

## Design and Development of a Wall-Climbing Robot for Wall Inspection and Crack Detection

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Mobile robots have been very popular in industries to perform various tasks. The problem of manual inspection of concrete walls, is that it requires highly trained operatives and various tools to analyze and identify cracks that pose future threats to structural integrity, which is also a dangerous task considering human lives. Our objective here was to introduce a solution to all the above-mentioned problems and to use robotics to make this task even easier. To address this, a wall-climbing robot was designed, developed, and fabricated for wall inspection and crack detection. The robot's design incorporates two ducted fans; one maintains grip on the wall, while the other counterbalances the robot's weight. For locomotion, four directly coupled Mecanum wheels are present. The robot is controlled using a wireless RC transmitter and receiver. The inspection and crack detection system, uses an ESP-32 camera module externally mounted on the robot for wall inspection and a Canny edge detection algorithm integrated into the robot's microcontroller for crack identification. Following these stages, the robot and its crack detection algorithm underwent rigorous testing on various wall surfaces such as concrete, glass, cement and in varied light conditions such as noon, evenings, and cloudy conditions as well to simulate its practicality. We can deem the project successful in the expected disciplines, but with further developments and with more budget, this robot has the potential to go beyond crack detection and work on various other remote uses which is hostile in nature to use manual labor.

**Keywords:** *wall climbing robot, mobile robot, mecanum wheels, wall inspection, crack detection*