Thesis Project Portfolio

C.H.E.S.S.B.O.A.R.D.: An Interactive Chessboard Learning Aid

(Technical Report)

Electric Vehicle Supply Equipment (EVSE) as a Product – An Investigation Into Poor Product Packaging

(STS Research Paper)

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Kevin Dang

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Department of Electrical and Computer Engineering

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Sociotechnical Synthesis

The Chess Helper, Evaluator, and Study Supporter to Boost Observation, Acumen, Reasoning, and Deduction (C.H.E.S.S.B.O.A.R.D., referred to herein as CHESSBOARD) is a smart chessboard focused on streamlining the chess learning process from beginner to intermediate level of play. The CHESSBOARD provides an alternative to learning through books with active light-emitting diodes (LEDs) feedback to convey possible and ideal moves, move validation notification, and automatic game transcription. By providing these features in a physical product, the user benefits from sensory feedback (touch) reinforced by the utility provided by many virtual resources. The goal is not to give the user an advantage, but rather to open their perspective on what is possible and to provide the opportunity for education via experimentation. Hints are therefore not provided by default, suggesting the typical mode of use is for the user to explore on their own before seeing what the system thinks is most optimal. The hints are provided by Stockfish, a chess engine running on one of the board's embedded computers and tracked by code using Python's chess module. Linear Hall effect sensors are used to identify chess pieces (e.g., black pawn) that are associated with specific magnetic strengths. The exact implementation of the CHESSBOARD was not completed at the time of submitting the technical report but set the foundation for having a complete product. The setbacks which led to this conclusion highlighted notable areas of potential improvement, predominantly encompassing manufacturability.

When we acknowledge and act upon the capacity of accommodating designs, we empower ourselves to produce a more sustainable future. This paper aims to take this relationship between technology and people to help research a plan for developing more equitable electric vehicle supply equipment (EVSE) formfactors, the "kiosk" drivers drive to pay

and access the charging cable. I used the Feminist Technoscience framework to analyze my topic. Feminist Technoscience is interested in how power dynamics contribute to isolating marginalized groups from developing technology. Women, the physically impaired, the elderly, and the lower income are all examples of peoples who would be at a power disadvantage and thus are prone to being disregarded in the early stages of an emerging technology like EVSE. Key words and phrases used during research were "EVSE User Experience", "electric vehicle (EV) Charging Standards Survey", "EV Charging Cable Theft", "EVSE Security Concerns", and "EVSE Confusion". Used sources included forum posts, journalist reports, professional studies, surveys, press articles, newsletters, and government policies/recommendations. Issues with EVSE were found to pertain to safety, clarity of instruction, compatibility, and ergonomics. After identifying these concerns, a recommendation was made that included standardizing plug-and-charge, utilizing graphic instructions, angling human machine interfaces (HMI), providing an external shading and lighting device, encasing the charging cable, creating an automatic tampering alert system, and standardizing toward combined the combined charging system (CCS).

At a glance, the technical topic and STS topic seem unrelated; the technical topic is about a smart chessboard while the STS topic is about EV charging. What makes the two topics related is the importance of product packaging. The CHESSBOARD is unique in that it was developed with the needs of a beginner player in mind. The CHESSBOARD provides many aids to the user which in most cases are not necessary for the fundamental gameplay of chess. Likewise, the conversation within the STS research paper is about how features can be added or modified on current implementations of EVSE to move the technology beyond just a functional product and to an optimal/inclusive product. There are design decisions that can be made which enable or

disable particular users from engaging with the technology, and therefore having explicit intent to investigate deficiencies and inequalities is important.

While developing the CHESSBOARD, for example, the team identified some areas that we struggle with ourselves given our lack of professional chess experience. Realizing what your possible moves are, trying to remember where pieces belong when resetting, how to perform en passant, transcribing a game, etc. were all problem areas that could be addressed. We see these being addressed through dynamic tile lighting, an etched guide for piece placement, auto-transcription, and exporting capabilities. The dynamic tile lighting addresses multiple concerns since it can highlight what pieces can move and then where a chosen piece can move. The en passant move can be shown through the latter feature. The ability to undo a turn is additionally helpful in the case of making a mistake in setting up an en passant. This process of identifying problems for the user and adding and/or modifying aspects of the physical product to accommodate the user is the fundamental structure of the STS research paper.