A Wearable Application Integration Framework

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SULAWESI: A WEARABLE INTERACTION FRAMEWORK

In order to investigate multi-modal interaction techniques a user interface framework has been constructed and deployed on the authors wearable computer. The prototype system, called Sulawesi [3], encompasses a wide range of interaction techniques and can be tailored for specific purpose. It also provides a multi-modal integration platform which separates the application from the input/output interaction mechanisms. The architecture of Sulawesi can be seen in Figure 1.

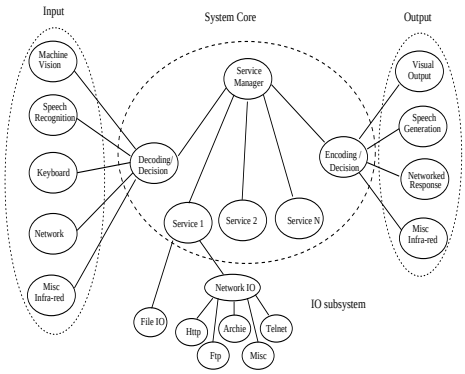

Figure 1: The Sulawesi Wearable Application Integration Framework *(WAIF)*

Functionality for dynamic loading, runtime configuration; and remote service retrieval gives the system the ability to incorporate an unknown application into the framework at any time. A set of communication primitives and application programming interfaces contribute to the diversity of services and interaction techniques that is achievable.

THE INFORMATION ABSTRACTION LAYER

The separation of the input modalities from the application provides some problems in resource discovery [4] and integration. If an input resource that an application was dependent on suddenly disappears, the application may behave unpredictably. In order to solve this problem an intermediate service gathers data from relevant input channels and provides a "mediated" [2] version of the data. Pascoe [1] describes a similar system in which abstracted global positioning system (GPS) sensor information is provided to an application.

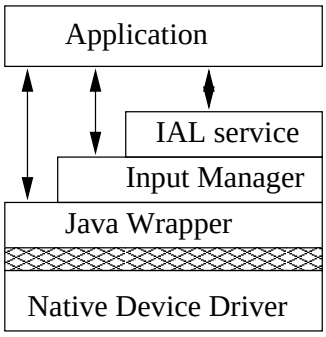

Figure 2: The Information Abstraction Layer

The difference here is that the mediating layer receives the raw data and translates them into an abstract form which an application *or the WAIF itself* can use to alter system behaviors and react to certain events. For example, if the user is walking, or traveling in a car (using a walking/movement sensor, video camera, GPS, etc.), a movement IAL could directly affect the WAIF by requesting that all visual output should be re-directed to a speech renderer until it detects that the user has stopped moving.

A WORKING EXAMPLE: THE SPATIAL REMINDER

The Chronological schedulers found in nearly all electronic diaries and PDAs provide reminders that are triggered by the date and time. This facility is useful in that the machine *volunteers* information when it detects a triggering event. In a similar way the *Spatial Reminder* provides location-specific reminders that are triggered by the location of the wearable computer.

The spatial information used in this prototype is provided by a global positioning system (GPS) and an infra-red (IR) receiver [6]. The use of GPS provides an international outdoor positioning system with an accuracy approaching a few meters, but once the receiver enters a building of any significant size the GPS signal is lost and the receiver can no longer provide the information needed to locate the user. To provide a seamless transition between indoor and outdoor location, the use of IR detectors enables the location to be pinpointed to a reasonably accurate position within a building.

The *Spatial Reminder* application makes use of a location IAL which transparently decides what signal (GPS or IR) should be translated. When a user is in a building the GPS signal is lost and the receiver stops producing coordinate data. If this happens and messages are received from the IR sensor, the location IAL will use the IR data to generate location messages that are broadcast to applications and to the WAIF. The same is true when the IR signal is lost and the GPS signal is received (when a user moves from inside to outside): the location IAL generates location messages based on the GPS signal. This enables location devices to appear and disappear without any disruption in the location messages as far as the application is concerned. The location IAL also allows the system to incorporate other forms of positional information such as pico-cellular devices [5], RF tags or even a visual identification marking system such as fiducials [7] easily.

References

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