Privacy and Context Awareness in Ubiquitous Environment, A Survey Report

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Abstract
The idea behind the usage of online and smart environments has been researched. Smart environments is a universal computer that help the people to do their daily activities invisibly and let them feel relax from daily tedious task. For the idea of making life much easier and independent of tedious work, ubiquitous computing gave birth to smart environments that will help us in our daily lives. As the technology is evolving day by day so it is become important for people to know the context behind every technology. In present study, a survey has been conducted to investigate the privacy and context awareness while working in an Ubicomp environment in different age groups. For this purpose, three different age groups (less than 30 years, between 30 to 40 years and above 40) has been selected. An online and physically participants are examined by different questions involving collection of personally and identifiable information. Results indicate that majority of online and smartphone users are aware of ubiquitous computing, smart environments and context awareness. At the same time the sampling data shows that the subjective are highly concerned about their privacy and want to know the context behind their actions. Further analysis of the data suggest on the basis of distinct groups participants with age between 30-40 Years are more concerned about privacy and knows the context behind their each action.

Keywords: ubiquitous environment, smart environment, context awareness, Privacy.

I. Introduction
Ubiquitous computing is making people’s lives much easier and more efficient (Liu, Li, & Huang, 2011). Ubiquitous Computing refers to making device available throughout the physical environment while it is invisible to the user (JUAN-CARLOSCANO, 2006). Ubiquitous computing the global revolution that has emerged the powerful computer into an ordinary device which is also gets fit in person’s pocket. Ubiquitous computing allows us to process information from anywhere in a much easier way (Stajano, 2010). Ubiquitous computing is being reality, by which people are able to collect and utilize information anytime from anywhere using a device which is connected through some source of networks (Jeon, Leem, Kim, & Shin, 2007).

In modern society, interface technology, mobile internet devices such as PDA, laptop, notebook and smart phone are changing very rapidly (Sarrab, 2012). In ubiquitous computing user’s
concern about privacy is consider as debate in internet privacy. In ubiquitous computing there are many risks to privacy and security. User usually does not have a complete understanding of risk to their privacy by means of context and security. Privacy is concern with individual’s right to access and control their information with respect to their personal collection, use and data that they transfer over the internet (Dinev & Hart, 2004). Context implicitly means ‘information’, so context awareness refers to any information related to user dynamic and static information (Perera, Zaslavsky, Christen, & Georgakopoulos, 2014). Dynamic information of users means user current and historical location, current and historical activity, current emotion, relationships or contact with colleagues or friends. Whereas user static information means social situation, user personal information, and user habit and user preference (Boritz, No, & Sundarraj, 2005).

Researcher such as Westin identify that each user have a security and privacy claim that what kind of information of his must be kept private and what kind of information must be kept public. He categorizes the user into three categories with respect to privacy. First category belongs to the users who are much concerned about their privacy and not eager to provide information which is personal to them. Second who are not concerned about the privacy and willing to share their all information and third are those who are concerned about privacy but can share their information (Westin, 2003).

Numerous researchers have contributed in a valuable manner to address some obvious threat in Ubiquitous Computing (Motahari, Manikopoulos, Hiltz, & Jones, 2007). Smit.et.al gives a new scale known as Concern for Information Privacy (CFIP). His scale consist of fifteen items measuring four correlated factors: collection of personal information, internal unauthorized secondary use of personal information, unauthorized secondary use of personal information and improper access to personal information (Smith, Milberg, & Burke, 1996).

Sheehan studied the Westin’s traditional typology of customer concern and he came to the conclusion that user’s on the basis of privacy can be categorize into four categories that are, unconcerned internet users, circumspect internet user, wary internet user and alarmed internet users ((Boritz, No, & Sundarraj, 2005). Malhotra et.al categorizes the CFIP scale for adapting it to an internet environment. They produce two scales. First scale named as General Information privacy Concern(GFIP) consist of 6 items and second scale named as Internet Users Information Privacy Concern (IUIPC) consist of ten items use for 3 correlated items collection, control and awareness. Malhotra et al. claims that IUIPC is has more effect than CFIP because it has fewer factors, a better internal fit, and a stronger relation to GIPC (Malhotra, Kim, & Agarwal, 2004).

Janice et.al considers the Malhotra scale IUIPC to study what variables affect consumer trust and their personal information. They include additional variables for study such behavior. Variables that they introduce additionally are dimensional global information concern (GIPC) scale and four dimensions of the concern for information privacy (CFIP) scale which include collection (COLL), unauthorized secondary use (SECO), improper access (IMPR), and errors (ERRO). They concluded that trusting beliefs is a significant interpreter of risks beliefs. In turn, both trusting beliefs and risk beliefs were found to be interpreter of user’s intention to provide personal information for an online transaction (Ward, & Connolly, 2012). Knijnenburg et al consider three different goals in his research, increasing the leak of context data, increasing the leak of demographic data, and increasing the users’ subjective experience of the system. They
concluded that information expose by user is prerequisite for personalized systems, and strategies with disclosure can improve personalization system (Knijnenburg & Kobsa, 2013).

In the presented paper we have conducted a Questionnaire based survey for understanding user perspective that who performs specific actions online are aware of the context behind their action or are they aware of that how their information can be used for some other purposes for instance by third party. For this purpose, the questionnaire has been distributed to the undergraduate, postgraduate students and Faculty Members. Nowadays mostly people uses smartphone, we through our questionnaire have also analyzed that either they know detailed context of their mobile phone or not.

In presented paper we have two sections, in first section we have studied how much users generally know about smart environments, ubiquitous computing and context over internet, and in second section we have studied that how much they are concern about the online and smartphone privacy and either they have context awareness behind every action they perform.

II. Methods

Many public opinion polls have been conducted to know what user’s major concern to protect their privacy are and what factors affect user’s privacy (Brown & Muchira, 2004). When there are much type of users then everyone have their own standards in there context of security and privacy, but the awareness of the context in using the services is essential part for the learning with respect to the user perspective.

In presented research paper goal is to find out how much user is concern about their privacy and how much knowledge they do have or not either. The specific action perform by them had some pros and cons. In order to understand the user’s perspective a survey was designed and was uploaded online and also was filled manually. By taking total of 100% participants 98% filled the survey form and return it back. The Questionnaire is divided into two categories. The first section consist of general questions to conceive how much user generally knows about the ubiquitous computing and either he knows about the context in the sense of ubiquitous computing or not. The second section of Questionnaire is based on the questions regarding the specific user concern about privacy and either the task they perform online either they know pros and cons of it or not.

A. Sampling Procedure

Our major concern as participants was respondents belongs to different age. During survey total number of participants were 200 while there appears to be dis-appropriate percentage of participants from different age factor filling survey paper, only 192 participants are presented, in which 64 are below 30 years, 64 ranges between 30-40 years 64 are above 40 years. All these participants were well educated and earning
minimum bachelor’s degree or higher. We analyze individually and collaboratively that how much user is concern about the privacy in terms of context and how in depth he/she knows the side effects of ubiquitous computing.

B. Survey Measures

User’s context awareness and privacy concerns was measured using 15 statements that represented 5 different categories for context awareness regarding privacy and ubiquitous computing and general 7 categories, identified after the analysis of participant response. In general section, analyzed that how many of user are aware of that everything being anywhere and everywhere comes in the ubiquitous computing and either user are aware, that they are in smart environments and there awareness regarding context. In order to analyze these general question, some cross questioning were asked that either participant saying that he/she is using smart phone either knows or not what smart phones are and participants claiming that he knows ubiquitous computing either really have knowledge about ubiquitous computing (Ubicomp) or not.

In context awareness and privacy section, the first category in context awareness regarding privacy is, users’ knows about the context and is more concern about privacy as shown in Figure 1.

![Figure 1. General View of Survey Paper](image-url)
This suggest that the online user or user using the smartphone have much knowledge about the online context and smartphone and they are conscious about the privacy. The second category, user knows about the context but he/she is not conscious about the privacy. The third category that user is not aware of context but he/she still is much possessive about the privacy. The fourth category are those who don’t have knowledge about context and as well as they don’t care about privacy. The fifth category the user who came to know the pros and cons about online and smart environment (SE) after our survey and will now and onwards will take care about privacy. Our question was placed in random order and participants were instructed to answer each question from the point of an individual using internet or smartphone.

III. Results

In this section shows evidences of the research as the results and analysis. In this section shows evidences of the research as the results and analysis. In this section shows evidences of the research as the results and analysis. In this section shows evidences of the research as the results and analysis. As a first step, categorize overall participants in general perspective and came to the result that 46% of participants in average knows about the ubiquitous computing and 53% of participants don’t know about the ubiquitous computing. After the analysis of how much user knows smart environments 67% knows they are in smart environment, 17% don’t know about smart environments and 16% don’t know about smart environment but are using smartphones.

For analysis of context awareness regarding and smartphone, as a first step, categorize all participants those are concerned with privacy. Second participants who are not concerned about the privacy but know the context behind each of their task, third participants who knows about privacy and its context but can share their information.

In presented research, analyzed that there are also number of participants did not share their information not because of they know the context behind their task but they are somehow concerned about their privacy. Through presented survey question, analyze that either the participant after filling our survey paper and knowing some context about privacy being online and using smartphones, will they take care of their privacy or not.

A. Inter Group Differences

As in presented research paper, participants are categorize into three different categories such that peoples having age above 40 years, having age 30-40 and below 30. Table 1 shows the analysis of overall participants with reference to general section in survey paper.
As shown in Table 1, 56% of the participant who had age above 40 years (First category) knows about ubiquitous and 44% of participants did not knows about ubiquitous, 56% of participants knows that they are in smart environment and are using smartphones whereas 22% of participants do not know about the smart environment and are not using smart phones and 22% are those who are using smart phones but do not know about smart environment. In total, 94% having awareness of context related to online and smartphones and only 6% are not aware of context related to online and smartphones.

The next category of participants having age from 30-40 years. It was found that 59% knows ubiquitous computing, means they are aware of ubiquitous computing, 49% don’t know about the ubiquitous computing, 76% of participants knows that they are in smart environment, 8% of participants do not know that they are in smart environments and 16% of participants do not know that they are in smart environments and are using smartphones.

The last category of presented research survey consist of participants having age below 30 years. In this category, 24% of participants knows about the ubiquitous, 76% do not know about the ubiquitous, 70% of participants knows that they are in smart environment and 22% of participants do not know about smart environment and 8% do not know about smart environment but are using smart phones and with respect to context awareness total of 32% of knows about context awareness and 68% of participants do not know about context awareness.

<table>
<thead>
<tr>
<th>Category (Age wise)</th>
<th>Aware of Ubicomp Term</th>
<th>Un-Aware of Ubicomp Term</th>
<th>Aware of using SE</th>
<th>Aware of SE Term</th>
<th>Un-Aware of SE Term</th>
<th>Context Aware</th>
<th>Un-Awareness Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 Years and Above</td>
<td>56%</td>
<td>44%</td>
<td>56%</td>
<td>22%</td>
<td>22%</td>
<td>94%</td>
<td>6%</td>
</tr>
<tr>
<td>30-40 Years</td>
<td>59%</td>
<td>49%</td>
<td>76%</td>
<td>8%</td>
<td>16%</td>
<td>24%</td>
<td>12%</td>
</tr>
<tr>
<td>Below 30 Years</td>
<td>24%</td>
<td>76%</td>
<td>70%</td>
<td>22%</td>
<td>8%</td>
<td>32%</td>
<td>68%</td>
</tr>
</tbody>
</table>
As shown in table 2, 56% of the participants who had age of above 40 (first category) knows the context behind each of their action and are conscious about their privacy either being online or using smartphones whereas 16% of participants are those who knows context behind their action but are not conscious about their privacy. The 15% of participants are those who do not know context behind their action but are taking care of privacy as they do not want to share their information online or using smartphones, 14% of participants were those who do not know about the privacy and also do not care about privacy. There were 9% participants who were not aware about the context and but after filling our survey paper they will take care of privacy and context afterwards.

The next category of participants having an age of 30-40 years. It was found that 60% of the participants knows about the context and take care (TC) of privacy, whereas 23% of the participants knows about context but don’t care of privacy, 2% are those who don’t know about the context but are possessive about their privacy and sharing information online or no smartphones, and 11% were those who are not aware context and not are possessive about privacy but after filling or survey paper and knowing some of the context from next time they will be careful.

The last category of presented research survey consist of participants having age below 30 years, 45% of participants knows the context and take care of their privacy when perform some actions online or on smartphones whereas 25% are those participants who have idea and knowledge behind their action or context but are not concerned about their privacy, 18% of participants are those who are not aware of context but take care of their privacy, 25% are those who do not know about privacy and do not take care about privacy as well. The 12% participants were those who will from now onwards will take care of privacy.
IV. Analysis And Discussion

On the presented survey paper, it is observed there are almost five times of participants, first are participants who knows about ubicomp, smart environments and context awareness and are highly concerned about privacy and knows the context behind their action. Second type of participants who knows the context but do not care about privacy, third participants who do not know about context but hesitate while sharing their information online or on smartphones, fourth the participants who do not know about the context and do not want to take care of their privacy and the last one who do not know about the context but will take care about privacy in future.

The results of individual suggests that majority online users and smart phone user are concerned about privacy and knows the context behind each action they perform, but for many user ubiquitous and smartphone is still novelty and online and smartphones user still learning how to behave when they are online and using smartphones and faced privacy and context problem. As the online and smartphones user face many changes on day to day basis therefore one should have very high contextual approach towards understanding the change situation and features.

As the situation changes day by day and new technology are being introduced in the market, so with the technology the users perspective also changes about privacy, so it is very hard to pretend user point of view and his/her contextual information and their privacy concerns. From our analysis we have analyze that user no matter from which field or from which area of study belongs to he has much awareness regarding the online and smartphone and he take care of privacy but it may differ with respect to situation and technology advancement.

In the Presented paper it has indicated that participants ranges between 30- 40 years are aware of ubiquitous computing, and being a part smart environment equal number of participants do not know about smart environment and are using smart environment and more of the participants ranges between 30-40 years had idea of context awareness.

As general sections has shown that, participants that ranges between 30-40 years are more aware of context that is why they are more concerned about privacy no matter either their area or fields differs. We may say that younger generation had much more explore the option age below 30 and above 40. From presented study, it is conclude that participants that below 30 and above 40 are less concerned about privacy and are less aware on context. Indeed participants below 30 years after knowing the context behind privacy claims that they will be careful from next time while being online or using smart phones.

V. Conclusion and Future Work

An online and physically survey has been done. The survey questions were divided into three categories: participants below 30 Years, between 30-40 Years and above 40. Results indicate that majority of the participants are concerned and knows the meaning of context but with the distinct categories, participants between 30-40 years in general knows about ubiquitous computing,
smart environments and context awareness as well as are more concerned about privacy and have an idea behind each action they perform.

As an exploratory study, it suffers from many limitations. It is possible that people who are very much concerned about privacy did not respond to the questionnaire that we place online after considering it a threat related to their privacy. Other findings from this research suggest that other areas for research can be how user behavior changes with the changes in context of online and smart environments.

As an exploratory effects this study highlight the user privacy concerns and his/her level of understanding in general and in context perspective. Further study with the context and change in technology will add to this knowledge and help to determine more specifically participants towards privacy concern and their awareness regarding context of privacy.

References


