

THE SUMMARY OF Ph.D DISSERTATION

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Thesis Title An Ontology-based Programming Platform for Smart Artifact Systems			
Abstract <p>Computing is moving towards everyday artifacts to make them “smart” and “intelligent”. By making use of the perceived contexts, smart artifacts can deliver a variety of human-centric applications. Due to the reasons such as privacy, personality and creativity, end users should be empowered to exert control over these applications, or even create new applications if they find existing ones cannot meet their particular needs. However, because existing smart artifact systems mainly rely on ad-hoc definitions of contexts, they don’t provide any reusable components that can facilitate other developers’ effort. Moreover, diversity of user ability and interest is not considered in existing user-oriented smart home toolkits.</p> <p>To avoid having to start from scratch when building new human-artifact interaction systems, we proposed an ontology-based knowledge infrastructure called Sixth-Sense, which enables rapid prototyping of artifact-related applications. Unlike previous systems, Sixth-Sense builds upon the Semantic Web technologies, which includes a normalized ontology (called SS-ONT) definition to reflect vital aspects of human-artifact interactions. Sixth-Sense also supports semantically querying of collected contexts and includes a generic reasoning engine to derive higher level contexts from raw sensor data. In a word, our infrastructure paves the path for rapid prototyping of smart artifact applications.</p> <p>Based on this context infrastructure, we proposed an ontology-based programming model, called <i>Open-Programming</i>. Different from previous systems, this model is designed to meet both the “simplicity”, “high intelligence” requirement from novice users and the “functionality”, “in-depth” requirement from advanced users. For example, it enables an advanced user from <i>family-A</i> to create a rule-based game, and allows parents from <i>family-B</i> to reprogram it for their children to play through a simple front-end (according to their domestic settings and imagination). Because “error checking” is an important function as a programming tool, we also integrated several mechanisms to debug the programmed applications, including a commonsense-reasoning based approach to deal with hardware errors in smart artifact applications.</p> <p>A wide variety of applications are enabled by making use of our system, such as the real-world search service (e.g., searching lost objects) and artifact-based pervasive games. We also did a series of experiments to evaluate the performance of our infrastructure as well as the feasibility of the <i>Open-Programming</i> model. The results indicate that <i>Sixth-Sense</i> is a promising tool for users with different abilities to control and program smart artifacts in future homes.</p>			