The goal of this summer project was the redevelopment of the existing ECE 360 Undergraduate Lab which complements the corresponding lecture ECE 360 “Control Systems” by exposing the students to physical applications for the theory imparted in the lecture. The necessity of this redevelopment was justified by an outdated content that also lacked in practical relevance. Furthermore, the relating laboratory hardware suffered from performance limitations and maintenance issues that would have made further preservation of the old infrastructure very costly or even impossible in the long turn.

Throughout the four months of spring/summer a complete redesign of the existing lab was achieved. From the beginning, Professor Lynch’s and mine idea was to make the laboratory content as practically relevant as possible. Hence, it was logical to let the students benefit from our hardware design and implementation effort. This enabled us to avoid the introduction of often-used black-boxes providing a better understating of the very basic framework. Hence, in a first lab session the students are asked to calibrate measurement circuits, to understand the principle of operation of the switched voltage amplifiers and experimentally estimate the physical parameters of the motor that are usually provided by the manufacturer in datasheets.

On the basis of this preliminary work the students are able to implement various standard control systems such as motor current, velocity, and position control while actually understanding how the measurement and actuator components in the control system work - an aspect that is often neglected. Besides implementing these standard controls that are theoretically introduced in the lectures, advanced control strategies as well as effects due to the non-idealities in actual physical systems are treated. This provides a great extra value since the students are taught solutions to problems they would only face when designing real world system in their later jobs.

To conclude, the content of the new lab is a significant improvement in comparison to the previous lab and we believe it imparts a great extra value, that the students will benefit from in their later professional careers. Additionally, the new hardware is state-of-the-art making us confident that it will last for the next decade.

Submitted by Florian Kaumanns
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