

User Assist Applications with Location Sensors Integration

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ABSTRACT

In this video paper, we introduce two context-aware applications: a navigator, and a communicator which are implemented in our laboratory premises. The applications are developed on a software platform which supports the integration of several different kinds of sensors. Currently we use data from three location sensing methods and user activity data as sensor input. The navigator is used for guiding guests in our laboratory premises with varying accuracy according to the user's position. The communicator combines voice over IP (VoIP), instant messaging (IM) and email functionalities in a single application, and switches between methods of communication according to the user's preference and context.

1. INTRODUCTION

With significant advancements in VLSI design and mass production, many ubiquitous computing services, which were once but a dream, have become technically feasible. In light of this, context-awareness has become a fundamental concern.

In order to provide context-aware services, the system should be able to identify the contextual information, process it, and present it to context-aware applications. Recently, we have seen research projects [1,2] that focus on context-sensing with multi-sensor middleware based approaches. The middleware based approach is best suited for rapid developments and proliferation of context aware applications. Within contextual data, location data could be considered as the most important piece. On the other hand location itself could be used as an index for other contextual data management. We have developed a prototype contextual-data management platform, built specifically for this purpose. Recognizing the importance of providing an *extensible* world model, we proposed a novel architecture in [3] using context data mapping components. Having implemented a prototype of this platform in our laboratory, the applications developed on the platform are currently being used by researchers and visitors alike.

In this Video paper, we show two prototype context aware applications, a navigator and a communicator, developed on our platform. The navigator benefits from the multi sensors support and fusion algorithms provided by the platform. The Communicator demonstrates the communication system which

provides the best possible communication interface according to the user's context.

2. DESIGN & IMPLEMENTATION OF CONTEXT ESTIMATION SYSTEM

2.1 Location sensing systems and fusion

In our implementation, it is possible to support various contextual sensing technologies. In the prototype, we use RFID, Floor Sensors and WiFi AP information. For the RFID tag, we have selected active tags since they have larger coverage area; covering almost a 10m radius.

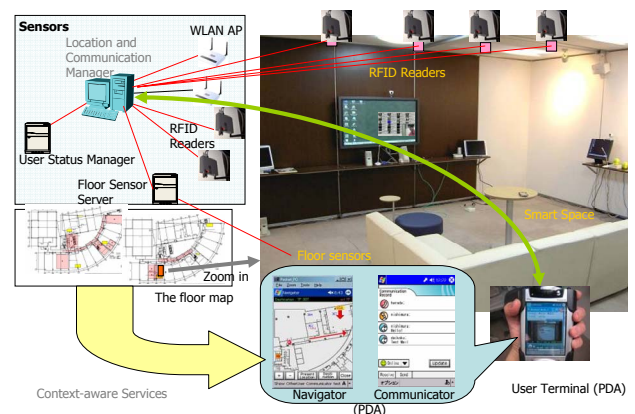


Figure 1: Location sensing in Smart Space

These location sensors have different capabilities. The RFID and the WiFi AP can offer user ID, but accuracy of location sensing is low. On the other hand, the floor sensor can offer much higher resolution location, but cannot detect the user ID. In order to obtain high resolution location of users, we have designed some fusion algorithms. As an example, we fuse Floor sensor data (high resolution anonymous location data) with RFID reader data (low resolution ID location data) to obtain high resolution ID location data. The settings could be illustrated as in figure 1. The Floor Sensors are pressure sensitive, and connected to a Floor Sensor Server through a serial communication interface. At the

Floor Sensor Server, received data is processed to recognize the position of each user. The ID is unknown but the point where each user is standing is evaluated and sent to the main location server. The main location server also receives ID values from each RFID reader. At the main location server these two data are fused to obtain high resolution ID location data.

We have installed WiFi AP's and many RFID readers in 2nd and 3rd floor of the YRP1st building. The floor sensors cover a small portion (the Smart Space) of the entire coverage area. In the smart space, high resolution location sensing is possible with sensor fusion. The sensor coverage varies according the place but the application developers do not have to worry about the underlying sensor technologies since the interface layer provides an easy to use method for application development. The application developers needed only be concerned with techniques for optimal utilization of information received from the middleware.

2.2 Estimation of the user's context

In our design, it is possible to merge the location information with different data from other sensors. The process is based on an extensible world model consisting of Mappers, which performs contextual data mapping between parameters, such as location and temperature. The extensibility is supported by easy installation and deletion of Mappers.

The parameters of the Mappers are updated dynamically with selection of proper Mappers for resolving a query performed by a Mapper Manager. Whenever a new Mapper is added or deleted from the Mapper Pool, the Mapper Manager updates its path list automatically.

As an example the prototype system recognize whether a user is in a meeting or not by accessing Mappers which contain the Location-ID Mapper and ID-Presence Mapper (Here the ID-Presence is updated by accessing the web based scheduler). The ability of easy deletion and installation of Mappers provide extensibility to the world model.

3. LOCATION & CONTEXT AWARE APPLICATION



Figure 2: Screenshots of the Navigator

Each user of the system wears an RFID embedded name card and is given a PDA for interaction with the system. Currently two context aware applications have been implemented on the PDA. One is a navigator, the screen shots of which are shown in Figure 2. One use of this application is to guide unaccompanied visitors to a specific area in the premises.

The second application we have developed is a communicator, which combines VoIP, IM and email functionalities in to a single application, and switches between methods of communication according to user preference and context. Screenshots of this are given in Figure 3. In this system, user status is automatically updated according to contextual information. As an example, consider a user attempting to start a VoIP session with his colleague who is attending a meeting; automatically the user is informed of his colleague's status and the use of IM instead of VoIP is proposed by the system.



Figure 3: Screenshots of the Communicator

The communicator's state is updated automatically based on the contextual data provided by the platform. If the user chooses to do it manually, he or she can over write the status of the communicator according to his or her preference.

4. CONCLUSION

We have introduced two applications developed on a novel contextual data management platform. Having developed two applications using the provided API, we have then shown that it is possible to use the platform with ease of both use and deployment. We are currently working on privacy support, as well as trying to resolve scalability issues associated with this architecture.

5. REFERENCES

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