Using Expressive Lights to Enhance Communication in Smart-speakers

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INTRODUCTION

- The growth of smart-speakers in recent years has been exponential - half of all American households are predicted to possess a smart speaker device by 2022
- However, interactions are prone to misunderstandings, **inadequate information transfer**, poor input-response mapping - revealing a **gap in the interaction dynamic**
- Light as a medium of interaction gained interest in recent past - specifically, we intend to use **expressive lights** to convey additional informational states from the speaker to the user
- Lights in smart speakers – **underutilized, presents potential.** Can also aid for communication with deaf and hard of hearing individuals

Augmenting smart-speakers' ability to convey contextual information without interrupting the natural flow of conversation

Characteristics of Expressive Light: Color, Speed, Frequency, Pattern

USE-CASES

- Conveying **sentiment** - expressing **happiness**, **sadness**, **anger**, **surprise** through light patterns
- Alerting users of **potential privacy concerns** - sensitive data, guest modes, unusual device/network activity
- Communicating **errors**
- Aiding in **discoverability** of new skills, devices

STUDY DESIGN

Survey 1

- Demographic Information
- Overall experience with smart-speaker and its visual apparatus
- Participants' **current understanding of use of expressive lights** within smart-speakers
- Understanding whether using expressive lights to give more **intuitive/context-specific knowledge** about states would be useful in certain scenarios

Survey 2

This survey will evaluate participants' perception of the smart-speaker's capability to convey sentiment in 3 conditions:

- Audio Feedback Only
- Audio + Expressive Light Feedback
- Expressive Light Feedback only

Emotions of interest: Happiness, Sadness, Anger, Fear, Calm, Disgust

Audio Feedback: Research validated audio clips from data sets with annotated emotions [1, 2]

Expressive Light Patterns: Research validated light patterns associates with above emotions [3]

[1] Livingstone, Steven R., and Frank A. Russo. "The Ryerson Audio-Visual Database of Emotional Speech and Song (RAVDESS): A dynamic, multimodal set of facial and vocal expressions in North American English." PloS one 13.5 (2018): e0196391.

[2] Cao, Houwei, et al. "CREMA-D: Crowd-sourced emotional multimodal actors dataset." IEEE transactions on affective computing 5.4 (2014): 377-390.

[3] Song, Sichao, and Seiji Yamada. "Designing Expressive Lights and In-Situ Motions for Robots to Express Emotions." Proceedings of the 6th International Conference on Human-Agent Interaction. ACM, 2018.