Swamp-Adaptable pH Measuring Hexapod Design

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Abstract

In this project, we designed and constructed a hexapod robot optimized for wetland terrains, particularly aimed at pH monitoring in swamp ecosystems to safeguard against industrial waste pollution. Leveraging Fusion360, we meticulously planned and executed the robot's mechanical design, integrating substantial mathematical theory to calculate inverse kinematics and devise swing trajectory strategies. Advanced analysis of the robotic workspace facilitated optimal adjustments in height and direction using the inverse kinematics function. Our research represents a significant advancement in both mechanical design and theoretical analysis. Notably, the robotic feet were meticulously calibrated to withstand high pressures through a combination of theoretical calculations and experimental validation. Additionally, innovative design iterations were implemented to minimize torque during leg movement. The derivation of a closed-form inverse kinematics solution and the creative utilization of Bezier curves for swing phase design further underscored our project's technical innovation. By harnessing its capacity to traverse diverse terrains, including both aquatic and terrestrial environments, the robot showcases vast potential for various applications.

Keywords: hexapod robot, trajectory planning, robotic control, mechanical design