Thesis Project Portfolio

Dots and Boxes as a Portable Game System

(Technical Report)

The Benefits of Standardization for Smart Home Device Privacy Implementations

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Introduction

The technical project and STS project both highlight the importance of standards in the design and implementation of new technologies. The technical project, Dots and Boxes as a Portable Game System, was designed following printed circuit board (PCB) and programming standards that are consistent with industry practices. Research was also done to find what other standards the finished prototype would have to comply with to be used commercially, including standards imposed by the United States Department of Labor Occupational Safety and Health Administration (OSHA). The STS project researched and analyzed how the lack of standards and regulations in smart home device designs and privacy policies affects user trust and social barriers for the device. Together, these two projects explored how standards not only affect technological design, but also how society perceives and uses technology.

Summary of Technical Capstone

Dots and Boxes as a Portable Game System recreated the classic game, Dots and Boxes, using electric components. The original game, played on pencil and paper, involved two players taking turns drawing lines connecting grid of dots to make boxes, competing to see who can make the most boxes. The recreation contains a light emitting diode (LED) array for the display, a joystick and rotary encoder for player movement, and a push button for move confirmation. A microcontroller was used to control the electrical components, and a software program determined the game logic. The microcontroller deterministically receives player input from the joystick, rotary encoder, and the button, and passes it to the software program where the game state updates and reflects on the LED array. This project transforms a game that is normally played with paper and pen into a more efficient and autonomous platform. There were standards

associated with each component of the game system that our team complied with, and standards set by OSHA that must be followed if the game system is to be sold or used outside of the finished prototype stage it is currently in. These standards uphold a level of safety, compatibility, and environmental sustainability, allowing for game system to be customizable, used with universal power sources, and maintain a long product life. These standards, along with many more, also act as the unifying factor for this game system to integrate seamlessly into the network of pre-existing game technologies, as well as allow users to see the environmental and societal impact this system has.

Summary of STS Research Paper

The STS research paper researched and analyzed different aspects of the relationship between standards, smart home devices, device protocols, privacy policies, and users through the Actor Network Theory (ANT) STS framework. Using techniques like translation and black boxing, ANT examines the human and non-human actors in the smart device network and how these evolving relationships influence social networks. I researched various smart device data collection methods, privacy policies, academic papers, and current standards for smart device technology to understand why there is a lack of standardization and how it impacts all actors in the network. For the analysis, I explored how data collection transparency and device security can be improved by considering user trust and perception of the device in the implementation of standards for those devices. I also analyzed the contribution of users and device manufacturers to the social and economic barriers that limit smart device potential and protocol standardization. Translation and black boxing were used to analyze the relationship between federal legislature, device manufacturers, and privacy policies. Through the research done, standardizing smart

device security protocols and privacy policies would protect user data and trust and make future technological development more efficient.

Conclusion

Both projects have their own separate merits in completion: the technical project reinforced hard skills associated with product design, team-based industry practices, and the many considerations that go into creating a product from scratch; the STS research paper taught how engineering design decisions can influence all aspects of society and how standards can lay the foundation for improving current and future technologies. Working on both projects simultaneously allowed me to understand how my technical project is shaped by standards and envision the future usage of the game system in its intended spaces. These two projects showed me that standards are not merely industry rules that have to be followed, they are the knowledge of past engineers passed down for the current generation to improve modern technology with.