Laboratory Curriculum for Introducing ECE to Freshmen

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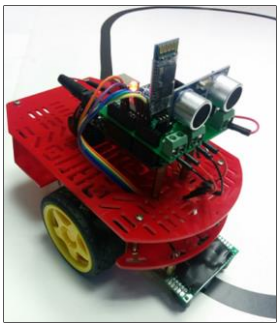

The authors present in this paper a summary of the laboratory material they created for introducing freshmen to the field of Electrical and Computer Engineering (ECE). This new ECE material is currently being offered in a pilot trial, as part of an existing multi-disciplinary course to the major fields of engineering, including mechanical, industrial, and ECE. The course, IME100, is co-taught by multiple faculty from all the different disciplines. It is made up of short lecture sections and longer laboratory components. The main goal is to introduce the students to the basic principles, areas of applications, and practical tools of the different fields of engineering.

The ECE component of the course introduces students to the general field of ECE by going over the main innovations that everyone takes for granted in their daily lives, and then looking at the concepts behind the technologies that drive the advancements in the field today. From student feedback and the faculty input, it was learnt that the old ECE component of the course needed major updates due to the outdated nature of the material and its lack in inspiring creativity.

The main objective of the course overhaul is to enhance its effectiveness, by updating the hands-on practical components using more interesting and challenging activities. Also, as part of the learning experience the students are motivated to exercise their creative thinking skills and to come up with innovative applications of the basic concepts covered in the course. The main focus topics for the ECE component of the course are electrical/electronic circuits and components, microcontrollers and programming, sensors and actuators, and wireless communication. The hands-on laboratory components of the course offer the students with opportunities to learn basic skills and apply them in designing and prototyping circuits, assembling a PCB, wiring a microcontroller board and programming it, and finally building and testing a sensor-based mobile robot for autonomous navigation and remote control operation. The students spend five weeks to work on the ECE topics, with a class meeting of two hours each week.

Example applications, such as building a traffic light circuit are used to demonstrate the concepts in circuit design techniques and tools. Students learn about alternative design options, such as building the traffic light circuit completely in hardware using a timer chip and additional components, or using a simple Arduino microcontroller and programming. Online tutorials and assignments are provided to supplement the classroom instruction, so students will spend most of their time in the classroom doing the practical components of the course rather than just going over lecture material. This is a work in progress, and currently we are offering the course as a pilot program this Winter semester. We have developed survey questions to assess the effectiveness of the newly developed course modules and anticipate having early assessment results by within one year.