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(57) Abstract :

The present invention discloses a quad-wheeled wall-climbing robot featuring a centralised electromagnetic disc for magnetic adhesion and omnidirectional rotation on vertical ferromagnetic surfaces. The system integrates four Mecanum wheels driven by individual gear motors, enabling omnidirectional movement without rotating the entire chassis. A dual-servo mechanism enables axial engagement and 360° rotational actuation of the central electromagnetic disc, allowing instantaneous directional changes while maintaining surface adhesion. The robot's core architecture is controlled by a microcontroller (Arduino Mega), which coordinates wheel vectors, disc engagement, and chassis rotation using a path-planning algorithm. This invention overcomes limitations in payload capacity, manoeuvrability, and adhesion reliability found in existing wall-climbing robots. The system enables faster surface traversal, supports higher payloads, and reduces energy consumption via localised, regulated magnetic adhesion. A fail-safe detachment mechanism involves sequential disc de-energisation and mechanical retraction. The platform is suitable for industrial applications such as non-destructive testing, maintenance, and painting of vertical metal structures. It can be integrated with NDT sensors and wireless data modules for smart inspection tasks. Accompanied Drawing [FIG. 1] [FIG. 2] [FIG. 3] [FIG.4]

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