REMOTE CONTROLLED MECHANICAL TROLLEY

Dr. Hemant R. Bhagat Patil[1]
H.O.D. Professor, Department Of Mechanical Engineering, Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India
hemant_bp@yahoo.com

Prasanna Dipak Pande[2]
Student, Department Of Mechanical Engineering, Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India
prasannapande96@gmail.com

Siddesh Rajesh Dhomne[3]
Student, Department Of Mechanical Engineering, Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India
siddeshdhomne4499@gmail.com

Narendra Bhaulal Pardhi[4]
Student, Department Of Mechanical Engineering, Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India
narendrapardhi2004@gmail.com

Utkarsh Pramod Shriwant[5]
Student, Department Of Mechanical Engineering, Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India
utkarshshriwant@gmail.com

Shubham Ganesh Shimpi[6]
Student, Department Of Mechanical Engineering, Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India
shubhamshimpi358@gmail.com

Abstract
This paper presents the design and development of a remote-controlled mechanical trolley using a 27 MHz radio frequency (RF) communication system. The objective of this project is to demonstrate a simple wireless control mechanism that integrates basic concepts of mechanical engineering, electronics, and mechatronics. In this system, a handheld RF transmitter sends control signals which are received by an RF receiver module mounted on the trolley. The received signals are processed through a control integrated circuit (IC) that drives the DC motors according to the commands provided by the user. The trolley is powered by a rechargeable 9V battery and constructed using a lightweight acrylic chassis that provides strength while keeping the overall weight low. High-speed DC motors with a maximum speed of approximately 2000 RPM are used for motion. Since high rotational speed is not suitable for load carrying applications, a spur gear reduction mechanism is installed in front of the motor to convert high speed into lower speed with higher torque. This gear mechanism reduces the motor speed from approximately 2000 RPM to around 60 RPM, significantly improving the torque capacity required for smooth movement of the trolley. Additional components such as inductors, antennas, and RF circuitry help in generating and receiving the 27 MHz radio frequency signals required for wireless communication. The proposed system provides a practical understanding of wireless control systems, gear mechanisms, and motor-driven mechanical motion. It is cost-effective, easy to construct, and highly suitable for academic demonstrations, robotics learning, and small automation experiments. The project highlights the integration of RF communication with mechanical power transmission to develop a simple yet efficient remote-controlled transport mechanism.
Keywords: *RF Communication, Remote Control System, Spur Gear Mechanism, DC Motor Control, Mechatronics.*

I. Introduction

Remote-controlled systems are widely used in modern engineering applications such as robotics, automation systems, industrial transport vehicles, and wireless devices. With the advancement in electronics and communication technologies, wireless control systems have become more efficient, reliable, and affordable for both industrial and educational purposes. Radio frequency communication is one of the simplest and most commonly used wireless technologies for short-distance communication because it provides stable signal transmission without the need for physical connections.

A remote-controlled trolley is a small mobile platform that can move in different directions using signals sent from a remote controller. Such systems are useful for understanding the integration of mechanical components, electronic circuits, and wireless communication technologies in a single system. The use of RF modules operating at 27 MHz frequency enables the transmission of control signals without the need for physical wires, making the system flexible and easy to operate. These systems are commonly used in robotics learning, toy vehicles, and small-scale automated transportation models.

In this project, a mechanical trolley is designed using DC motors, a spur gear mechanism, and RF transmitter-receiver modules. The DC motors used in the system operate at approximately 9 volts and have a maximum speed of around 2000 RPM. Since high speed is not suitable for load-carrying applications, a spur gear reduction system is used to reduce the speed to approximately 60 RPM while increasing the torque. This allows the trolley to move smoothly and carry small loads efficiently while maintaining stability and control during operation.

II. System Overview

The remote-controlled trolley consists of both electronic and mechanical subsystems that work together to achieve wireless movement. The electronic subsystem handles signal transmission, reception, and motor control, while the mechanical subsystem converts electrical energy into mechanical motion.

The RF transmitter located in the remote controller generates control signals at 27 MHz frequency. These signals are transmitted through an antenna and received by the RF receiver placed on the trolley. The receiver sends the signal to a control IC which activates the motors according to the user command. The motors then rotate and drive the wheels through a spur gear reduction system.

Hardware Components

The major components used in the development of the system are listed below. Each component contributes to the proper functioning of the wireless control mechanism and mechanic.

Table 1. Hardware Components Used

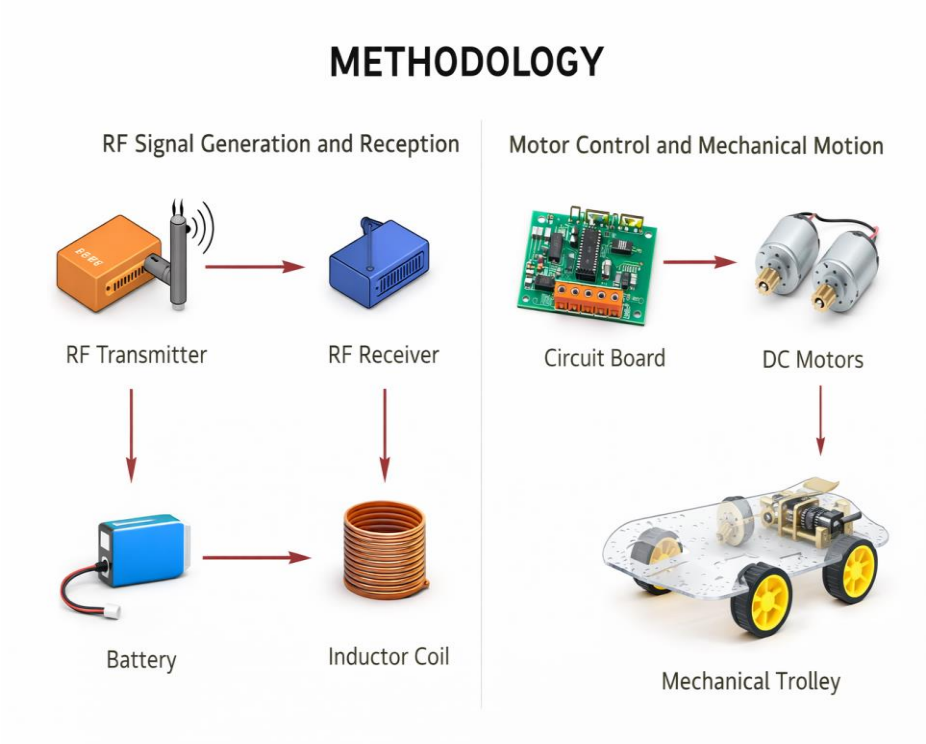
Sr No	Component	Specification	Purpose
1	RF Transmitter	27 MHz	Sends control signals
2	RF Receiver	27 MHz	Receives signals from remote
3	DC Motor	9V, 2000 RPM	Drives trolley wheels
4	Spur Gearbox	Reduction Gear	Increase torque
5	Rechargeable Battery	9V	Power supply
6	RF Antenna	External antenna	Signal transmission
7	Inductor Coil	Magnetic coil	Frequency generation
8	Control IC	Motor control IC	Controls motor direction
9	Acrylic Chassis	Lightweight frame	Structural support

III. Methodology

The methodology of the project focuses on integrating RF communication with mechanical motion control. First, the RF transmitter generates radio frequency signals based on the command given by the user through the remote controller. These signals are transmitted wirelessly through the antenna.

On the trolley side, the RF receiver captures these signals and converts them into electrical signals. These signals are then processed by a motor control IC which determines the direction of motor rotation. The motors rotate according to the command received from the remote controller such as forward or backward movement.

The motors are connected to a spur gear reduction mechanism that converts high rotational speed into lower speed with higher torque. This mechanism allows the trolley to move effectively and carry small loads without slipping or instability.



IV. Working Principle

The system works on the principle of radio frequency wireless communication. When a user presses a button on the remote controller, the RF transmitter sends a signal at 27 MHz frequency. This signal travels through the air as an electromagnetic wave and is received by the RF receiver mounted on the trolley.

After receiving the signal, the control circuit processes it and activates the DC motors accordingly. The motors then rotate in the required direction to move the trolley. The spur gear mechanism reduces the motor speed and increases torque so that the trolley can move steadily and efficiently.

V. Mechanical Design

The mechanical structure of the trolley is built using a lightweight acrylic chassis which provides strength and stability. The chassis holds all electronic components including the RF receiver, control IC, battery, and motors. The DC motors are mounted securely using metal spacers to maintain proper alignment with the wheels and gear system.

The spur gear mechanism is installed in front of the motor shaft. This gear system reduces the high rotational speed of the motor and increases torque which improves the load-carrying capability of the trolley. The rechargeable battery supplies power to all electronic components of the system.

VI. Advantages The proposed system provides several advantages:

- Wireless control using RF communication
- Simple and low-cost design
- Lightweight acrylic structure
- Increased torque using spur gear reduction
- Easy construction and maintenance
- Useful for learning basic mechatronics systems

VII. Applications

The remote-controlled trolley can be used in different engineering and educational applications.

- Educational demonstrations for engineering students
- Robotics learning platforms
- Small wireless transport systems
- Prototype models for automation research
- Laboratory experimentation and training

VIII. Conclusion

This paper presented the design and development of a remote-controlled mechanical trolley using a 27 MHz RF communication system. The integration of wireless communication, DC motors, and spur gear reduction provides an efficient method for controlling movement without physical wiring. The system successfully converts high motor speed into usable torque through the gear mechanism which allows smooth and stable movement.

The project demonstrates the integration of mechanical engineering concepts with electronics and communication technology. Due to its simplicity and low cost, the system is highly suitable for academic learning, experimentation, and demonstration purposes. In future work, the system can be enhanced by integrating microcontrollers, sensors, and advanced wireless technologies for improved automation and intelligent control

References

[1] B. Razavi, RF Microelectronics, 2nd ed., Pearson Education, 2012.
[2] P. Horowitz and W. Hill, The Art of Electronics, 3rd ed., Cambridge University Press, 2015.
[3] T. Kenjo and S. Nagamori, Permanent Magnet and Brushless DC Motors, Oxford University Press, 1985.
[4] R. C. Dorf and J. A. Svoboda, Introduction to Electric Circuits, 9th ed., Wiley, 2018.
[5] M. M. Mano and M. D. Ciletti, Digital Design, Pearson Education, 2013.
[6] "RF Transmitter and Receiver Modules for Wireless Communication," International Journal of Engineering Technology and Management Sciences, 2022.
[7] "Design of RF Based Wireless Remote Control System," Journal of Emerging Technologies and Innovative Research, 2019.
[8] 27 MHz RF Transmitter and Receiver Module Datasheet.