Thesis Project Portfolio

The Abaclock

(Technical Report)

Effect of Microcontrollers on Engineering Education

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

My technical project and my STS research paper are connected primarily through the use of microcontrollers in education and the study of mechatronics. Mechatronics combines the study of mechanical engineering with electrical and computer engineering and has sprouted into a category of its own. My technical work focuses on the creation of a mechanical wall clock in the form of an abacus. The aim of this project is to demonstrate the real world practicality of implementing microcontrollers within undergraduate education. Moreover, the STS research paper aims to focus on the effects of microcontrollers on the engineering industry as well as its influence on education and student experiences.

My technical work explores the idea of using microcontrollers and the principles of mechatronics to create a mechanical abacus clock. This clock will integrate mechanical and mechatronics systems that both demonstrate the practical skills of undergraduate students at the University of Virginia while paying homage to the origins of numerical methods. An abacus is a computing tool made from sliding beads on rods used for the four arithmetic operations (addition, subtraction, multiplication, and division). This machine was built entirely from scratch using a combination of 3D printed parts, motors, microcontrollers, and acrylic. The goal of the project is to promote the study of engineering and inspire students to understand the usefulness of microcontrollers in the real world. My STS research aims to analyze how microcontrollers have become an integral part of education and their effects on the student experience. My research uses the Social Construction of Technology (SCOT) method to discuss how microcontrollers have become an integral part of education as well as ways in which the student experience has changed. By analyzing the various societal factors contributing to the design of microcontrollers and use in education the paper aims to create points of discussion that will highlight effects on student experience and education.

Working on these projects in tandem significantly influenced the value of both. My technical project provided me with a better understanding of mechanical and mechatronic systems as well as the practicality of using microcontrollers. Similarly, my STS research contributed to my view of the importance of using microcontrollers in education as well as ways in which the student experience can be improved. Both projects inspired me to further pursue my engineering studies and to contribute to the growth of prospective engineering students. Working on both my STS research paper and technical project this past year has allowed me to explore the use of microcontrollers in education from various perspectives and each work contributed to improving one another.