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TRANSFORMING TRAVEL: SMART RAILWAY STATION

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ABSTRACT

In this paper, we are going to close or open the movable platform where people are waiting for the train. This is done mechanically. Movable platform is in which the passenger can move from one platform to the other platform. When the sensor detects the train, the platform closes and it allows the train to go through track and when it reaches another sensor it automatically gets open. Microcontroller is used for sending the signals. Stepper motor is used to open and close the platform. Piezoelectric sensor is used to generate power, when people walk on platform due to the weight of people power is generated.

I INTRODUCTION

Each day, our lives become more dependent on 'embedded systems', digital information technology that is embedded in our environment. More than 98% of processors applied today are in embedded systems, and are no longer visible to the customer as 'computers' in the ordinary sense. An Embedded System is a special-purpose system in which the computer is completely encapsulated by or dedicated to the device or system it controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few predefined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded systems are often mass- produced, benefiting from economies of scale. The increasing use of PC hardware is one of the most important developments in high-end embedded systems in recent years. Hardware costs of high-end systems have dropped dramatically as a result of this trend, making some projects feasible which previously would not have been done because of the high cost of non-PC-based embedded hardware. But software choices for the embedded PC platform are not nearly as attractive as the hardware. Typically, an embedded system is housed on a single microprocessor board with the programs stored in ROM. Virtually all appliances that have a digital interface -- watches, microwaves, VCRs, cars -- utilize embedded systems. Some embedded systems include an operating system, but many are so specialized that the entire logic can be implemented as a single program. Physically, Embedded Systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. The applications software on such processors is sometimes referred to as firmware. The simplest devices consist of a single microprocessor (often called a "chip"), which may itself be packaged with other chips in a hybrid system or Application Specific Integrated Circuit (ASIC). Its input comes from a detector or sensor and its output goes to a switch or activator which (for example) may start or stop the operation of a machine or, by operating a valve, may control the flow of fuel to an engine.

II LITERATURE SURVEY

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Various researchers worldwide are working on developing intelligently operated rail level crossing gate control systems. Throughout the past few decades, researchers have been attracting attention to the need for automated systems in Bangladesh. Most developed nations already have automated systems. The automated gate control system for railway level crossings is yet to be developed in some developing countries, like Bangladesh. (Siddh et al.,2015) proposed an automatic railway gate control system using IR and pressure sensors along with voice declaration. This system allows the gate to close when the train arrives or leaves a railway-road level crossing. Microcontroller was used to trigger the siren to alert people who may be near or on the track. And closing or opening the gate by rotating the servo motor. (Abu Salman Shaikat, 2021).

This paper addresses some of the major challenges and opportunities in developing smart railway systems for smart cities, such as safety, efficiency, sustainability, and user comfort. According to (Ali et al. 2023), rail accidents are a major problem in many countries around the world, and there is an urgent need to install protective elements to prevent accidents. They propose a sensor-based smart railway accident detection and prevention system for smart cities using real-time mobile communication, which consists of several sensors, LTE module, micro-controller, motorized gate and various displays for traffic control. They claim that their system can achieve real-time two-way communication between the train and the control room, and can detect and prevent accidents effectively, (Ali M., Rasheed O., Rehman S., Ullah F., Ahmed S. 2023).

Another aspect of smart railway systems is power utilization and management, which can enhance the performance and comfort of railway operations (Dethe et al. 2022) propose a loT-based smart railway management system for passenger safety and comfort, which can automatically turn lights and fans on and off based on the number of people in the coach. They also propose a prototype for automatically examining and identifying cracks, obstacles, and fire in railway tracks using various sensors. They state that their system can update the status of all sensors on a website to assist railway administrators (Dethe T., Maheswari B.U., Ullas S., 2022). The paper also incorporates some innovative features that are not commonly found in existing smart railway systems.

III EXISTING SYSTEM

Key Components of Existing Smart Railway Station Systems:

1.Information Systems:

- Digital Displays: Real-time train schedules, platform information, and service updates.
- Mobile Apps: Journey planning, ticket purchasing, and real-time notifications.
- Interactive Kiosks: Wayfinding, information access, and ticket services.
- Public Address Systems: Automated and manual announcements.

2.Security Systems:

- CCTV Surveillance: Monitoring station activity for security and safety.
- Access Control: Automated gates and barriers to regulate passenger flow.
- Sensor Networks: Detecting potential hazards like fires, smoke, or unusual activity.
- AI-Powered Surveillance: Facial recognition and anomaly detection.

3.Operational Systems:

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- Automated Ticketing: Self-service kiosks and online ticketing platforms.
- Smart Energy Management: Optimizing lighting, heating, and ventilation.
- Predictive Maintenance: Sensors monitoring equipment for potential failures.
- Train Control Systems: Automated signaling and train movement management.

4.Infrastructure Systems:

- Smart Parking: Guidance systems and real-time parking availability.
- Waste Management: Sensor-based monitoring of waste levels.
- Environmental Monitoring: Sensors tracking air quality and other environmental factors.
- Wi-Fi Connectivity: Providing internet access for passengers.

5.Train Operations Systems:

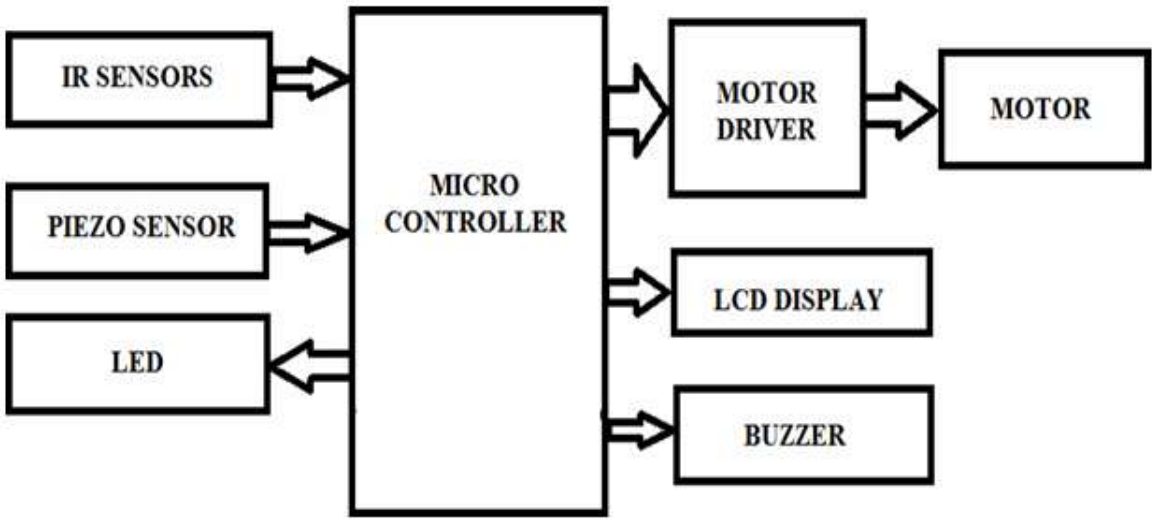
- Train detection systems: systems that monitor the location of trains on the track.
- Collision prevention systems: Systems that use sensors and software to prevent train collisions.

6.Technological Foundations:

- Internet of Things (IoT): Connecting devices and systems for data collection and exchange.
- Artificial Intelligence (AI): Analyzing data, predicting trends, and automating tasks.
- Big Data Analytics: Processing large volumes of data for insights and optimization.

IV PROPOSED SYSTEM

When the train passes from the IR sensor, it senses the train and passes a signal to the microcontroller. Microcontroller goes into alert mode and it will turn on the LED and buzzer. This will give a signal to the platform and the platform will open. When another IR sensor senses the train it will again send a signal to the controller and the platform will close again through the stepper motor. Here we use piezoelectric sensors which are mounted below the platform. These sensors will generate the electric energy while crossing the bridge. This energy we can use to run domestic appliances which are use at station such as fans, tube lights, etc



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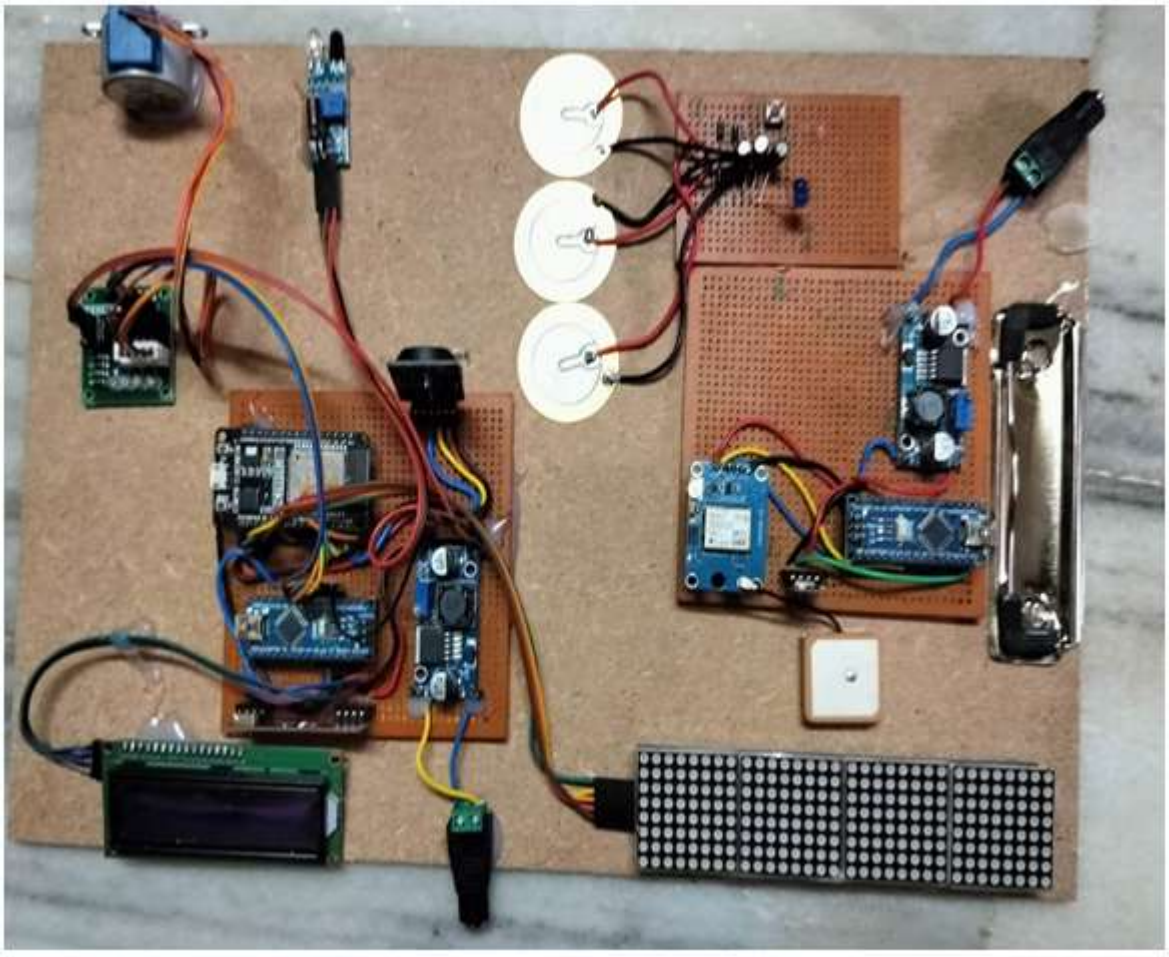
V RESULTS

This image shows a project board with various electronic components connected by wires. Based on the components visible, it's likely a custom-built system designed for data acquisition, processing, and display, possibly related to environmental monitoring or a similar application. Let's break down the components and speculate on their roles:Microcontrollers:At least two microcontrollers are visible, possibly Arduino or ESP boards, based on their blue PCBs and pin headers. These are likely the brains of the system, responsible for processing data from sensors and controlling outputs.Sensors:Infrared (IR) sensor: The black module with a blue top is likely an IR sensor, possibly for detecting proximity or ambient light.GPS Module: The small white square is likely a GPS module, used to determine the location of the device.Other sensors: The three round, metallic discs could be touch sensors or other types of environmental sensors (e.g., temperature, humidity). Displays:LCD Display: The rectangular display with a black screen is likely an LCD, used for displaying text or numerical data.LED Matrix: The large square display with a grid of holes is an LED matrix, used for displaying patterns, text, or simple graphics.Power Supply:The black cylindrical connector on the right side is likely a power jack, indicating an external power supply is used.Other Components.



Relay: The blue module with a black component on top is likely a relay, used for switching high-power circuits.Perforated Circuit Boards (PCBs): The brown boards with components soldered to them are PCBs, used to mount and connect the electronic components.Possible Functionality and Discussion:Based on the components, this project could be a system that:Collects Environmental Data: The sensors could be measuring temperature, humidity, light levels, or other environmental parameters. Tracks Location: The GPS module provides location data.Displays Data: The LCD and LED matrix are used to display the collected data or other information.Controls External Devices: The relay could be used to switch on/off lights, motors, or other devices based on sensor

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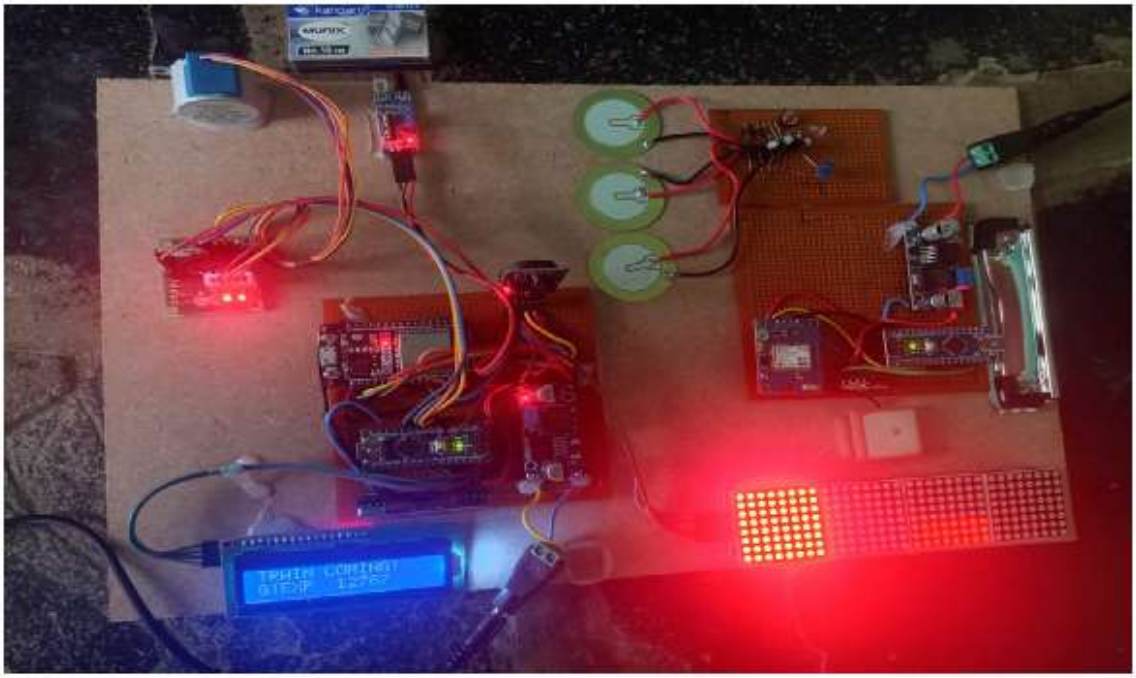
readings or user input. Weather Station: The system could be used to monitor and display weather conditions.Home Automation System: It could be used to control lights, appliances, or other devices based on sensor readings or user input.Asset Tracking System: The GPS module could be used to track the location of valuable assets.Interactive Art Installation: The LED matrix and sensors could be used to create an interactive art piece.Further Discussion .



LCD Display: The LCD screen is now illuminated with blue backlighting and displays the message "TRAIN COMING! STOP 12787". This strongly suggests the system is related to train detection or a similar transportation-related application.LED Matrix: The LED matrix is also illuminated with a bright white light, further indicating the system is actively displaying information or providing a visual alert.

LEDs on PCBs: Several LEDs on the PCBs are lit, suggesting the system is powered on and components are functioning.Reddish Lighting: The overall reddish hue of the image is likely due to the ambient lighting in the room, affecting the camera's white balance.Timestamp: The image includes a timestamp "2025/3/29 16:42", which is likely embedded by the camera.Interpretation and Discussion: Based on the illuminated components and the message displayed on the LCD, we can refine our understanding of this project:Train Detection System: The "TRAIN COMING! STOP 12787" message strongly indicates that this system is designed to detect approaching trains and provide a warning. The number "12787" could be a train ID, a distance, or some other relevant information.Safety Application: The "STOP" command suggests the system's primary purpose is safety, likely to prevent accidents at level crossings or other potentially hazardous locations.Real-time Information: The active display of information on the LCD and LED matrix suggests the system provides real-time updates based on sensor data. GPS Integration: The presence of the GPS module likely plays a role in determining the location of the system and potentially correlating it with train schedules or location data. Further Discussion:To fully understand the system, we need to consider: Sensor Data: What type of sensors are used to detect the train? The IR sensor could be used to detect the train's presence, while other sensors might monitor vibrations or track the train's speed.Data Processing: How is the sensor data processed to determine if a train is approaching? The microcontroller code would reveal the algorithms used for detection and analysis.Communication: Does the system communicate with a central control system or other devices? The GPS module could be used to transmit location data, and the system might send alerts or warnings via wireless communication.Power Source: Is the system powered by batteries or a wired power supply? This would impact its portability and deployment.

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VI CONCLUSION

Here design is used to routinely near/open the movable bridge. It stores time for pedestrians to pass the subsequent platform. Sensing is made constantly each time the train comes and bypasses. For this reason the tracing of trains is sensed constantly, which mechanically near/open the cellular bridge is in part automatic; this is worthwhile for passengers to go to the rail grade crossing. This green technique may be greater dense for maintaining the train timings for attaining unique vacation spots and additionally for crossing the right systems. Energy generated with the aid of piezoelectric sensors is used to run the home domestic equipment used at the station.

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