

Design of a Pneumatic Rover for Educational Purposes

Authors : Max Kloosterman, Mauricio Munoz Arias, Gerald Jonker

Abstract : The integration of advanced engineering concepts such as pneumatics and control systems, particularly PID control, is critical for modern STEM education. However, current educational tools primarily focus on basic robotics and coding, leaving these complex topics underrepresented. This research aims to bridge the gap by developing a modular pneumatic rover kit designed to enhance hands-on, interactive learning in educational settings. The rover integrates pneumatics, control systems, and robotics into a single, adaptable platform, allowing students to engage in dynamic experimentation and explore advanced engineering systems. The research employs a Design-Based Research (DBR) methodology to iteratively develop and evaluate the rover, ensuring both its technical functionality and its educational impact. The rover's scaffolded learning approach enables students to progress from basic modular assembly to advanced tasks such as PID controller programming. Testing in classroom environments has demonstrated the rover's potential to improve student engagement, comprehension, and skill development in pneumatics and control systems. This project addresses key gaps in STEM education by providing a versatile, industry-relevant tool to prepare students for careers in automation, manufacturing, and robotics.

Keywords : modular pneumatic rover, stem education, hands-on learning, control systems, pneumatics education, DBR, engineering education, iterative learning, scaffolded learning

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