PROJECT ABSTRACT

Mecanum Wheel Omnidirectional Robot Platform

A four-mecanum-wheel omnidirectional robot platform with independent motor control, strafing kinematics and joystick/Bluetooth drive, built on Arduino. Delivered built-to-order with working prototype, firmware, kinematics documentation, report, PPT and viva kit.

01. Title

Mecanum Wheel Omnidirectional Robot Platform

02. Introduction / Background

Mobile robots that must work in tight spaces — warehouses, hospital corridors, factory aisles — cannot afford car-like turning circles. The mecanum wheel answers with pure mechanics: rollers angled at 45° around each wheel let four fixed wheels produce any planar motion, including sideways strafing, with no steering linkage. This project builds a complete student-scale mecanum platform: fabricated chassis, four driven mecanum wheels, and an Arduino implementing the inverse kinematics that make the magic work.

03. Problem Statement

Students often buy mecanum wheels and wire them like ordinary wheels, then wonder why the robot drifts and crab-walks. The project addresses this by treating the platform as a kinematics exercise first: the mixing equations are derived in the report, implemented in firmware, and verified with a strafing calibration procedure on the student's own floor.

04. Objectives

- Build a rigid aluminium chassis carrying four independently driven mecanum wheels.
- Implement the mecanum inverse-kinematics mixer in Arduino firmware.
- Provide proportional joystick control and Bluetooth phone control.
- Deliver a strafing calibration procedure for straight sideways motion.
- Document the kinematics derivation and verification for the report.
- Deliver the complete student kit: prototype, firmware, docs, report, PPT and viva Q&A.;

05. Proposed Methodology

The platform is developed in three stages. (1) Mechanical: aluminium chassis fabrication with true wheel geometry, mecanum wheels on geared DC motors with independent H-bridge drivers. (2) Firmware: the inverse-kinematics mixer converting (vx, vy, yaw rate) to four PWM wheel commands, plus joystick and Bluetooth input handling. (3) Verification: the strafing calibration procedure trims per-motor speeds until strafe commands track straight, documented with the student's own measurements.

06. System Architecture / Working

The joystick or app supplies a velocity vector (vx, vy, yaw rate). The Arduino applies the mecanum mixing equations to compute each wheel's speed and direction, driving the four H-bridge channels with PWM. The 45° rollers resolve the four wheel motions into the commanded planar motion — forward, strafe, diagonal or spot rotation. Calibration trims remove motor-to-motor variation so the motion matches the command.

07. Hardware / Software Requirements

- Arduino Uno/Nano
- 4 mecanum wheels (100 mm class)
- 4 geared DC motors
- Dual L298N-class H-bridge drivers
- Analog joystick module
- HC-05 Bluetooth module
- Fabricated aluminium chassis
- Arduino IDE (C/C++ firmware)

08. Expected Outcomes

- A working omnidirectional platform with strafe, diagonal and spot-rotation motion.
- Firmware implementing the documented inverse-kinematics mixer.
- A student-performed strafing calibration with recorded results.
- A complete report, PPT and viva Q&A; on mecanum kinematics and motor control.

09. Applications

- Warehouse and intralogistics robot concept demonstrations.
- Teaching mobile-robot kinematics in mechatronics labs.
- A base platform for later autonomy additions (line following, mapping).

10. Future Scope

- Wheel-encoder odometry and closed-loop velocity control.
- Autonomous navigation with ultrasonic/LiDAR sensing.
- ROS integration on a single-board computer.
- Heavier-duty mecanum wheels for larger payloads.