

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

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

1. Introduction

Ubiquitous computing is making people's lives much easier and more efficient [1]. Ubiquitous Computing refers to making devices available throughout the physical environment while it is invisible to the user [2]. Ubiquitous computing is the global revolution, which 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 [3]. Ubiquitous computing in reality is, by which people are able to collect and utilize information anytime from anywhere using a device which is connected through some source of networks [4].

In modern society, interface technology, mobile internet devices such as PDA, laptop, notebook and smart phone are changing very rapidly [5]. In ubiquitous computing user's concern about privacy is considered as a debate in internet privacy and smart environments. 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 [6]. Context implicitly means 'information', so context awareness refers to any information related to user dynamic and static information [7]. 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 [8].

Researchers such as Westin identify that each user has a security and privacy claim. Each user is concerned with 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 [9].

Numerous researchers have contributed in a valuable manner to address some obvious threat in Ubiquitous Computing [10]. Smit et al. gives a new scale known as Concern for Information Privacy (CFIP). His scale consists 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 [11].

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 categorized into four categories; unconcerned internet users, circumspect internet user, wary internet user and alarmed internet users [12]. 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 (GIP) 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 GIP [13]. 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 [14]. 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 [15].

In the presented paper we have conducted a Questionnaire based survey for understanding the user perspective. Users who performs specific actions online, are they aware of 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 with participants of different age groups.

2. Methodology

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 [16]. There are much type of users who have their own standards related to security

and privacy, but the awareness of the context is essential part for the user.

In presented research paper goal is to find out how much user is concern about privacy and how much context aware they are. In order to understand the user's perspective a survey was designed and uploaded online as well as was filled by different participants who were physically present in different organizations. By taking total of 100% participants 98% filled the survey form physically and return it back. The Questionnaire is divided into two sections. The first section consist of general questions related to Ubicomp, smart environments, and context awareness. The second section of Questionnaire explores participants concern and awareness about privacy in Ubicomp.

2.1 Sampling Procedure

Our major concern as participants was respondents must belongs to different age group. 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, so 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 participants individually and collaboratively that how much participants are concern about the privacy and how much in depth he/she knows the context behind each action performed online and in smart environments.

2.2 Survey Measures

Participant's context awareness and privacy concerns are measure using 15 statements consist of 5 different options. In total, 7 statements belongs to first section, used to identify participants understanding for Ubicomp, smart environments and context awareness, whereas 8 statement belongs to second section specifically for identifying context awareness regarding privacy in smart environments and Ubicomp.

In first section considered as general section, it is analyzed that how many of participants are aware 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 environment either knows or not what smart environments are and participants claiming that he knows ubiquitous computing either really have knowledge

about Ubicomp or not. In second section, user concern about privacy has been analyzed and as well as either participants are aware of pros and cons behind each action they perform online and on smart environment such as on smart phones.

3. Results

In presented paper, participants are categorize on the basis of age differences. Analysis of questionnaire is conducted on the basis of two section which is general and context awareness with respect to privacy. From the analysis of participants on the basis of questionnaire, five factors has been figured out. The first factor is, participants knows about the context and is more concern about privacy as shown in Figure 1.

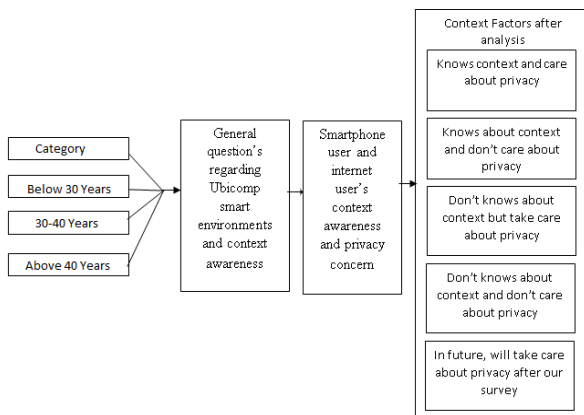


Figure1: General View of Survey Paper

This suggest participants have much knowledge about the context of online and smart environments and they are conscious about the privacy. The second factor as mention in Figure 1, are those participants who knows about the context but he/she is not conscious about the privacy. The third factor from Figure 1, are those participants who are not aware of context but he/she still is much possessive about the privacy. The fourth factor consist of those participants who do not have knowledge about context and as well as they do not care about privacy. The last factor include those participants who came to know the pros and cons about online and smart environment 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 their individual point of view.

3.1 Inter Group Differences

As in presented research paper, participants are categorize with respect to age group. The age of different participants

are then further classified 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.

Table 1: Inter Group Differences General

Category (Age vise)	Aware Ubicom p	Un-Aware Ubicom p	Awa re using SE	Awa re SE	Un-Awa re SE	Cont ext Awa re	Un-Awa re Cont ext
40 Years and Above	56%	44%	56%	22%	22%	94%	6%
30-40 Years	59%	49%	76%	8%	16%	24%	12%
Below 30 Years	24%	76%	70%	22%	8%	32%	68%

As shown in Table 1, 56% of the participant who had age above 40 years knows about Ubicomp and 44% of participants did not know about Ubicomp, 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. 22% are those who are using smart phones but do not know about smart environment. In total, 94% of participants have idea of context awareness term and only 6% of participants did not have idea of context awareness term.

Next category in Table 1 participants having age from 30-40 years are considered. It is found that 59% knows Ubicomp, means they are aware of ubiquitous computing, 49% do not know about the Ubicomp, 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. 24% of participants knows context awareness term and 12% are those participants who did not have idea of context awareness term

The last category of mentioned in Table 1 consist of participants having age below 30 years. In this category, 24% of participants knows about the Ubicomp, 76% do not know about the ubiquitous computing, 70% of participants knows that they are in smart environment and 22% of participants do not know about smart environment and are not part of smart environment, whereas 8% of participants do not know about smart environment but are using smart phones. With respect to context awareness total of 32% of participants knows about context awareness and 68% of participants do not know about context awareness.

Table 2: Inter Group Differences Context and Privacy Concerns

Categories (Age vise)	Aware context and TC	Aware context not TC	Not Aware context but TC	Not Aware Context and do TC	Not Aware context but TC in future
40 Years and	56%	16%	15%	14%	9%
30-40 Years	60%	23%	2%	15%	11%
Below 30 Years	45%	25%	18%	25%	12%

Now analyzing participants with respect to their context awareness regarding privacy in Ubicomp. As shown in table 2, 56% of the participants who have age above 40 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 in Table 2 consist of participants having age between 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 do not care of privacy, 2% are those who do not know about the context but are possessive about their privacy and do not share information online or on smartphones, and 11% are those who are not aware of 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 presented in Table 2 consist of participants having age below 30 years. In this category 45% of participants knows the context and take care of their privacy when they 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 privacy, 18% of participants are those who are not aware of context but take care of their privacy in terms of context, 25% are those who do not know about privacy and do not take care about privacy as well. The 12% participants are those who from now onwards will take care of privacy.

4. Analysis and Discussion

In the presented survey paper, it is observed that there are almost five type of participants, first participants are those 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 in situation and features.

As the situation changes day by day and new technology are being introduced in the market very rapidly, 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 context 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 explore much more the option as compared to the 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 of context in Ubicomp and smart environment. 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.

5. Conclusion and Future Work

An online and physically survey from different organization has been done. The survey questions were divided into three categories and in two sections. Categorize includes participants below 30 Years, between 30-40 Years and above 40 whereas section include general and context awareness with respect to privacy. 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 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 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 with the rapid growth of technology.

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 of the effects of user behavior that changes with the advancement in technology and user context awareness with respect to privacy will add to this knowledge and help to determine more specific participants who are concern about privacy and their awareness regarding context of privacy.

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