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Modular Educational Robotics with BitDogLab: From Introductory Mobile Robots to Advanced Rover Concepts

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This paper presents a modular educational robotics platform based on the BitDogLab microcontroller and additive manufacturing (3D printing). The platform comprises a family of eight mobile robots organized in a progressive learning path from basic to advanced topics. We describe the modular design philosophy, hardware and software building blocks, representative robots (line follower, self-balancing, skid-steer remote, 4WD with independent steering, color follower, ESP-cam obstacle avoidance, rocker–bogie 6WD, and a terramechanics-oriented rover with grousers and force sensors), and a set of CoppeliaSim tutorials to support hands-on learning. The approach fosters active learning, reusability of parts, and a smooth transition from classroom exercises to engineering and research-level projects.

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