

<u>Question</u>	<u>Answer</u>
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Title of Paper	A First-Year Design Project Combining LEGO® MINDSTORMS® Kits and Other Materials

#### Abstract

EGR110, Introduction to Engineering, has a design project as its primary component in which teams of first-year students plan, design, and build a device to complete a challenge. The project serves the learning objectives of practicing engineering design, organizing a project, communicating relevant information, working on a team, and promoting innovation.

This presentation shares the experience, both positive and negative, of transitioning the project from remote-controlled devices to one relying on fully autonomous, programmable devices. The current project is innovative; devices can be constructed using LEGO® MINDSTORMS® (LM) parts and additional materials such as wood, plastic, and cardboard. Other universities and K-12 projects educate with LM kits, but the tasks are either more discipline-focused or parts are limited to LEGO® kit pieces.

The EGR110 projects begin with a challenge, such as gathering objects and transporting them to scoring zones. In prior competitions, students created remote-controlled devices from motors, servos, wood, plastic, and cardboard. The project utilized LM kits in Fall 2011. The kits include a programmable brick, wheels, LEGO® pieces, motors, bump sensors, and ultrasonic sensors. In addition to the kits, teams could use additional materials such as wood, cardboard, and plastic to construct the physical form of the “hybrid” robot.

EGR110 is interdisciplinary, serving all engineering and computer science majors. The original project model provided design experience with structures, materials, and movement – a solid introduction to civil and mechanical engineering. The LM kits provide additional exposure to electrical engineering and computer science. Using LEGO® pieces solely limit potential structures; however, the hybrid model grants structural variety while providing a broad exposure to engineering and computer science. The hybrid model supports iterative refinement since LEGO® pieces can be attached and detached easily. On the other hand, autonomous robots do not accurately repeat programmed motion and without human-controlled input, they require more precision.