Thesis Portfolio

The Lonely Robo
(Technical Report)

Computing and Physical Disabilities with an Emphasis on Visual Impairment
(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Sciences
University of Virginia • Charlottesville, Virginia

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Bachelor of Science in Electrical Engineering

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SocioTechnical Synthesis

For the technical project, a word search solving robot, named "The Lonely Robo" was built. By taping a word search down to the bed of the machine, an automated highlighter is used to highlight the location of each word in the word bank on the puzzle grid of letters. This is done by taking a single picture of the word search, and using computer vision and optical character recognition (OCR) to solve the puzzle. From there the solution is mapped back into physical space, and the start and end coordinates of each word are sent to a microcontroller that controls the actual highlighting of the words by using stepper motors to position the highlighter and a solenoid to pick up and drop the highlighter.

The design of computing devices and their interfaces do not serve all users equally. Users with physical disabilities are often a secondary thought during the design process, leading to barriers of access to contemporary computing devices. Impaired vision is one of the most common barriers a user might have. Screen readers auditorily describe the visual aspects of a program to allow interaction without the use of sight. Contemporary life is becoming increasingly dependent and intertwined with the use of computing devices. As a result, access to computers is paramount to function in society. Those with physical disabilities may experience a barrier to access due to their non-normative physical state preventing them from interacting with devices as designed. From a universalism prospective, accommodation must be provided. As with the development of any user interface, the development of accessibility technology, such as screen readers, is inherently iterative and recursive. The Interactive Sociotechnical Analysis (ISTA) framework and universalism ethics are well suited to explain observations and evaluate success of technologies in this space. Research will be focused specifically on screen reading

programs. I will collect quantitative data on when screen readers became standard in common operating systems and computing platforms, when website and pdf design standard were updates to include consideration for users with screen readers, and google trends on the general interest in screen readers. Qualitatively I will conduct interviews with the UVA SDAC, and examine accessibility design standards. A study of prior research will be used to gauge issues and opinions related to the use of screen readers from both a user and administrator prospective. I expect to find that forward, positive progress in the space of promoting and enabling access has been made, but universal commitment and integration has yet to be achieved. In the long run, the introduction of and greater access to new software and hardware technologies will open the road to enabling universal, equitable access to computing for all individuals.