Thesis Abstract

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Title of Thesis:

Detection of User's Interruptibility for Attention Awareness in Ubiquitous Computing

Summary of Thesis:

There has been an explosion of information available for people to read and act on in the age of ubiquitous computing. Users computing experience have been getting all-day long, carrying and using an increasing number of mobile and wearable devices with an increasing number of applications, and being connected to more number of remote users. Notification, a side channel for pushing information from a computer to a user has been a taking on greater importance in such computing, with increasing versatility in the notification source, an increasing length of notification experiences, and an increasing number of devices as the notification destination. On the other hand, a human user's attention resource with a limited amount of capacity is, however, remaining constant. This research addresses the problem of interruption overload, a situation in which too many ill-timed interruptions by notifications delivered to the user in an as-soon-as-possible manner cause the user's divided attention and negatively affect their performance.

What is fundamentally needed in computer systems is attention-awareness, particularly the fundamental functionality of attention sensing. This dissertation shows that the breakpoint of user's activity, as an interruptible timing that lowers the user's perceived workload while preserving their limited attention resource, can be sensed in real-time, in a mobile and wearable multi-device environment without external psycho-physiological sensors, and without modifications to the existing operating systems and applications. The design and the implementation of "Attelia", the first middleware that realizes such detection, are proposed along with an extensive evaluation through user studies on the participants' real mobile and wearable environment. The evaluation validates the effectiveness of Attelia, which results in a significantly lower overhead in the user's workload perception when receiving notifications in the detected breakpoint timing on a smartphone or smart watch, or in a multi-device environment with a combination of such devices.

Keyword: ubiquitous computing, interruption overload, attention-awareness, interruptibility, mobile sensing, mobile multi-device environment