

Perceived Trust of an AI-Enabled Smart Home System: An Exploration of Improving UX

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ABSTRACT



Artificial Intelligence (AI) has seamlessly integrated into modern life. AI-enabled Smart Home Systems (ASHS) represents this evolution, which offers automated conveniences through AI and Internet of Things (IoT) developments. However, concerns about AI's opacity remain, calling for transparency and trust-building measures. An online survey was conducted focusing on users' attitudes towards AI in ASHS. This article also proposed solutions to enhance reliability and overall experience. An energy management system (EMS) was created as a case study, with prototype interfaces prioritizing explainability. By testing dataset, function, and performance-based explanations, the study measures their effectiveness and trustworthiness. This research provides insights into users' algorithmic awareness, offering strategies to enhance Algorithmic Decision Making (ADM) understanding among non-experts.

INTRODUCTION



The integration of advanced technology in domestic environments, commonly referred to as smart homes, represents a rapidly evolving field in technological development. As this technology develops and the use of it is moving forward quickly, worries about ethical problem arises. Several studies have researched users' concerns about ADM. These issues include concerns about algorithm transparency, fairness and trust (Rodrigues, 2020). Solutions have been proposed by many researchers to fix these issues and improve the user experience within the context of ADM. As proposed by Goebel et al. (2018), making AI understandable is one of the solutions to enhance trust. However, discussions in the context of AI-enabled Smart Home Systems were not extensive. Also, most current studies about XAI focus on technical users, which might not help non-expert users to understand AI-generated decisions.

For non-expert users to understand AI-given decisions, a series of strategies can be derived by analysing the various steps of AI decision making. These strategies explain based on **Dataset, Function and Outcome**. In this study, the efficacy and trustworthiness of these strategies were tested.

METHODOLOGY



Study 1: Online Survey

An online survey was conducted to answer **RQ1** and **RQ2**. The goal was to understand users' attitudes towards AI in ASHS. The questionnaire was designed in four dimensions:

Algorithm-literacy

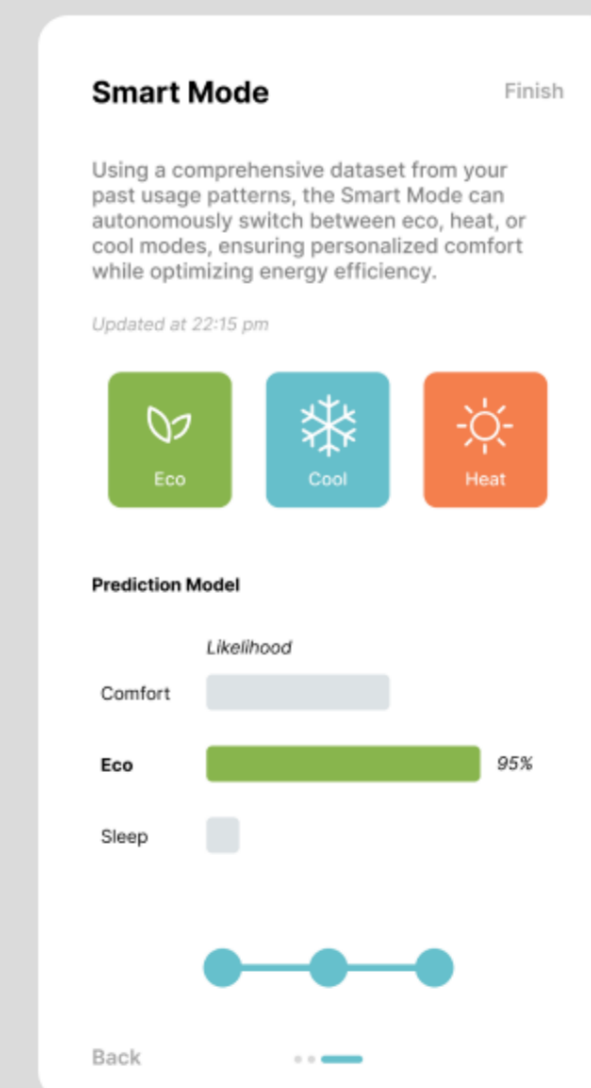
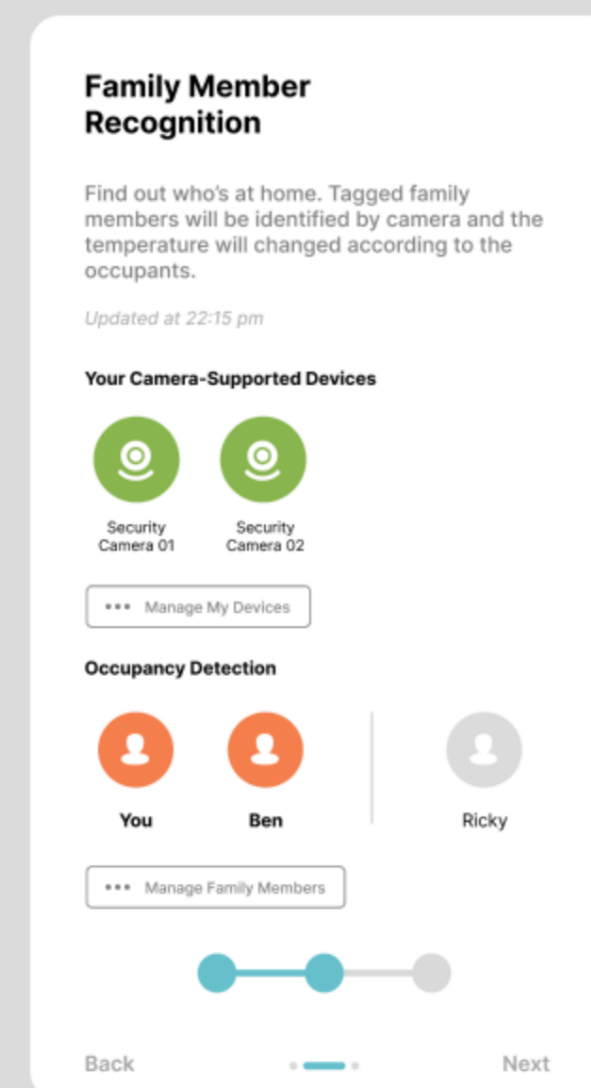
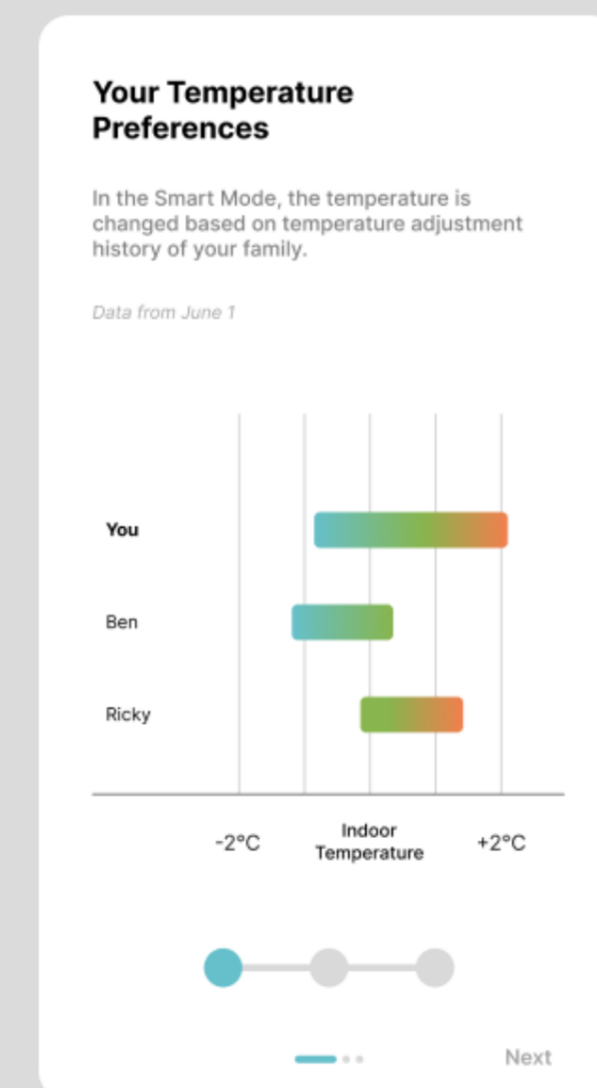
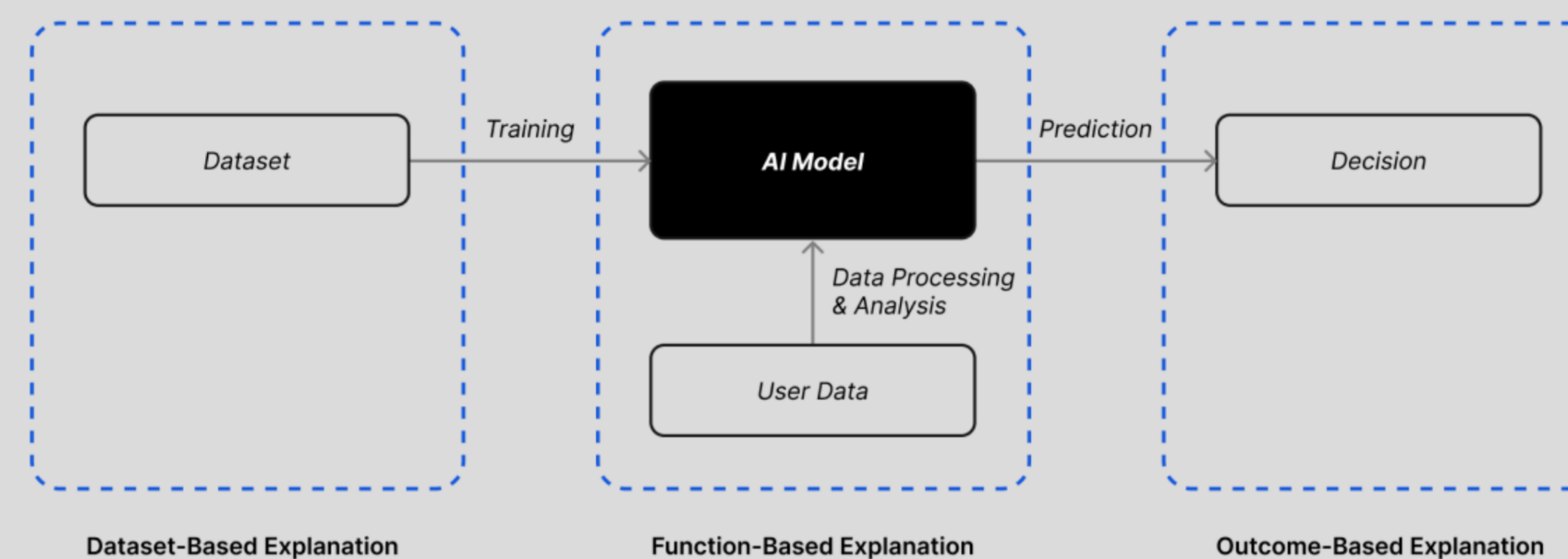
Awareness of Data Use and AI

Level of Engagement

Perception of Transparency

Study 2: User Testing

An user testing was conducted to answer **RQ3** and **RQ4**. Three explanation interfaces were created based on the strategies:



The goals were to test the efficacy of explanations in helping non-expert users understand AI-given decisions and test the implications on users' trust. The interfaces were evaluated from these dimensions:

Understanding

Confidence

Trust

RESULTS



RQ1: Based on the context of AI-enabled Smart Home System (ASHS), how do users feel about AI decision-making?

- Most users assume they are aware that data is being collected and AI is applied to make decisions in ASHS.
- Users are open to AI.
- Users' active participation in decision making is evenly distributed, and algorithm-literacy is not an influential factor.

RQ2: Do users perceive the experience to be better if transparency is increased?

- They are positive about adding transparency, believing that it will improve the experience of using ASHS.

RQ3: How effective are the explanation interfaces in helping non-expert users understand AI-generated decisions?

- Providing explanations has a positive effect on the understanding of AI-given decisions by non-expert users.

RQ4: Will explanation interfaces increase users' trust in AI?

- Providing explanations helps increase user trust.

CONCLUSIONS



This study explored users' attitudes towards AI in ASHS. By conducting user testing, the efficacy of each strategy and the implication on users' trust has been understood.

There were several limitations in this study. In the user testing section, the pre-existing knowledges may influence the participants' understanding of the information, which results in inaccurate results (Cheng et al., 2019). In addition, since smart homes provide users with a long-term service, a short-time test might not make a great impact on participants' perceptions, which might result in the insufficient depth of results obtained. For the future work, the method for evaluations of efficacy should be improved. Also, more strategies for explanations can be expanded.