Study on User Usability in Disaster Prevention Guidelines through Augmented Reality and Wearable Technologies

Name: DE LEON AGUILAR SERGIO

Laboratory's Ubiquitous Computing Systems

Supervisor's YASUMOTO Keiichi

Abstract

Disaster preparedness guidelines help citizens protect themselves during common disasters, yet the general public rarely engages with or applies them. Meanwhile, Augmented Reality (AR) interfaces have shown promise for improving knowledge transfer across various domains, but existing systems are typically designed for specific user populations rather than the general public. To increase public engagement in these activities, our first study tested a novel AR-assisted disaster preparedness guide that leverages deep learning models to identify objects relevant to disaster preparedness. Comparing this interface against paper-based guidelines, we observed that both media type and participant age influenced performance in securing their environments, highlighting age-specific usability issues. To address these differences without compromising the experience of proficient users, we designed an adaptive interface that aims to balance usability across age groups. Because these usability differences often stem from user frustration, we next investigated whether Adaptive User Interfaces could benefit from real-time frustration detection. In our second study, we examined the feasibility of using ML learning models to detect friction points in AR interfaces by comparing video-based emotion elicitation tasks with a calculator application recreating the frustration reported in our first study. We found that, though pretrained stress detection models do not generalize to frustration, retrained models can detect frustration at lower accuracy, opening a path toward adaptive AR experiences. This dissertation demonstrates the viability of adaptive guidance interfaces for less technology-aware users and contributes to the underexplored area of adaptive AR for the general public.