Wireless Powered Hitech Train

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ABSTRACT: The "Wireless Powered Hitech Train" is an innovative prototype showcasing future-ready driverless train technology. It integrates wireless charging, automatic station detection, and enhanced passenger communication to create an efficient, eco-friendly public transit model. This scalable concept has significant potential for advancing urban transit systems, contributing to smart city initiatives, and promoting sustainable transport. Stage 1: Automatic Train Operation and Station Identification Implementation of an Automatic Coach Display System to assist passengers in identifying approaching stations. The system utilizes magnetic switches and IR transmitters to detect stations and provide real-time updates on an LCD display. Train doors open and close automatically at stations, ensuring convenience for passengers without manual intervention. A prototype includes a motorized trolley controlled by an arduino to simulate train movements. Stage 2: Wireless Power Supply and Energy Transmission Power for the system is derived from a rechargeable 12V battery, which is charged via wireless energy transfer from solar panels installed at each station. Wireless charging operates on the principle of electromagnetic induction to eliminate the need for physical wires. These stages collectively address automation and energy efficiency for modern train systems.

KEYWORDS: WIRELESS, LCD, TRAIN, ARDUINO, BATTERY.

I.INTRODUCTION: The "wireless Powered Hitech Train" represents a pioneering approach in modern train technology, emphasizing automation, sustainability, and efficiency. By integrating wireless power transfer, automatic station detection, and eco-friendly design, this project showcases a scalable model of driverless train systems. It aims to redefine public transportation by addressing environmental challenges while ensuring passenger convenience and reliability. The development of a Wireless Powered Hitech Train system aligns with the growing need for sustainable and efficient transportation solutions. Automating train operations through advanced control systems, sensors, and machine learning algorithms ensures precise station detection, real-time decision-making, and safe operation. The inclusion of real-time passenger information systems enhances communication, offering live updates on train schedules, delays, and station

details. Additionally, the project focuses on developing scalable prototypes for driverless train systems, featuring autonomous navigation, obstacle detection, and emergency fail-safe mechanisms. The emphasis on energy independence and reducing power losses during wireless transmission ensures a reliable, efficient, and futuristic transportation model that meets the demands of modern urban mobility.

II.OBJECTIVE: The aim is to design a Wireless Powered Hitech Train Develop a wireless power transmission system. Automate train operations, including station detection and door control. Promote ecofriendly and energy-efficient transportation. Enhance passenger communication with real-time station updates. Create a scalable prototype for driverless train systems. Ensure energy independence and reduce power losses.

III.PROPOSED SYSTEM: The train moves automatically along the track. IR sensors are positioned at station locations, and when the train reaches a station, the IR sensor detects it and stops the train. Once the train stops at the station, servo motors automatically open the doors. The station name is displayed on the LCD screen for passengers. After a predetermined period, the servo motors close the doors automatically, and the train resumes its journey to the next station.

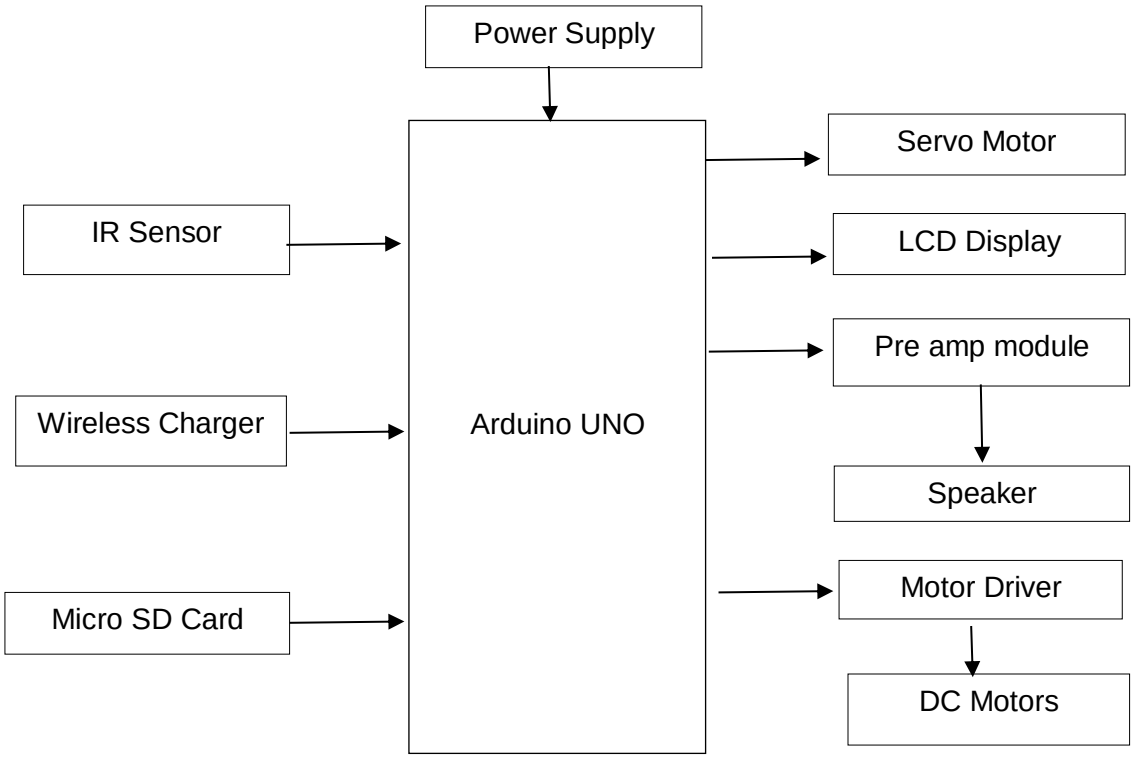


FIG 1 BLOCK DIAGRAM

1. Arduino Uno: The central microcontroller managing all operations. This microcontroller acts as the brain of the system, handling all operations and processing commands. The Arduino Uno is a popular microcontroller board based on the ATmega328P. It is widely used in electronics projects, prototyping, and embedded systems due to its ease of use, open-source nature, and affordability.

2. Servo Motors: Responsible for opening and closing train doors at stations. These motors are used for precise control of angular or linear motion, making them ideal for operating train doors. A servo motor is a rotary or linear actuator that allows precise control of angular or linear position, velocity, and acceleration. It consists of a motor coupled with a sensor for position feedback and is commonly used in applications requiring high precision, such as robotics, CNC machinery, and automated systems.

3. IR Sensor: Detects station presence and stops the train automatically. Infrared (IR) sensors detect the presence of stations or obstacles. In this system, they help the train identify station locations and trigger automatic stopping mechanisms, ensuring efficient and accurate station halts.

4. LCD Display: Displays station names for passenger information. The LCD screen is used to provide real-time information to passengers, such as station names, announcements, or train status. This enhances the user experience by keeping passengers informed throughout the journey.

5. Micro SD Card Module: Stores station names and audio files for announcements. This module is used to store station-related data, including names and pre-recorded audio announcements. It allows the system to retrieve and play information relevant to the current station automatically.

6. Preamp and Speaker: Used to announce station names and related messages. The preamplifier amplifies audio signals, while the speaker broadcasts announcements like station names or safety messages. This setup ensures clear and audible communication with passengers.

7. Wireless charging module: The 5V 2A Wireless Charging Module consists of a transmitter (TX) and receiver (RX) pair used for wireless power transfer. It is based on inductive coupling, a technology similar to what is used in Qi wireless charging. It is ideal for DIY electronics, embedded systems, and portable charging devices.

IV.HARDWARE RESULTS: The train moves automatically along the track. IR sensors are positioned at station locations, and when the train reaches a station, the IR sensor detects it and stops the train. Once the train stops at the station, servo motors automatically open the doors. The station name is displayed on the LCD screen for passengers. The Micro SD card module retrieves the pre-recorded station name, and the preamp and speaker announce it for auditory communication. Wireless chargers are installed at each station. When the train halts, the wireless charging system activates, recharging the train's battery during the stop. This ensur **DF mini Player** remains powered without manual intervention. After a predetermined period, the servo motors close the doors automatically, and the train resumes its journey to the next station.

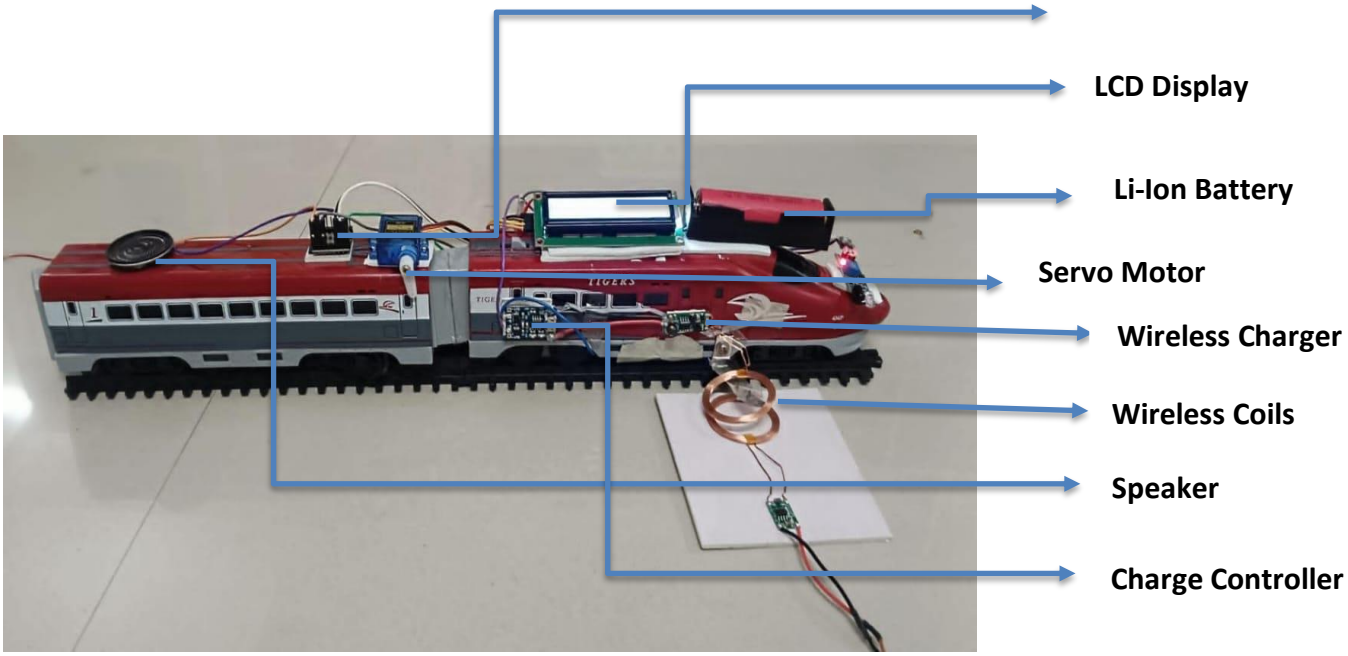


FIG 2 HARDWARE SETUP

The figure shows the hardware module of the wireless Powered Hitech Train. As we can see the Arduino, DC motors, Battery, Servo motor, LCD Display, IR Sensor, wireless, Battery charger controller which are explained below.

1. Arduino Uno- Arduino Uno R3 is one kind of ATmega328P based microcontroller board. It includes the whole thing required to hold up the microcontroller; just attach it to a PC with the help of a USB cable, and give the supply using an AC-DC adapter or a battery to get started. The central microcontroller managing all operations.

2. Servo Motor- 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. Responsible for opening and closing train doors at stations. These motors are used for precise control of angular or linear motion, making them ideal for operating train doors. They ensure smooth and accurate opening and closing of doors at stations, enhancing passenger safety and convenience.

3. L293 motor Driver IC-- L293D motor Driver IC is an integrated circuit that can drive two motors simultaneously and is usually used to control the motors in an autonomous system. This motor driver IC enables us to drive a DC motor in either direction and also control the speed of the motor.

4. IR Sensor- An infrared proximity sensor or IR Sensor is an electronic device that emits infrared lights to sense some aspect of the surroundings and can be employed to detect the motion of an object. As this is a passive sensor, it can only measure infrared radiation.

5. Power Bank Module- The Power Bank Module like T6845C is mainly designed for providing power to mobiles, devices, etc. It comprises different modules like load management, discharge management, protection & and LED indication. **6.LCD 16×2 Pin: -** The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications. Nowadays, we always use the devices which are made up of LCDs such as CD players, DVD players, digital watches, computers, etc. These are commonly used in the screen industries to replace the utilization of CRTs.

7. Wireless charging module: The 5V 2A Wireless Charging Module consists of a transmitter (TX) and receiver (RX) pair used for wireless power transfer. Supports wireless power Cover short distances(typicallyupto6mm).Transmits 5V power at up to 2A of current.

TEST CASES:

A. IR Sensor Based Train Stop Detection At station IR sensors are positioned at the top of the train and when the train reaches a station, the IR sensor detects it and stops the train.

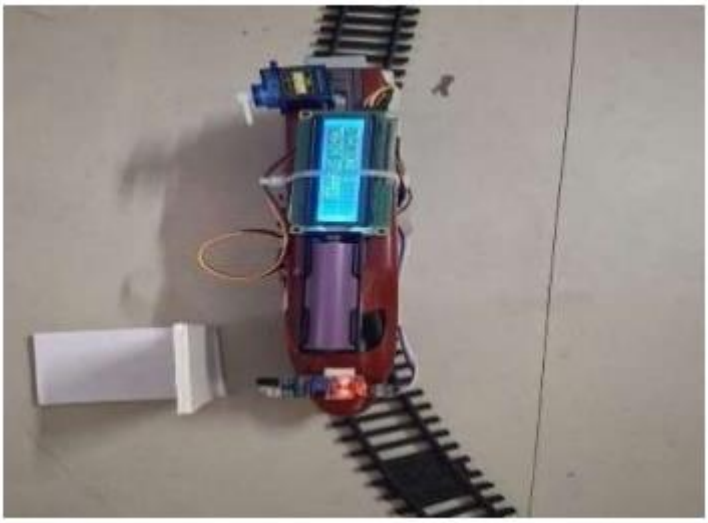


Fig 3 IR Sensor Based Train Stop Detection At station

B. Automatic Door Opening with Station Name Display

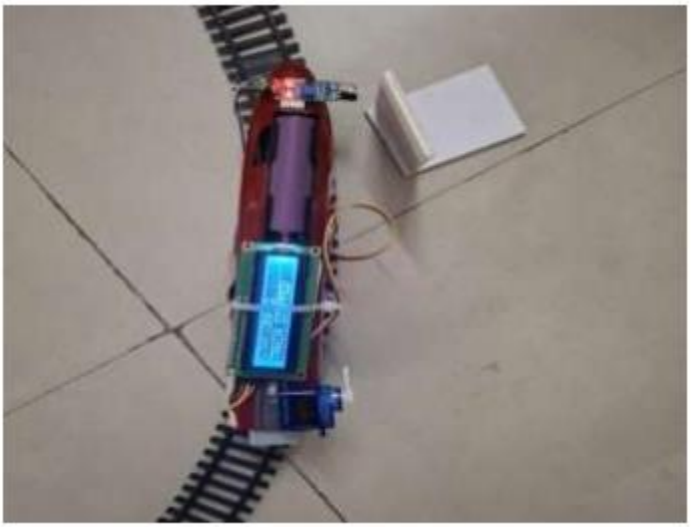


Fig 4 Automatic Door Opening With Station Name Display

Once the train stops at the station, servo motors automatically open the doors. The station name is displayed on the LCD screen for passengers.

C. Train Movement Resumption After Door Closure

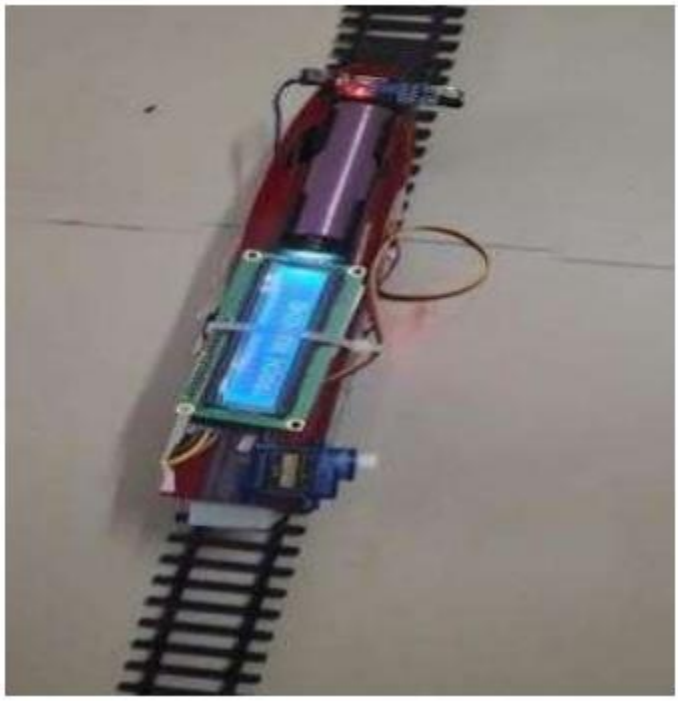


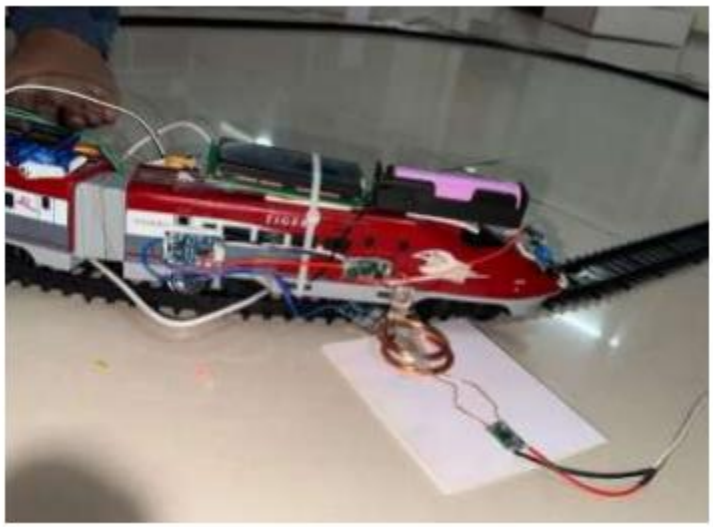
Fig 5 Train Movement Resumption After Door Closure

After a predetermined period, the servo motors close the doors automatically, and the train resumes its journey to the next station.

D. Station Announcement

The Micro SD card module retrieves the pre-recorded station name, the preamp and speaker announce it for auditory communication

E. Wireless Charging at Stations:



Wireless chargers are installed at each station. When the train halts, the wireless charging system activates, recharging the train's battery during the stop. This ensures that the train remains powered without manual intervention.

V.CONCLUSION & FUTURE SCOPE: This project work titled as “The “Wire less powered Hitech Trains" is an innovative prototype showcasing future-ready driverless train technology. It integrates wireless charging, automatic station detection, and enhanced passenger communication to create an efficient, eco-friendly public transit model. This scalable concept has significant potential for advancing urban transit systems, contributing to smart city initiatives, and promoting sustainable transport. The inclusion of real-time passenger information systems enhances communication, offering live updates on train schedules, delays, and station details. Additionally, the project focuses on developing scalable prototypes for driverless train systems, featuring autonomous navigation, obstacle detection, and emergency fail-safe mechanisms. The emphasis on energy independence and reducing power losses during wireless transmission ensures a reliable, efficient, and futuristic transportation model that meets the demands of modern urban mobility.

FUTURE SCOPE

1. AI Integration: Incorporate AI for predictive maintenance and route optimization.

2. Enhanced Passenger Services: Add real-time GPS-based updates for passengers.

3. Longer Range Wireless Charging: Improve charging efficiency to support longer transit routes.

4. Renewable Energy Integration: Use solar or wind power to supplement charging systems.

5. Smart Ticketing Systems: Integrate cashless, contactless ticketing for enhanced user experience.

6. Systems: Integrate cashless, contactless ticketing for enhanced user experience.

7. Systems: Integrate cashless, contactless ticketing for enhanced user experience.

REFERENCES: [1] Erbina, and C. Soulara. Twenty Years of Experiences with Driverless Metro in France VWT 19 proceedings. Dresden, 2003L.

[2] 1315 Cappaert-Blondelle. Metro Automation Facts. Figues and Trends. The International Association of Public Transport (UTP), Technical 2012 report Belgium.

[3] Transportation restem division. The Dubai Metro, the World's Longest Fully Automated Metro Network. Mitsubishi Heavy Industries Technical Review Vol. No. 2 June 2012.

[4] H. Jun, and S. Choi. Development of a Multi-main Operation Simulator with Interactive Human Computer Interfaces. International Conference on Hybrid Information Technology (ICHIT06), 2006. Cheju Island, Korea, 5. Fischer. "Justifving andoquation". RailwayTechnology.com. 23 August 2011.

[5] CThabit Sultan Mohammed, Wiisam Fahmii All Azzo, Mohammed Ahmed Akaak, “Full Automation in Driverless trains: A Microcontroller-Based Prototype”. Vol. 3, no. 4, Issue 7, July. 2014.

[6] P. V. Karande Parkash Tambare[2015] Auto Metro Train to Shuttle Between Stations.

[7] Prem chand Bharti1, Ratneshpandey “ Automated Metro Train to shuttle between two stations”, e-ISSN: 2395-0056 Volume: 05 Issue: 03 Mar-2018,p-ISSN: 2395- 0072, IRJET

[8] Impact Factor value: 6.171 | ISO 9001:2008 Certified Journal. Premchand bharti, Ratneshpandey [2018] Designed metro train concept in which arrived stations can be detected using IR sensors.

[9] D. Briginshaw[2019] Microcontroller Based Driverless Metro Train . This study focuses on developing a driverless metro train utilizing microcontroller- based technology.

[10] Burroughs[2020] Wireless power transfer trials. This contribution addresses wireless power transfer (WPT), an innovative solution for powering metro systems without the need for conventional overhead or third-rail systems.