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Tools and Techniques for Designing, Implementing, & Evaluating Ubiquitous Computing Systems

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ABSTRACT

Interactive systems in the mobile, ubiquitous and virtual environments are at a stage of development where designers and developers are keen to find out more about design, use, and usability of these systems. Ubiquitous Computing is the design, implementation and usability that highlight the theories, techniques, tools and best practices in these environments. This paper shows that usable and useful systems that can be achieved in ways that will improve usability to enhance user experience. Research on the usability issues for young children, teenagers, adults and the elderly is presented with different techniques for the mobile, ubiquitous and virtual environments. Interactive frameworks in the portable, omnipresent, and virtual situations are at a phase of advancement where creators and engineers are quick to discover more about the outline, use, and ease of use of these frameworks. The objective of this research paper is to assess the tools and techniques for designing, implementing, and evaluating ubiquitous computing systems used by developers so as to formulate practical solutions that address the functionality of these systems. Ideal systems ensure that designers are able to develop and predict usability of systems at all the stages of virtual environments. This is particularly essential as it increases the experience of the users. This requires one to use the best tool and techniques backed by theories to practice the same. However this varies across different fields such as ubiquitous and mobile environments. In addition all the computing tools have to share visionary tools that allow them to network while at the same time they are processing and distinctively modeling the user interface. Some of the main methods that are used for smart devices include tools such as tabs, boards and pads. Various tools are usually used in the design of the works of the computer. The need to select appropriate techniques that will allow for the efficient use of the chosen techniques for the devices is thus a necessity. This implies that the selection of such tools should be based on set out effective techniques that have been tested so that the required output is achieved.

Keywords: *persuasive computing, ubiquitous computing systems, internet of things*

I. INTRODUCTION

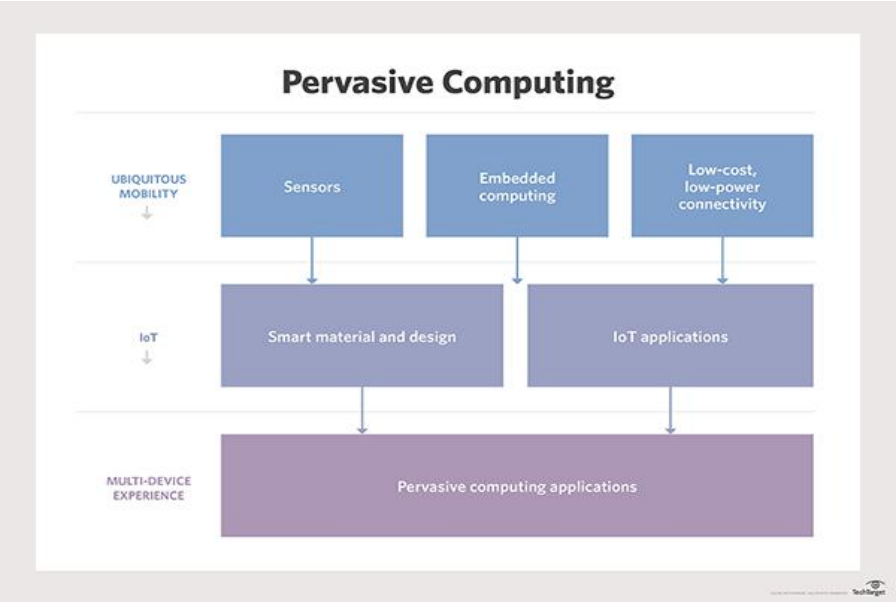
This section introduces us to the research study. It consists of background of the research, significance of the research, research rationale, scope, questions, hypotheses, aim, and objectives.

A. Background of the Research

Technological innovation in the information technology sector has prompted corporations to invest in ubiquitous computing. However, measures put towards implementation of ubiquitous computing have encountered some difficulties since web designers tend to have limited understanding on the functionality of ubiquitous computing systems and tailor make designs anchored on ensuring effective performance of these systems. For instance issues related to sensing and scale is responsible for causing ubiquitous computing systems to resist iteration prototype creation, and ecologically valid evaluation. In order for software developers to create prototypes aimed at ensuring that ubiquitous computing systems are robust and capable of handling ambiguities likely to manifest themselves in the system by putting the data collected into good use.

With efficiency and accuracy being many of the goals in today's modern world, ubiquitous computing system has gone forth to be developed. To many, ubiquitous computing systems are also known as pervasive systems. Ubiquitous systems are technologies that embed microprocessors into everyday usable gadgets such as the mobile phone among others. In history, initially, such gadgets would not be able to perform the kind of activities that they are performing today. Thanks to research and evolution, the embedding of microprocessors into various gadgets has ensured that information and communication among users is swift and efficient. A key technology playing a major role in ubiquitous computing systems is the internet, especially the use of wireless

connections in order to function efficiently. For the complexity aligned with the design and development of these systems, it calls for the developer to have gathered vast information.



For design, the developer ought to gather soft data from the user to ensure that they have their needs and preferences in mind while they develop the system. Data gathering through focus groups, observation and forecasting of trends can be used. Until the evaluation stage where the success of the ubiquitous computing system is tested, it calls for the developer to be not only keen but also accurate in every activity that they undertake. Ubiquitous computing systems have often been termed as uncontrollable, with even some being labeled as privacy invaders; with the proper tools and techniques for design, implementation and evaluation, then the ultimate goal of the systems, with minimal negative impacts and challenges shall be arrived at.

B. Significance of the Research

The implementation of ubiquitous computing system in the contemporary society engages several tools and techniques. Subsequently, computational capabilities as well as quick access to information suggest smart paradigms of new world interaction. Thus, proliferation of computing in the contemporary society promises ubiquitous of computing infrastructure. On another hand, it is vital to address notion of scale, physical space of distributing computation, as well as number of clients using this system. Despite the fact that cumulative experience in the ubiquitous availability of computing as far as security, control, visibility and privacy are concerned. However, there are no specific guidelines for steering ubiquitous availability of computing method. Similarly, it is crucial to review accomplishment of the ubiquitous availability of computing in the process of charting the course of future research. The fact that push of traditional desktop plays an essential role in changing the relationship between computers and people; this provides a continuous advancement in computers. Therefore, it is significant for researchers to posit new areas, which entails application research, majorly focused on scaling interaction in every computing research. Consequently, evaluation strategies in the current society form an important spectrum from technology feasibility, thus any research effort in ubiquitous computing system must engage a kin evaluation.

C. Research Rationale

Weiser introduced the area of ubiquitous computing (ubicomp) and put forth a vision of people and environments augmented with computational resources that provide information and services when and where desired [Weiser 1991]. For the past decade, ubicomp researchers have attempted this augmentation with the implicit goal of assisting everyday life and not overwhelming it. Weiser's vision described a proliferation of devices at varying scales, ranging in size from hand-held "inch-scale" personal devices to "yard-scale" shared devices. This proliferation of devices has indeed occurred, with commonly used devices such as hand-held personal digital assistants (PDAs), digital tablets, laptops, and wall-sized electronic whiteboards. The development and deployment of necessary infrastructure to support continuous mobile computation is arriving

D. Scope of the Research

Building pervasive structures requires another perspective about the diagram and use of ICT systems and how they interweave with the collected environment. In urban extents we have the best open entryways and the most grounded solicitations to blueprint and build inevitable systems, yet urban arrangement has not highlighted unequivocally in unavoidable structures research. We have no essential speculation, data base, principled techniques or mechanical assemblies for laying out and constructing certain structures as basic parts of the urban scene. We are enthusiastic about delineating not just the building space in which people move and continue and interface also the joint effort spaces for information and organizations which they find and use and which support their advancements, practices and relationship inside compositional space. To arrange these new organized systems, we need to create and alter our perception and routine of urban framework. The Cityware wander facilitates the requests of Architecture, Human-Computer Interaction and Distributed Systems, developing our past work to make measures, mechanical assemblies and methodologies for laying out, executing and evaluating city-scale unavoidable structures as essential parts of urban setup. Cityware addresses the troubles of scaling up the design and execution of unavoidable structures to whole deal, city-scale systems and surveying these systems and their relationship with urban space and society through both concentrated on and longitudinal studies.

E. Research Questions

The research will address the following questions:

- Do usable and useful systems improve usability to enhance user experience?
- Areinteractive frameworks in the portable, omnipresent, and virtual situations at a phase of advancement where creators and engineers are quick to discover more about the outline, use, and ease of use of these frameworks?
- Do sensing and scale hold responsible for causing ubiquitous computing systems to resist iteration prototype creations?

F. Research Hypothesis

- **H1** Useful systemsenhance user experience and consumer's satisfaction.
- **H2**Interactive frameworks create ubiquitous systems built on reliability.

G. Research Aim and Objectives

The aim of the research is to analyze ubiquitous computing systems in order to suggest improvisations and outline the pros of improved systems.

Objectives of the research will be:

- To assess the tools and techniques for designing, implementing, and evaluating ubiquitous computing systems used by developers
- To formulate practical solutions that addresses the functionality of these systems.

II. RESEARCH METHODOLOGY

This section emphasizes the methodology and techniques for this research and the pattern considered most appropriate for this study. It is made up of the research purpose, study design, ethical considerations, and challenges encountered in the course of the research.

A. Research Purpose

This is a theoretical research with the sole aim of providing emphasized descriptions of various phenomenon and conditions persistent which are connected to situations, individuals, or occurring events. The aim of the research is to generalize the outcomes of theories which develop over the course of the study. Along with that, a descriptive and theoretical research is always carried out on the basis of sufficient knowledge of the researcher with hypotheses based on the questions and that there is not intent to investigate the clauses between situations and occurring events. Empirical study gained from literature review and secondary data are involved in most aspects of the research. Analysis and derivations are used as evidence or proof.

B. Study Design

The study design is a mixture of empirical and theoretical study design. Theoretical aspect accrues data from mathematical modelling and empirical aspect is in the use of available literature evidence in substantiating the assertions. The advantages of this design is because it is cheap, less time consuming, and it enables the comparison of data to come up with valid and reliable findings.

C. Ethical Considerations

The study adhered to the principal ethics requirements. Permission to proceed with this research was obtained from relevant authorities. The studies selected for the literature review met the ethical requirements and they were published in the public domain. The authors of the literature reviewed for secondary data were accredited in both the in-text citation and reference page for conformity to policy against plagiarism.

D. Challenges Encountered

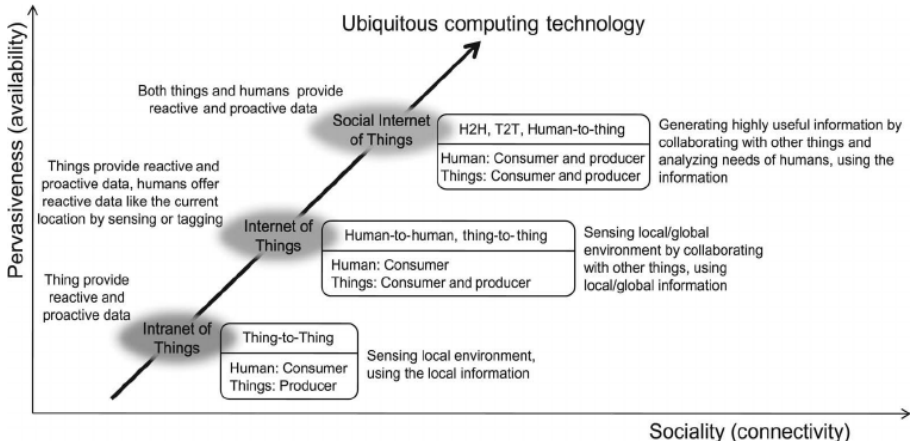
Several challenges were encountered in this research. Given that it is a mixed study, the outcome of the literature review may not correlate with the theoretical modelling findings because as one is theoretical the other one is empirical evidence. It was cumbersome to get sufficient peer reviewed papers relevant to this topic because the field is least researched due to its rapid advancement. The time was limited and financial constraints experienced necessitated cheap and less time consuming study designs to be selected for the research.

III. RESULTS OF THE RESEARCH

This section presents the findings of the research. It provides results of the research on the available body of knowledge in regards to the topic of the study, which constitutes a review of relevant literature. It also provides the evidence obtained in the mathematical modelling section to come up with valid and reliable assertions. The results from empirical evidence and mathematical modeling are analyzed to provide credible conclusions.

A. Findings from Empirical Evidence Reviewed

Ubiquitous computing is a contemporary trend that is growing towards embedding microprocessors into existence everywhere such that everyday objects can easily communicate information. The computing systems in this trend have completely connected devices that are also constantly available. Various tools and techniques are generally used to design, implement and evaluate ubiquitous computing systems around the globe. Designing ubiquitous computing systems goes beyond just providing building instructions. In designing ubiquitous computing systems, the first technique is physical integration that offers a connection between the nodes of computing or the virtual world and the physical world of users. A computing system that creates such a connection must make it clear where the 'Semantic Rubicon' lies and distinguish the line that separates the processing of semantic done by the physical world of the system from the virtual processing done by the human users.



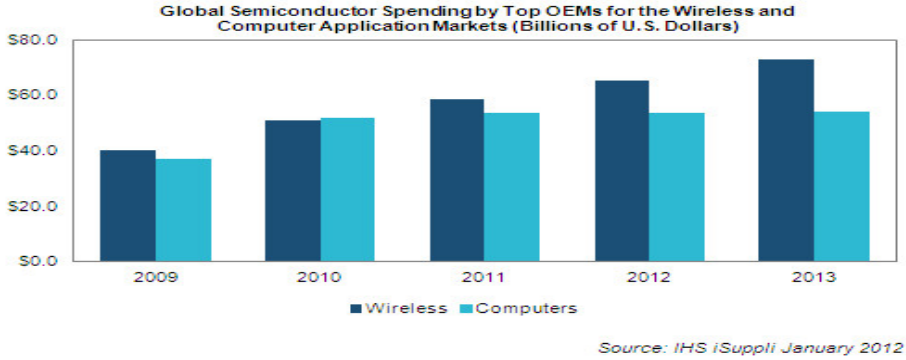
Another one is the spontaneous interoperation that involves the interaction of heterogeneous features that impulsively appear and disappear. In regard to tools used for design, events and tuple spaces are examples that facilitate the natural interaction within the boundaries of the system. However, designers are yet to enable spontaneous interoperation that is purely program driven across ubiquitous computing systems boundaries. In implementation, such systems have mostly utilized leverage of mobile computing work that puts into use adaptation and transformation based middleware to deal with the issue of heterogeneity and dynamism. As Weiser recommends in his vision of calm computing, some generalizations to the spontaneous interoperation technique are necessary to allow graceful blending into the background.

B. Data framework improvement instruments

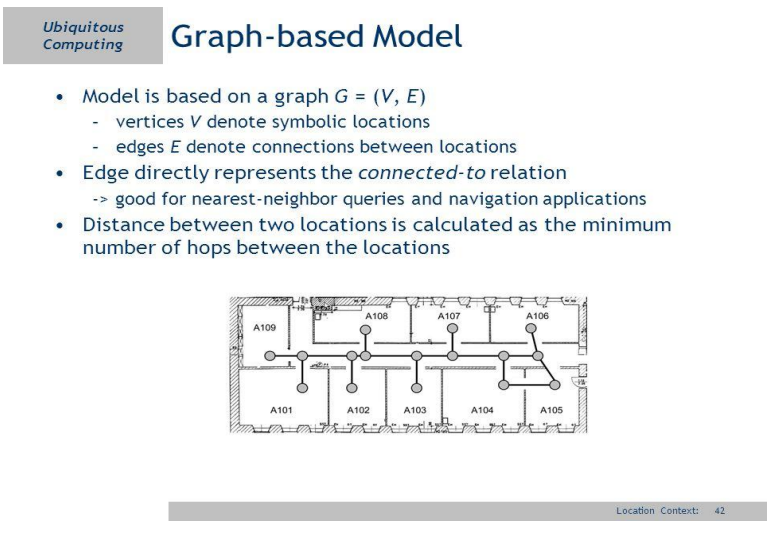
The shell model permits us to represent the instrument support tended to in this proposition: ISD devices incorporate no less than a piece of strategy learning. Ordinarily devices contain parts of the calculated structure as their blueprint definition, bolster displaying with specific documentations, or backing the procedure definition and administration. Device backing is imperative for our exploration questions since instruments can guarantee that strategy information is additionally connected and does not stay just as technique portrayals.

While the shell model focuses for the most part on the "profound structure" of the technique information behind ISD apparatuses, the instruments likewise give backing to the surface and physical structures of strategies. Profound structure indicates those parts of technique learning which mirror the area being worked on, while surface structure and physical structure manage properties of displaying apparatuses. Surface structure portrays UI qualities of an ISD instrument, for example, how strategy learning behind a demonstrating system is unmistakable in discoursed, menu charges and reports. This takes after the notational piece of strategy information. Physical structure indicates the specialized means connected in the execution of the ISD apparatus.

In this area our emphasis is on devices which bolster the utilization of strategies, i.e. method for supporting. This shaped the third emphasized part in our meaning of ISD. In the first place, we quickly describe ISD devices as far as how they bolster diverse stages and undertakings of ISD. Second, we depict connections amongst strategies and apparatuses in more detail through the idea of technique instrument friendship. This permits us to clarify how devices can bolster demonstrating systems. This is pertinent for our exploration questions, since we try to compute systems and their undertakings.

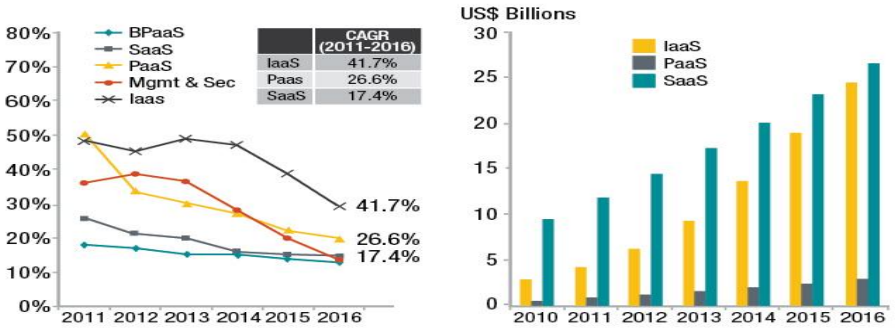


Technology in computing has undergone fast changes in the past years. Mainframe computers dominated the computing scenes based on the fact of one computer serving many people until in the late 1980s, when they gave way to personal computers, where the emphasis was one computer for one person. In the 1990s, a new era of many computers serving one person emerged, thanks to an increase in computing power at affordable prices. Technology then reduced transistors to microscopic sizes that enabled computer chips to be found in the things we use daily, even down to a pair of shoes made by Adidas (McCarthy, 2005). Mark Weiser (1993), father of ubiquitous computing (ubicomp in short), came up with the term "ubiquitous" to refer to the trend that humans interact no longer with one computer at a time, but rather with many sets of small networked computers, often invisible and embodied in everyday objects in our environment. Keefe and Zucker (2003), see ubicomp as a technology that enables information to be accessible anytime and anywhere and uses sensors to interact with and control the environment without users' intervention.
Hence, ubicomp defines a paradigm shift in which technology becomes invisible and integrated into our everyday lives, allowing people to interact with devices in the environment more naturally.



IV. OUTCOME OF THE RESEARCH AND ANALYSIS OF RESULTS

Propels in web administrations innovations alongside their mix into portability, on the web and new plans of action give a specialized framework that empowers the advance of versatile administrations and applications. These incorporate element and on-request benefit, setting mindful administrations, and versatile web administrations. While driving new plans of action and new online administrations, specific procedures must be produced for web benefit sythesis, web benefit driven framework outline philosophy, making of web administrations, and on-request web administrations. For applications that need to recognize or classify located objects to take a specific action based on their location, an automatic identification mechanism is needed. For example, a modern airport baggage handling system needs to automatically route outbound and inbound luggage to the correct flight or claim carousel.



Source: Gartner, *Consumer Research: Personal Cloud*, 2012

Figure 2: High Growth Expected for Cloud Services

A proximity-location system consisting of tag scanners installed at key locations along the automatic baggage conveyers makes recognition a simple matter of printing the appropriate destination codes on the adhesive luggage check stickers. In contrast, GPS satellites have no inherent mechanism for recognizing individual receivers. Systems with recognition capability may recognize only some feature types. For example, cameras and vision systems can easily distinguish the color or shape of an object but cannot automatically recognize individual people or a particular apple drawn from a bushel basket.As portable and universal processing turns into a reality, more formal and casual learning will remove pace from the bounds of the conventional classroom. Two patterns meet to make this conceivable; progressively intense phones and PDAs, and enhanced access to remote broadband. In the meantime, because of the expanding multifaceted nature, present day learners will require devices that work in an instinctive way and are adaptably coordinated in the encompassing learning environment.

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