Thesis Project Portfolio

ROMULUS I: 16-Bit Computer

(Technical Report)

Negative Effects of Child and Adolescent Use of the Internet and Mobile Devices

(STS Research Paper)

An Undergraduate Thesis

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Executive Summary

Current trends in children's and adolescent's use of mobile devices, the internet, and social media are doing more harm than good, for all the connection and knowledge these technologies bring, it is overshadowed by the anxiety, mental problems, and unintelligence that they cause. The capstone project completed by our group was a fully functional 16-bit CPU with custom designed hardware and instruction set architecture. All the important registers in the CPU were designed with LEDs so the processes in the computer can be seen in real time. This computer is meant to help computer engineering and computer science students learn about basic machine code and assembly-level programming. My research aims to investigate the causes and effects of the massive use of mobile devices seen in young children as well as the massive use of social media and the internet by adolescents. This research is only becoming more relevant as the number of children and amount of time they spend in front of a screen in only increasing and the long-term effects of this usage have not been seen. There is not a strong connection between my STS research and our capstone project. The research is important in my field as the things that me and my colleagues will design in the future could be used or contribute to making smaller and cheaper mobile devices. It is good to explore the effects that these have, not just their technical capabilities. The capstone project is very important in our field as computers are everywhere and it is beneficial to spread the knowledge of how they work on a fundamental level.

Our capstone project aims to bridge the gap between hardware and software. We designed a 16-bit CPU with an easy-to-use instruction set and assembler for students to learn how to program in machine code and assembly. Most classes use a simulator to teach this to students, but it completely takes away the physical hardware that these processes run on. Our

device lets students see what their programs are doing in real time and allows them to see the actual hardware that the programs are running on. Our device has different speeds settings, students can increment from instruction to instruction to debug or verify code and they can run it at the highest speed (200,000 operations per second) to allow them to run more complicated programs. Our device also incorporates 4 IO slots that are memory-mapped to the last four addresses in the RAM bank. This allows the computer to interface with different devices (a modified typewriter for instance) to increase the usability and versatility of the device.

All our goals for the capstone project came to fruition. We were able to assemble all of the boards we designed, and trouble shoot the device to fix minor problems that occurred as a result of small oversights. The computer demonstrated Turing completeness. The assembler was created and verified. This assembler allows more complicated programs to be written, then converted to machine code. The different speed settings all worked and we were able to manually increment through programs instruction by instruction.

The question that my research aimed to answer was: How is the increased use of the internet and mobile devices for young children and adolescents affecting their mental, social, and physical health. The significance lies in the fact that children and adolescents spend a lot of time behind screens and on the internet and the long term effects of what we are seeing have not be fully explored and considered. These children will run the world one day and the isolation and cognitive decline associated with chronic use of mobile devices should be concerning.

My research found that children who spend unsupervised time on mobile devices and the internet choose to watch content that decreases their attention span and ability to socialize with their peers. They tend to choose shorter and shorter content because of their decaying attention span, this process simply accelerates itself. Teens who spend prolonger periods of time on the

internet, mobile devices, and social media experience the same problems with the attention span but more mental issues attributed to social media. Their view of themselves tends to deteriorate and they have trouble connected with their family and community.