SOME ASSEMBLY REQUIRED: AUTONOMOUS PLANT NURSERY

ANALYSIS OF SMART GARDENING TECHNOLOGY USAGE AND IMPLEMENTATION

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SOCIOTECHNICAL SYNTHESIS

As a result of continued food scarcity in both developed and developing nations, the technological area known as Smart Gardening, which involves the growing and care of plants without direct human intervention, has been proposed as an alternative to traditional, manual plant cultivation methods. For the technical project report, four other people and I theorized, designed, and implemented a smart gardening device that monitored soil moisture content, nutrient content, and lighting of two independently-maintained plots in accordance to thresholds set by the user. Our device was designed such that it could be implemented in regions where horticultural infrastructure is antiquated or nonexistent. The STS research paper investigated the lack of implementation of Smart Gardening technology in the context of omnipresent socioeconomic factors, with the goal of determining to what extent these factors affect implementation. The technical report and STS research paper are connected in that the technical report assesses the design one particular Smart Gardening implementation and the STS research paper analyzes how socioeconomic factors are manifested different implementations.

The Smart Gardening device designed by my group and I addressed the overall reason of designing a Smart Gardening device with device that worked locally without the use of communication devices that utilize the internet that may not be available in all areas. A microcontroller was configured for the functionality of light and moisture levels for both plots. The moisture sensors determined if appropriate amounts of water and nutrients were present, and the lights would turn on for set periods of time. Two water pumps pumped water and a nutrient solution for each plot for a total of four pumps. A Liquid Crystal Display (LCD) was connected to the microcontroller to display current moisture, nutrient, and light levels, and also allowed the user to change parameter threshold levels.

Due to issues with the chip used to read the moisture and nutrient levels, we had to alter the device to run on fixed times for moisture and nutrient delivery. In addition, we were unable to deliver the required to all four water pumps, thus only one pump was used in order to demonstrate functionality. The device was successful in using power provided from a wall socket for operation and distributed water and nutrients based on electronic readings. The Smart Gardening device did work in a general sense but did not perform some specific functionality as expected. The final implementation of the technical project fell short of the group's expectations.

The question of the STS research addressed the overall reason for investigating Smart Gardening technology as a viable plant cultivation paradigm, asked in the form "How has the socioenvironmental factors in developed and developing countries affected the adoption and perception of Smart Gardening systems in those countries"? Despite studies that investigate various Smart Gardening implementations in both developed and developing countries, a study where the underlying desires for implementation, and the specific styles of implementation, are put into context and compared has not been conducted. This thesis was proved by analyzing the relationships present with Smart Gardening technology in the context of the Social Construction of Technology framework proposed by Wiebe Bijker, Trevor Pinch, and Ronald Kline. In particular, this thesis investigated how researchers, gardening experts, and ordinary users affect the adoption of Smart Gardening in the context of the "Diffusion of Technology" first proposed by Everett Rogers. These groups were chosen as these groups combined form a majority which increases the rate at which a technology is adopted.

When analyzing researchers of Smart Gardening technology, the gathered papers suggested these people embodied the "innovator" role by developing implementations that would be feasible in their home countries. Similarly, gardening experts actively embodied the "early

adopter role by giving opinions on specific implementations that allow people to have a more human perspective on feasibility. Lastly, the collected papers suggest ordinary users can form the "early majority" of Smart Gardening adoption, but socioeconomic factors prevent widespread adoption. The research suggests socioeconomic factors are the motivating force behind Smart Gardening adoption. Implementation of Smart Gardening depends on the location at a local level, with country of origin being one of many factors that should be considered in implementation.

Smart Gardening implementations should consider the socioeconomic factors in different areas, and make adjustments to implementations to sufficiently take these factors in account. In areas where agricultural or technological infrastructure is more rudimentary, it is possible to implement self-sufficient Smart Gardening designs that do not require wireless communication. If implementations account for socioeconomic factors, Smart Gardening can become a more widely diffused and adopted technology.

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