Implementing an Intelligent Cabin using Ubiquitous Computing

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ABSTRACT
This paper describes design directions for an intelligent cabin application. Office cabin appliances can be connected in a ubiquitous manner by communication networks. In addition to the operation sensing of these appliances, appliance management via sending control messages would be needed.

This paper reviews some factors of human intelligence to be considered for implementing the scenario. The generic architectures of three factors like are physical environment awareness; community awareness and interaction awareness are considered. The resulting architecture for Ubiquitous Computing is presented.

1. INTRODUCTION
Ubiquitous Computing integrates the computer intelligence to enhance people social experience in the capabilities of physical environment awareness, community awareness and interaction awareness. This paper aims to provide a multiple view of ubiquitous computing.

The sections are organized as follows. Section II presents notations related to Ubiquitous Computing. Section III presents the detailed description of our proposed system in augmenting multiple human intelligence.

2. UBIQUITOUS COMPUTING
Fig. 1 shows a logical view of Ubiquitous Computing. Five dimensional researches of social signal processing, multimodal Human Computer Interaction (HCI), social networking, social media, and pervasive computing converge at the point of Ubiquitous Computing. Its relevant notations are given as follows:

Pervasive computing changes the way people thinks about computers. Pervasive computing makes computers vanish into the background. Pervasive computing allows computers available throughout the physical environment but making them effectively invisible to the user. In the future, pervasive computing system must be everywhere, live in our real world, allow users to move around freely, and respond to changes in user requirements and operating conditions.

A common feature in pervasive computing is to compute physical context to enable the user to adapt to physical environment, e.g. location-based applications.

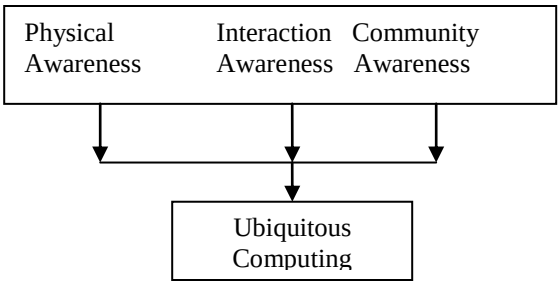

Fig. 1. A logical view of Ubiquitous Computing

Social media is considered as means of aggregating various media source via the Internet used to efficiently exchange and distribute information via social networks.

Social networking makes individuals into groups on the Internet. When it comes to online social networking, websites are commonly used. These websites are known as social sites. Social networking websites function like an online community of internet users, in which members can share common interests in hobbies or others. Social networking services allow users to manage, build and represent their social networking online.

We define Ubiquitous Computing as a collective computer mediated means for augmenting multiple human social intelligences by detecting human social context, recognizing human social intentions, and further presents human with desired computations during the course of his interaction with the cyber and physical environments. Those social intelligences have categorized into physical environment awareness, community awareness and interaction awareness. Ultimately social computing enriches and enhances human social experience.

Physical environment awareness detects contextual information on physical environment so that the interaction between the user and the computing system becomes pervasive and invisible. Community awareness detects searches and extends the user's social community based on his personal information. Community awareness extends users' social experience by presenting the user with all types of information interested by the user.

Interaction awareness detects the patterns used by the user to interact with cyber and physical environments, and adapts to an appropriate interaction way to communicate with the user.

3. UBIQUITOUS COMPUTING IN INTELLIGENT CABIN

The intelligent cabin scenario has examined in this section.

Siddharth is a manager of Intelligent Softwares Pvt. Ltd. Company has provided him a separate cabin with all the amenities like desktop, coffee machine and lockers, etc. His secretary Neha sits beside the cabin. Being a manager of a company, Siddharth needs to go out of station frequently for different business matters. In his absence, Neha looks after his office work. Siddharth maintains several confidential documents related to his work either in soft or hard form and in his absence only Neha should have access to these documents. Therefore, he prefers to use special security for his cabin from main door to drawers, lockers etc.

Siddharth decides to use Intelligent Cabin to solve all these problems. He configures all the electronic appliances at his office to the system. He configures door sensors, door locks and security cameras to the system. After Siddharth leaves for his business trip, he wants Neha to get the details from a document kept in his drawer. Neha comes to his cabin, at the doorstep the sensor detects Neha and sends an alert to Siddharth's mobile phone. He then remotely sees Neha and opens the door for her, puts the cabin lights on and unlocks the drawer using his mobile phone.

We will now see how an Intelligent Cabin employs different social computing capabilities to relieve Siddharth from the trouble of safeguarding his cabin.

3.1 Physical environment awareness

In physical environment awareness, identification of features of physical environment can be done by using different sensors. With the help of room sensors, it is possible to obtain the information like the temperature, humidity, noise level and this information can be used in an application which makes user adaptable to a physical environment physical environment awareness makes it possible to capture information related to the physical environment. Information related to the physical environment plays a very important role for easing human daily activities. Sensors used in the escalators can be another example, in which by sensing the coming person's footprints on the nearby surface, it starts moving if has stopped due to no people coming around.

A generic architecture for physical environment awareness has illustrated in Fig.2. The applications can be broken down into four layers sensing layer, analysis layer, computation layer and presentation layer. Coming to the scenario we have considered, when Neha comes at cabin door, analysis layer and computation layers determine that the person is Neha and she is standing at the doorstep. Similarly, when Neha closes the drawer, sensing layer senses it and next two layers determine that the drawer is closed. Finally, the resulting decision and data then presented to the presentation layer.

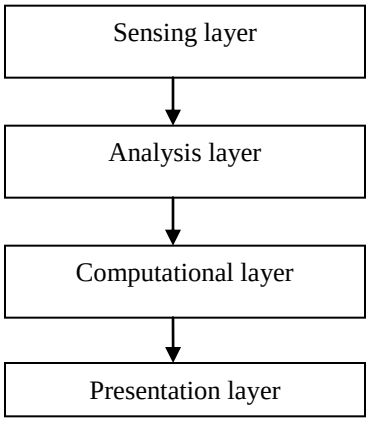

Fig.2. A generic architecture for physical environment awareness

3.2 Community awareness

A community is nothing but a group of people belonging to a particular physical area or a similar group. It is about understanding the common interests of a community and providing applications that support these common needs. In this, people generally know about each other, about social norms and their different roles within the community and about issues that affect the community. People in a community are neither organized as a group nor do they have any commonly identified goals. It is necessary to find a way to collect data from the community before making any decision about the community. Taking into consideration the scenario of proposed system, it employs community awareness to enable Siddharth to group other officers to share the configuration of office cabin devices and view of the office cabin plan. The alarm can also broadcasts presence of Neha in Siddharth's cabin to other officers.

A generic architecture for community awareness has illustrated in Fig.3

It consists of three layers. In the upper layer, community-aware systems use user profiles as inputs. Based on user profiles they analyze users into groups in the middle layer. For example, if a person's interests are close to interests presented by group A, then this person is classified into group A and his/her information is published in group A. The lower layer carries out linkage of communities with social media and other user groups.

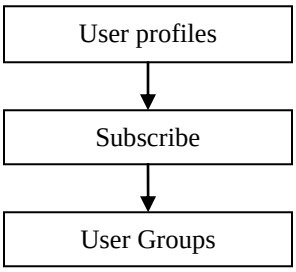

Fig.3. A generic architecture for community awareness

3.3 Interaction awareness

Interaction awareness makes interaction between human and computers more intelligent. Interaction-aware applications need information about the user's interaction interests and should present the user with a desired interaction mode. Interaction could be divided into few types as follows:

Visual based, touch based, gesture based and speech based interactions. Visual based interactions will respond to human appearance in front of it. Gesture based. interaction enables natural hand movements to trigger actions in a computer.

Touch based interactions enables the user to interact with the computer through touch screens or touch panels intuitively.

Speech based interactions carry out voice recognition to analyze speech-based instructions. Speech based interactions are considered to be more secure because this technique makes use of the creature character of human body to carry out identification. Since every body's creature character is unique, they are different from others and difficult to imitate.

Different types of sensors can be used to capture those above physical interactions so that the computer system can adapt to the desired interaction modes. A generic architecture for interaction awareness modeled into three layers in Fig.4.

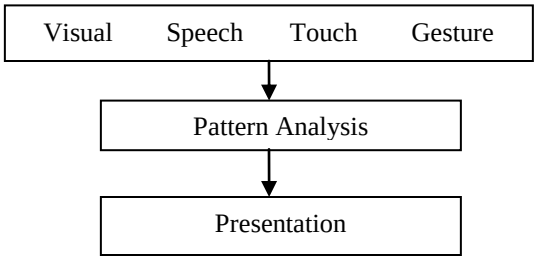

Fig.4. A generic architecture for interaction awareness

The upper layer consists of sensors to capture the interaction patterns. The middle layer carries out the interaction pattern analysis and determines appropriate presentations to the user. The lower layer is the application and presentation layer that provides the user with the customized interface to the context of the recognized interaction.

According to the scenario we have considered, Intelligent Cabin employs interaction awareness to enable Siddharth to configure the system in his office computer and in his mobile phone with the help of which, he could get the information that Neha has arrived near the cabin and then after she locks the drawer. System implied in the cabin interacts with his mobile and give the details of the things going on in the cabin.

Hence, we define Ubiquitous Computing as collective computer intelligence, targeting to augment multiple human social intelligences by detecting human social context, recognizing human social intentions, and further presents human with desired computations during the course of interacting with the cyber and physical environments.

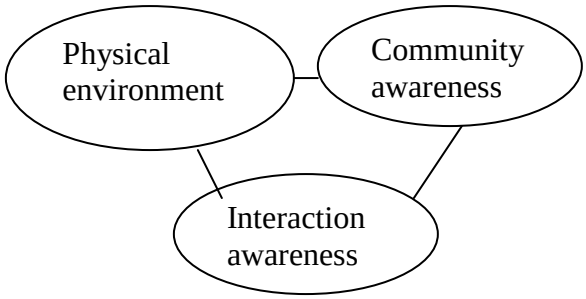

Fig.5. A conceptual Ubiquitous Computing architecture for augmenting three types of human intelligence

4. UBIQUITOUS COMPUTING IN INTELLIGENT CABIN

The following table summarizes the resulting examination.

Awareness	Use Cases	Explanation
Physical environment awareness	Mobile monitoring, cabin monitoring	System detects presence of Neha close to door
Community awareness	Group based cabin security	System broadcasts the alert to other officers
Interaction awareness	Cabin security	User uses mobile to interact

5. CONCLUSION

Ubiquitous Computing leads to augment three awareness of human intelligence such as physical environment awareness, interaction awareness and community awareness. To have an explicit understanding of Ubiquitous Computing in Intelligent Cabin, we first analyze the scenario and its bonds with other emerging computing technologies. Then we review its associated computing technologies, each of which addresses each awareness of human intelligence. Their generic architectures have formed as well. The case study has examined in order to investigate characteristics exhibited in Ubiquitous Computing.

6. REFERENCES

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