects of rails. Now railways are performing fault detection by means of manual inspection, so it will be better if go for an advanced system where Railway track damage status is monitored by using sensors and transfer related information through wireless modules. Because majority of railway accident's prime reason is fault within the track such as occurrence of crack etc. As there need to ensure safety at all related aspects, unmanned railway crossing also need to be taken to account. This problem can be solved by introducing a fully automated system controlling railway level crossing gate more effectively

1-INTRODUCTION

An automatic railway crossing system using embedded systems is a crucial application in ensuring the safety and efficiency of railway transportation. Embedded systems are specialized computing systems designed to perform dedicated functions within a larger system. In the context of automatic railway crossings, embedded systems play a vital role in automating the operation of railway barriers and signals to manage the flow of traffic at railway crossings.

The embedded system in an automatic railway crossing typically consists of sensors to detect approaching trains, a microcontroller to process sensor data and control the barriers and signals, and actuators to physically operate the barriers and lights. When a train is detected by the sensors, the microcontroller triggers the closing of barriers to prevent vehicles from crossing the railway tracks and activates warning signals to alert road users of the approaching train.

This technology enhances safety by reducing the risk of accidents at railway crossings, as it eliminates human error in manually operating barriers and signals. Additionally, automatic railway crossing systems help improve traffic flow by efficiently managing the opening and closing of barriers based on train movements.

In automatic railway crossings utilizing embedded systems, the core components work together seamlessly to ensure the safe passage of trains and vehicles. The sensors, such as infrared sensors or pressure sensors, detect the presence of an approaching train. Upon receiving the signal from the sensors, the microcontroller commands the actuators to swing the barriers down, blocking the road to prevent vehicles from crossing the tracks.

Fig 1.1 Railway Gate

Simultaneously, warning lights and signals are activated to alert drivers and pedestrians of the oncoming train. This coordinated operation ensures the safety of both road users and train passengers by preventing accidents at railway crossings.

2-LITERATURE SURVEY

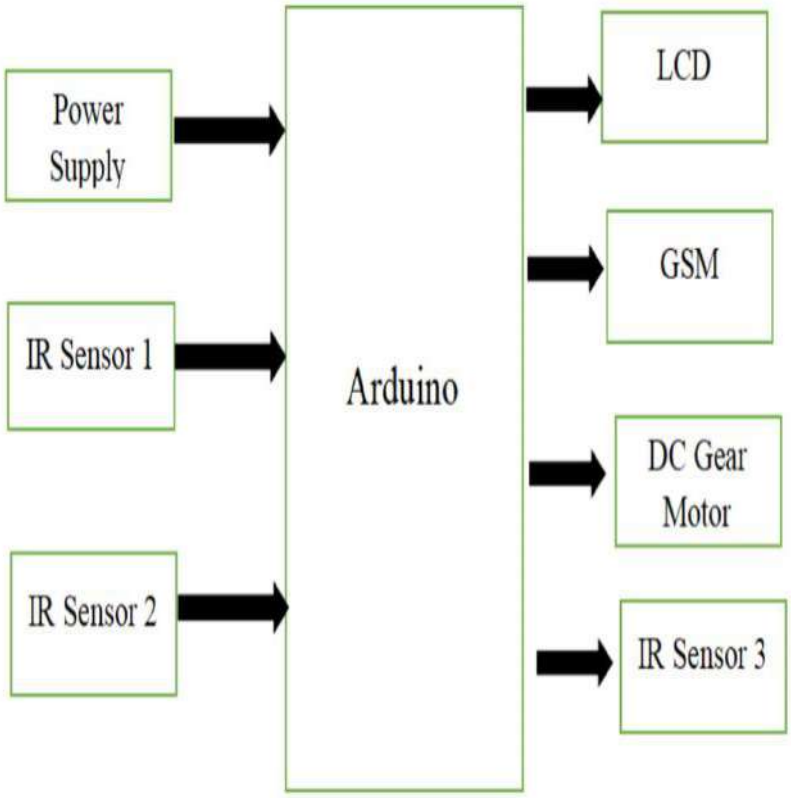
The automatic railway gates operation has been projected using various methods. As proposed by **Xishi Wang (1992),** the process of developing fault tolerance method has been applied for both the hardware and the software components. Magnetic sensors placed underground to detect the train are less affected by environmental changes and recognizes the direction of movement of vehicles.

Jeong Y (2008) defined the railway auto control system using OSGi (Open Service Gateway Initiative) and JESS. The state of railway cross has been estimate during 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.

Atul Kumar Dewangan (2012) gave a detailed introduction about the present railway technology and also discussed the disadvantages of manually activated railway signals and the railway warnings at thelevel cross. The train detectors act as the major component in the train automation system**.** **Banuchander J (2012)** developed a method to concentrate on anti-collision system to identify the collision points and to report these error cases to main control room, nearby station as well as grid control stations.

3- BLOCK DIAGRAM



4- HARDWARE & SOFTWARE REQUIREMENTS

In this chapter we will discuss hardware and software requirements for Automatic Crossing Using Embedded System.

Hardware Requirements

ARDUINO UNO:

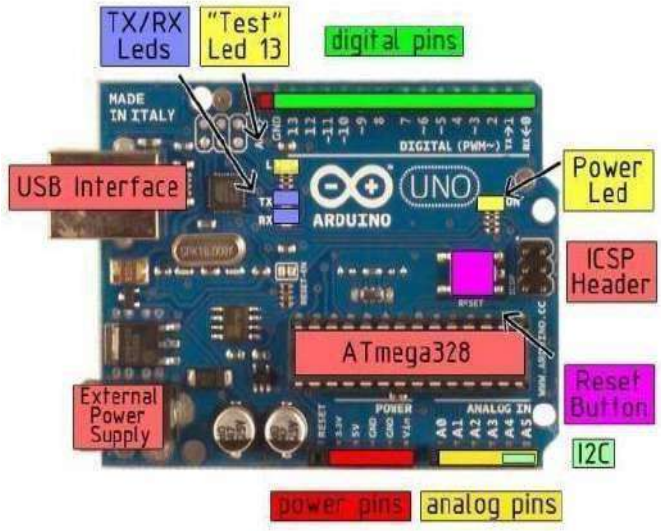


Fig 2.1 Arduino UNO

Fig 2.2 Atmega 328P

Arduino/Genuino 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 quartz crystal, 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 worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" 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.Automatic Railway Crossing. In this chapter we will discuss about Existing/Proposed System, block diagram and methodology for Automatic Railway Crossing Using Embedded System.

5- EXISTING SYSTEM

1. Manual Railway Crossing System:

Human-Controlled Gates: A gatekeeper is responsible for opening and closing the gates when a train is approaching or passing.

Signals and Sensors: In some advanced systems, signals from the train are received by the gatekeeper, who then manually operates the gates.

Disadvantages: Human error, time delays, lack of precision, and vulnerability to accidents.

2. Semi-Automatic Systems:

Track Circuits or Manual Signals: The gate operation is automated, but a human operator may still supervise the system and manually override it when necessary.

Basic Automation: Systems may use mechanical relays, and the gates close based on signals sent by the train approaching the crossing.

Disadvantages: Limited intelligence in decision-making, no ability to handle unforeseen scenarios, and often fails in extreme weather or maintenance issues.

6- PROPOSED SYSTEM

Microcontroller-Based System: The entire system is controlled by an embedded microcontroller (like Arduino, PIC, or ARM-based processors).

Sensors: IR or Ultrasonic Sensors: Detect train proximity by sensing the train's presence a certain distance before and after the crossing.

RFID Sensors: RFID tags placed on the train communicate with RFID readers at the crossing to determine train identification and proximity.

Pressure or Track Sensors: Detect the weight or movement of trains on tracks, triggering gate operation.

Gate Control Mechanism: The microcontroller uses input from sensors to automatically operate the gate motors, ensuring timely closure and opening.

Warning System: Warning lights and buzzers activate well before the train arrives, alerting vehicles and pedestrians of an oncoming train.

Advantages: Precise timing, reduced human error, minimal manual intervention, and improved safety.

7- WORKING

- Switch on the power supply. The LCD will display the saved numbers.
- When the IR Sensor 1 detect the objects then the signal is transferred to Arduino then the microcontroller will be 0.
- Then the gate will be closed by using the DC gear motor.
- When the IR Sensor 2 detect the objects then the signal is transferred to Arduino then the microcontroller will be 1.
- Then the gate will be opened by using the DC gear motor.
- When there is fault in the track then the IR sensor 3 will be activated.

8- ADVANTAGES

1. **Enhanced Safety**: Automatically stops vehicles at the crossing when a train approaches, reducing accidents.Sensors detect obstacles or vehicles on the track, alerting the system to prevent collisions.
2. **Reduced Manual Intervention:**Eliminates the need for manual gate operation, minimizing human error.Automated system ensures consistent and reliable operation.
3. **Increased Efficiency :**Trains can maintain optimal speed, reducing travel time. Automated crossing minimizes delays caused by manual gate operation.
4. **Real-time Alerts :**Provides real-time alerts to drivers and pedestrians through display boards, sirens, or flashing lights. Ensures timely evacuation of vehicles and pedestrians from the crossing.
5. **Improved Traffic Flow:** Dynamic timing adjustment optimizes traffic flow based on realtime traffic conditions. Reduced congestion at crossings.
6. **Cost Effective** : Long-term cost savings through reduced maintenance and personnel costs.Initial investment in automation yields significant returns.
7. **Environmental Benefits** :Reduced fuel consumption and emissions from idling vehicles. Lower carbon footprint.

9- DISADVANTAGES

1. **Complexity:** Embedded systems can be complex to design, implement and maintain**.**
2. **Power Outages:** Power failures can cripple the system, compromising safety**.**
3. **Communication Disruptions:** Connectivity issues can prevent real- time monitoring and control.

10- APPICATIONS

1. **Automatic Gate Control**: Embedded systems can control gates at railway crossings, automatically opening and closing them based on train schedules or sensor inputs.
2. **Train Detection:** Embedded systems can detect approaching trains using sensors, such as infrared or ultrasonic sensors, and alert drivers or pedestrians.
3. **Collision Avoidance:** Embedded systems can detect potential collisions and alert authorities or take control of the gates to prevent accidents.
4. **Remote Monitoring:** Embedded systems can remotely monitor railway crossings, allowing authorities to respond quickly to issues or accidents.
5. **Condition Monitoring**: Embedded systems can monitor the condition of gates, sensors, and other equipment, predicting maintenance needs and reducing downtime.

11- RESULTS

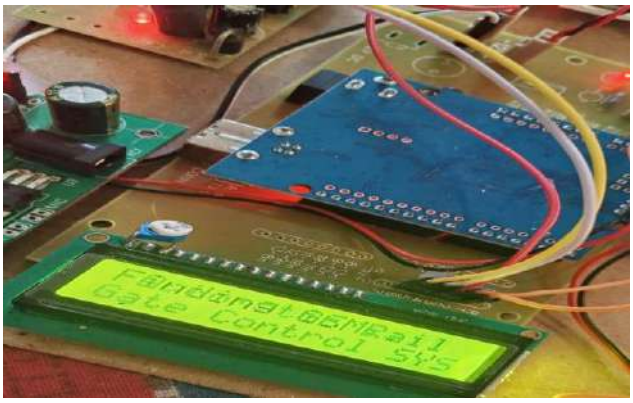


Fig 5.1 LCD Display

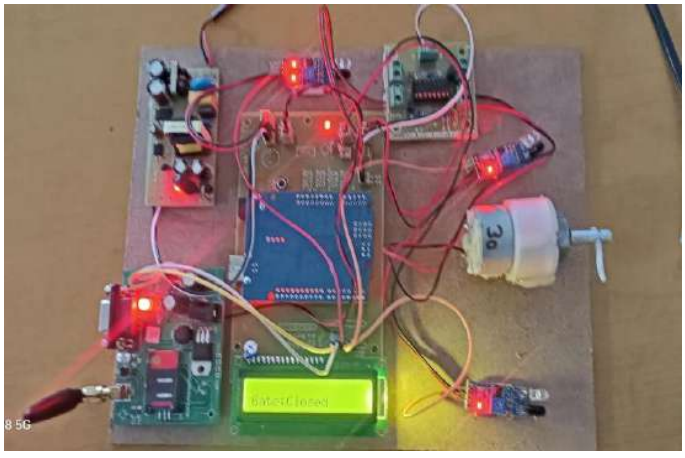


Fig 5.2 Gate Closed

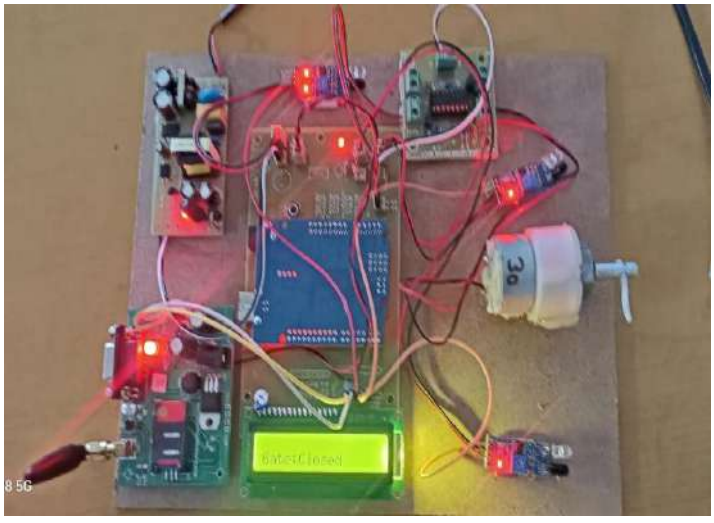


Fig 5.3 Gate Opened

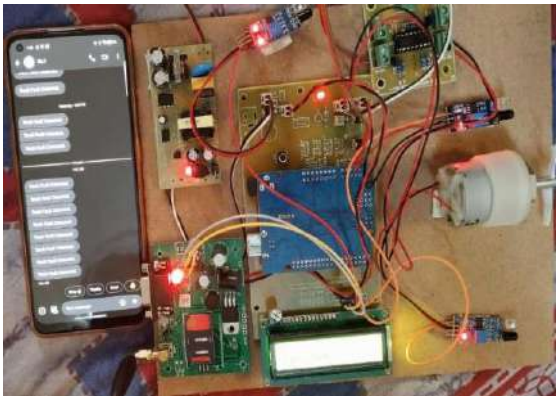


Fig 5.4 Fault Detection

The result and output of an automatic railway crossing using embedded systems are improved safety, reduced accidents, and smoother traffic flow at railway crossings. By automating process of detecting trains, activating warning signals, controlling traffic, and managing barriers.

10- CONCLUSION

This project is suitably fulfilled the basic things such as avoidance of accidents inside the gate and the avoidable of a gatekeeper. It avoids the railway accidents and provides safety. We have seen little improvement in railway accidents..Automatic gate control system offer 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. This system involves instrumentation system for detecting the railway track crack detection when the crack detected. The detected data from sensors is continuously uploaded to the control room for railway track crack detection. This system also enables notification services for the employees.

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