

Context-Aware Systems: the Location Variable

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ABSTRACT

Knowing that a person is near a door is sufficient information to have the door open automatically; knowing that a person is in a room is sufficient information to turn on the lights. The knowledge that comes from knowing a person's location within the environment can be used as an input to a computational system. This presentation focuses on computational systems that make use of location awareness. This presentation considers several dimensions to analyze the use of the location variable within context-aware systems: *local* versus *global* reference, *environmental* versus *device-specific* responses, offering of either *information* or *commands*, and action taken by *human* versus *system*. The presentation concludes with the limitations of location-based information.

SUMMARY

Context is defined by a technical report (Dey et al., 1999). Context is the identity (who), location (where), time (when), and activity (what) a person or object is doing. The designer then makes a guess at understanding *why* the activity is happening and *how* the system should respond. Schilit et al. (1994) provides a definition of context that includes the physical, user, and computing environment of a system. We are interested in the user environment for the location and identity of people.

Location can be obtained with *local* or *global* reference. Local position can be obtained by a unique transponder with a short range signal (less than the distance of a room) or line-of-sight infrared detectors. Alternatively, a global reference can be obtained with GPS or sensors placed everywhere indoors (e.g., Active Badge, Want et al., 1992). The key papers provide examples of both approaches. Bederson (1995) proposes a personal audio device that describes an exhibit in a museum setting using short range signals. The system only knows if it is nearby a specific location without a relationship to any other location. Cyberguide (Abowd et al., 1997) presents a

handheld device that show a map and navigation assistance using a global reference.

The *human* or computational *system* can take initiative based on one's location. Cyberguide (Abowd et al., 1997) allows the user to choose what kind of information is most useful to her using the mobile device. On the other hand, the system can also take action without consulting the user. As an example, Active Badge (Want et al., 1992) assumes that the person wants his telephone calls forwarded.

Location-based offerings can be provided as *commands* (*actions*) or *information* as defined by Schilit et al. (1994). Commands are actions associated to a particular location that should be performed only there (and it does not make sense to perform it elsewhere). Information is geographically situated for a user's particular location (for example, nearest restaurant).

The context-aware system can respond in the *environment* (other people are affected) or to a *personal device* (only one person is affected). Both Bederson's audio guide and Cyberguide are personal devices. Responsive office environments (Hall et al., 1993) explore changing the environment's temperature and ventilation based on a user's presence. MusicFX (McCarthy et al., 1998) customizes the music played in a shared fitness centre based on who is present.

The problem of interpreting context (beyond looking at location) is highlighted by Bellotti and Edwards (2001). They say that "there are human aspects of context that cannot be sensed or ever inferred by technological means." As an example with a user's presence in a room, the user might want the lights off on a particular day because of dilated eyes. The system should not respond automatically but "defer to the user in an efficient and nonintrusive fashion."

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Issues

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