**Executive Summary**

An Executive Summary submitted to the Department of Engineering and Society

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Bachelor of Science, School of Engineering

**Joseph Sam**

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Within this portfolio, you will find two projects, a technical project covering the engineering and design of an autonomous plant nursery, and a research project covering the social problems presented by the incorporation of Brain-Computer Interfaces into society, and its corresponding effect on individual privacy.

The technical report was a collaborative team effort detailing the engineering techniques used to design the codebase and electrical circuity to create an autonomous plant nursery. The purpose of such a device is to allow an end user to place up to two small, infant plants within the nursery, and through onscreen prompts, select values for various parameters regarding the level of light, water, and nutrients the plant should need for healthy growth. Once all the information is collected, the nursery will perform autonomous care for the plant, alerting the user whenever it is running low on supplies. I took on the role of designing the circuitry for this device, creating subsystems that were capable of handling the driving of an LCD screen, interfacing push buttons, a motor driver array to allow a microprocessor to drive 4 individual pumps asynchronously, over-current protection, electromagnetic noise suppression, interfacing to a standard US 120V AC power outlet, and designing an array to allow a microprocessor to asynchronously drive 2 LED lightbulbs. This project was a real test of my electrical engineering skills that were developed over the course of taking the FUN series of coursework. The rest of the team was focused on designing the codebase for the plant care and the information that would be presented on the screen. It was important that we worked together so that those writing the code knew what

sorts of inputs and outputs the system was going to have, and I knew what inputs and outputs I had to keep in mind when designing the board.

The research project was a personal effort to explore the consequences on individual privacy that BCIs could have in the near future. While currently there is no device that can read your thoughts, there are many companies like NeruaLink who are looking to become one of the first to make this scientific breakthrough. And once this breakthrough happens, what are the potential social ramifications that should be considered before allowing a technology like this to become public and widely available? This project covers the very basics of what privacy is and why we value it so much, as well as what BCIs are and what they can do. Then it moves on to outline the current state of privacy for the average American, how much BCIs contribute to the undermining of privacy, and how big of an impact it could have. In doing this research, I also analyze arguments regarding if people even value or desire privacy, and how social paradigms have changed over the years that might support this idea of total transparency.

The projects are not exactly related, but both represent areas of engineering that I am very passionate about. The hardware and circuit design was both extremely challenging and incredibly rewarding to complete, and the research paper was an opportunity to have free range in exploring a topic that genuinely wished to learn and explore on a much deeper level.