



Context-Aware Computing

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Abstract Context-aware systems are the systems that are aware of their situation/context and can autonomously adapt. Context-aware computing is a mobile computing paradigm. It is emerging as an effective paradigm for enabling the development of smart services. It refers to mobile systems that can sense their physical environment, and adapt their behavior accordingly. This paper provides a brief introduction to context-aware computing.

Keywords Context-aware computing, context sensitive computing, context-aware system, ubiquitous computing, mobile computing

Introduction

Today smart phones are seen everywhere. Their success is the reason for shifting towards developing context-aware mobile applications that proactively react to user's environment [1]. Smart phones can detect and react on contextual data due to their multiple sensors and processing capability. Such behaviour is known as context-aware.

Context-aware computing (also known as context sensitive computing) is having computing devices understand the real world and automatically provide appropriate services. To use "context" effectively, we must understand what it is and how it is used.

"Context" is any information that can be used to characterize the situation of an entity, which may be a person place, or object. It refers to a representation of the environment where the system operates. Some context such as time and location may act as sources of contextual information for deriving other contexts [2]. Context-aware is used more generally to include nearby people, devices, lighting, noise level, and network availability. Temperature, humidity, light sensors, and accelerometer can be used to capture some of the aspects of the contexts. Context may be changing rapidly such as in handheld and ubiquitous computing. Figure 1 shows a typical workflow of context-aware entities [3].

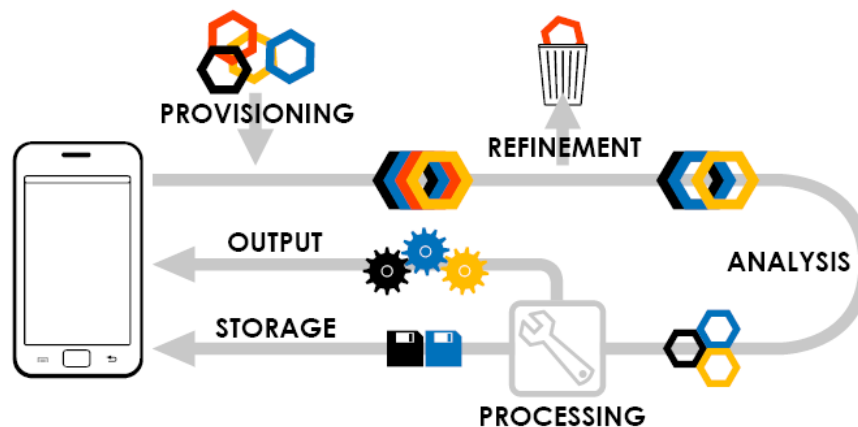


Figure 1: A typical workflow of context-aware entities [3].



The concept of context-aware computing (CAC) originated from ubiquitous computing, where the center of computing shifts from machine to human. The term was first introduced by Schilit and Theimer in 1994. It is a paradigm in which applications employ contextual information such as time, places, media, people, and activity, etc. as illustrated in Figure 2 [4]. The goal of CAC is to use context as an implicit cue to enrich the interaction from humans to computers, making it easier to interact with computers.

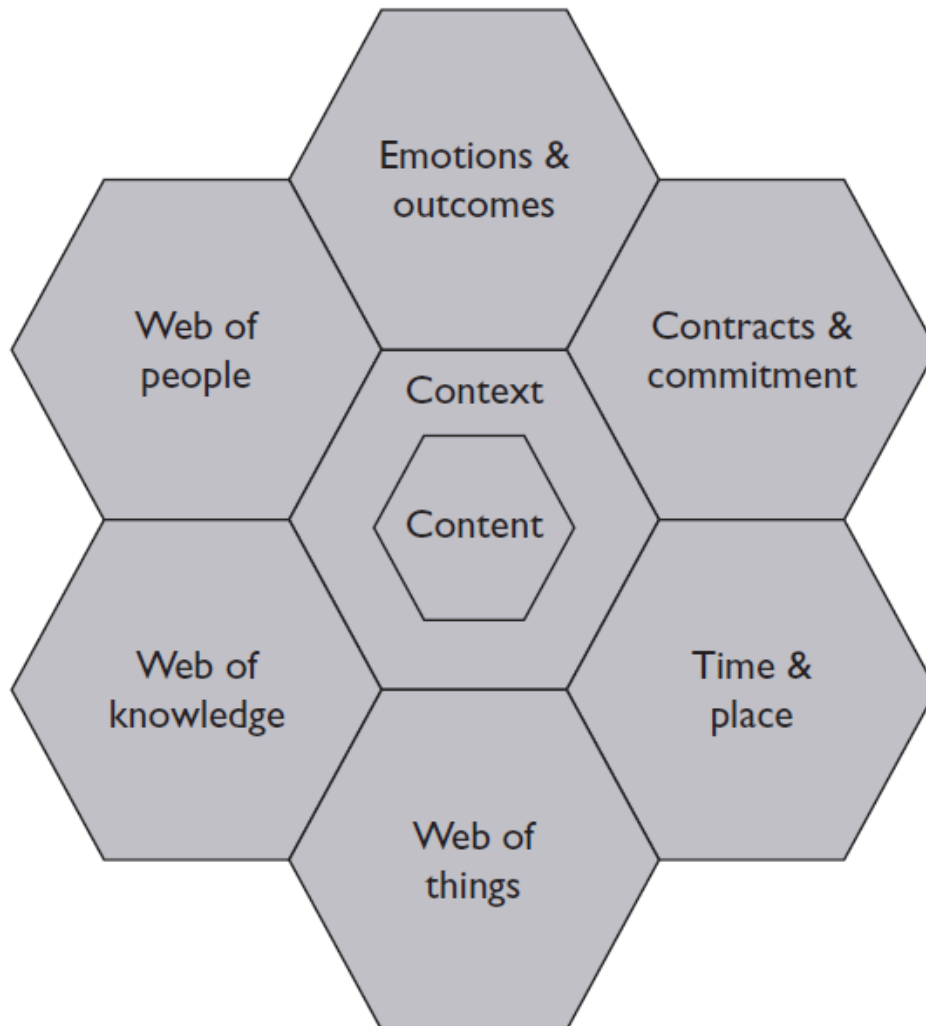


Figure 2: Context shapes human experience [4]

Basic Features

Context may refer to [5]: (1) Computing/communication context (network connectivity, resource accessibility), (2) User context (user profile, location, activity), (3) Physical context (temperature, noise level, traffic conditions), (4) Time context (hour, day, week, season, year).

Context awareness can be employed at two levels: low/hardware level and high/software level. At the hardware level, context-awareness is employed to facilitate tasks such as routing, modeling, and storage. The software level has access to a wide range of data, knowledge and sources. These enable complex reasoning to be performed [6].

Context-aware computing has the following characteristics [7]:

- *Sentience/Sensing*: This is the ability to perceive change in the user's environment
- *Autonomy*: This is the ability to respond without the user's intervention
- *Adaptation*: This is the ability to offer different behaviors to suit user's needs

Applications



Different kinds of services and applications of CAC can be seen everywhere such as information communication technology (ICT), health science, humanity, social science, etc. Context-aware applications can adapt their behaviour according to the context and act autonomously. They are widely used with mobile devices.

The first context-aware systems were active badges, which recognize the user's whereabouts. Next was making mobile phones to be context-aware by using MEMS sensors [8]. Efforts were made to integrate intelligence into everyday objects such as headphones, mobile assistants, coffee cups, and furniture.

In the Internet of things environment, things will sense more data and become context-aware. Context-aware information may offer substantial value to manufacturing. Context-awareness can be used in a manufacturing environment to increase the visibility and performance of operations [9].

Challenges

A context-aware computing system is generally distributed, large scale, and complex. Because of its complexity, it is difficult to develop such a system. Context-aware computing has not found commercial success yet. It has not been possible to apply context-awareness in practical systems. Managing context in IoT is fraught with challenges. CAC has proven to be successful in understanding sensor data.

Conclusion

Context awareness refers to the perception of the environment and the ability to act accordingly. Context-aware applications employ context information to guide their behaviour. Context-aware computing provides situation-specific services. It is an important component of a pervasive computing or ubiquitous computing environment. The context-aware nature is regarded as a key factor in realizing ubiquitous computing systems. Mobile CAC is an essential aspect of the smart cities infrastructure.

CAC is a disruptive technology that is capable of transforming and enriching human experience. It is poised to drastically change how we interact with our devices. Future devices will learn about you, the restaurants you have picked in the past, how you liked the food and then make suggestions for restaurants nearby based on experience.

References

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