# OSWalT - Omnidirectional Spherical Wall Traversing Robot

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***Abstract*— Development of a perfect adhesion mechanism along with robot capability to traverse omnidirectionally on both floor and wall has been a challenging task since past few decades. This paper presents Omnidirectional Spherical Wall Traversing Robot (OSWalT) with propulsion based adhering and omni-traversing capability independent of surface inclination. This new design takes advantage of the same thrust to both adhere and navigate the inclined surface through biaxially changing its direction. It not only eliminates the requirement of steering motors but also enables the robot to move laterally.**

## I. Introduction

Applications in surveillance and building inspections urge the requirement of wall climbing robots which could balance the gravitational force and move close to the surface. Various work has been carried out using mechanisms based on electromagnetic forces, grasping, suction and other to overcome gravity and adhere to walls [1]. But their applications are highly limited to specific purpose. The robots based on electromagnetic forces can climb only on ferromagnetic surfaces [2]. Robots using vacuum suction mechanism fails to develop sufficient adhesion on dusty and rough walls [3]. Other grasping based bio-inspired robots require design of complex mechanism and controlled gait for accurate foot placement [1]. Hence, a propulsion based gimbal mechanism is used where required normal reaction for frictional force is provided by the thrust [4]. But such robots are constraint in lateral motion and require large space for turning. Hence, we propose a novel design which leverages omnidirectional motion capabilities [5] of spherical robots with propulsion based gimbal mechanism.

## II. Mechanical Design

Figure 1. Design of OSWalT

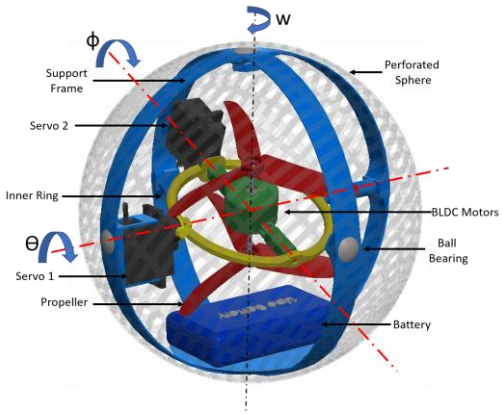


Fig 1. shows the mechanical design of the OSWalT consisting of two servo motors and inner ring forming gimbal mechanism. Servo 1 is fixed with Support Frame which is supported by ball bearings in the perforated sphere. Battery is attached to the support frame powering the servos and brushless DC motors (BLDC). Two coaxially placed BLDC motors provide the required thrust. The propellers are attached and rotate in direction opposite to each other to balance the reaction moment while producing force in same direction.

The support frame remains stable in vertical orientation due to mass of the battery producing restoring moment. The ball bearings allow free motion of the perforated sphere in contact with the ground or wall surface. Perforation allows unrestricted flow of air required for producing thrust. The direction of the thrust produced by the propellers is controlled by the two servos. This thrust partly balances the gravitational pull while other provides sufficient normal reaction for the robot to hold its position. Rotating any servo further will enable the robot to climb or move in lateral direction. Hence, a very novel design of wall climbing robot is formed. Experiments and detailed analysis verify the feasibility of the design.

## III. Key Contribution

An omnidirectional wall climbing spherical robot is designed eliminating mechanism complexity due to use of bifunctional propulsive mechanism and usage of steering motor.

## IV. Future Works

Future works involve development of working prototype and motion control of the robot.

## References

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