

Designing Mobile Ad Hoc Collaborative Applications: Scenario experiences with Smart-Its

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Abstract

This paper describes the results from a scenario workshop within the Smart-Its projects funded by the European Union. The aim of the workshop was to identify feasible application areas for Smart-Its, small computational units that can be attached to everyday objects and through collaboration in ad hoc networks provide useful functionality. The paper describes the scenarios and the method used to create them, the results gained and the use of scenario methods for interaction designers within the field of ad hoc collaboration.

Background

The Smart-Its project (www.smart-its.org) is a part of the European Union's Disappearing Computer initiative and focuses upon exploring ad hoc ubiquitous computing environments. More specifically, the project is developing small context-sensing computational devices, Smart-Its, that will be attachable to everyday objects to create on-the-fly applications. By using the devices' different sensors and ability to communicate in ad hoc networks, the project is exploring how to support activities in complex contexts where sensor information may contain much noise.

This paper describes the results from the first scenario workshop within the Smart-Its projects. The aim of the workshop was to identify initial application areas for Smart-Its; to explore what activities the devices could support and what technical requirements (in a general sense) the devices would need to have. A more general description of the use of scenarios within the Smart-Its project can be found in "Scenarios: Methods and Results", project deliverable No. 4 of the Smart-Its project (Gellersen 2002).

Scenario Methods

One major challenge for the Smart-Its project is that it simultaneously is developing the physical devices and the applications they will support. Although the core of the project concept was formed around a fundamental level of functionality, the more specific requirements had by necessity been left unspecified to be determined by the actual Smart-Its' applications designed within the project. To find plausible application areas for this yet-to-be-created technology, we chose scenario generation as the preferred working method.

Scenarios have traditionally been used in strategic development contexts where it is crucial to shape a working strategy for an uncertain future (Schwartz 1991; Heijden 1996; Fahey and Randall 1998; Ringland 1998). Unlike other methods to explore the future which give single forecasts (e.g. the Delphi method), scenario planning generates several orthogonal futures with indicators for how these develop. Although early scenario techniques produced many scenarios based on permuting all driving forces, recently scenario methods (van der Heijden, 1996 and Schwartz, 1991, Wilkinson 1995) has favoured developing a limited amount of scenarios, typically 3 or 4 scenarios, by using a matrix containing four quadrants or

combining forces identified to be both important and *uncertain*. Briefly, the typical scenario method can be described as:

- Identify a focal issue and determination of valid time frame
- Identify key factors
- Search for the "unknown" driving forces behind the key factors
- Organise forces in scale of importance and uncertainty
- Pick important and uncertain forces and create a scenario matrix or a few scenarios by combining forces
- Evaluate the focal question in each scenario
- Identify indicators which tell in which direction the environment is heading

Scenarios have been credited (Heijden, 1996) with four primary advantages: *robust decision making, stretching mental models, enhancing corporate perception* and *energising the management*. Although scenario methods have mainly been developed for the corporate management context, we believed that scenarios would be advantageous for a distributed multi-disciplinary research project such as Smart-Its. This was primarily because many of the problems with finding areas of use for new technology is similar to that of finding new areas of use for existing products, and previous experience (Bergqvist et al, 1999) using the method to quickly create a “common mental platform” between project participants from different backgrounds. Looking at the list above, the main difference between the traditional managerial use of scenarios and that of a research project is that the last task of identified indicators is replaced with designing applications and specifying technical requirements.

Setting

The scenario workshop took place at the Viktoria Institute in Göteborg, Sweden, during June 12-13 2001, and included 8 people. Participants to all partners in the project attended as well as an outside expert that had previously worked with the organizers in generating scenarios. The method outlined above was used, with the actual scenarios being created by subgroups that focused on different driving forces.

The chosen focal issue for the workshop was “How can Smart-Its support activities taking place in restaurants?” with a time frame of a couple of years into the future. Restaurants were chosen as they present a complex context with several simultaneous activities and several different categories of stakeholders. Further, it was a context everyone could relate to and one that was not perceived as having been extensively explored within ubiquitous computing. Below, we briefly describe the three application scenarios constructed from forces deemed most influential to the development of restaurants in the future, together with how Smart-Its technology would facilitate the applications.

Scenarios

The Edgy restaurant

The Edgy restaurant targets an audience that wishes to spice their dining experience with suspense and surprises and the restaurant changes performance a couple of times per year to offer returning visitors new thrills.

The most successful performance to date has been the HAL experience. Visitors of this performance were invited to the opening of restaurant where everything is supervised by an Artificial Intelligence. The evening begins nicely with efficient and attentive service

accompanied by personal attention by the AI but visitors soon notice small problems. The problems escalate from minor ones (getting the wrong order or wrongly prepared food) that are corrected, to major ones (fights between the personnel and robots, problems with lighting and air condition) that are not resolved until the visitors discover how to blind the AI's sensors and thus help the staff overcome the AI. The dinner ends with the human staff serving dessert in a restaurant lit only by candlelight and occasional sparks from machines.

The whole experience at the Edge restaurant is orchestrated by a director that is in control of the various props as well as in contact with all the staff. The technology available to the director is of two categories: props for the performance and those required to orchestrate the experience. Of these, the latter is significantly more advanced and complex as it allows the director to supervise the state of all visitors (which can be over 100 on a crowded night) as well as the staff to keep check of their progress into the dinner and detect where different sketches can be staged. In order to collect and aggregate the needed information, e.g. in what stage of eating people are, how annoyed or bored they are, exactly where they are, Smart-Its are placed in the furniture, lights, and machines surrounding the visitors. Smart-Its are also used to help the director and staff to detect potential dangerous situations for the audience.

The use of Smart-Its is non-controversial in the Edgy restaurant. The audience is prepared to be disturbed and many of the Smart-Its can often function as props for the setting. This also allows for the collection of data that might be sensitive in other settings, e.g. cameras and microphones can be used as they are devices that one would expect to find in the setting.

Moody Blue

Moody Blue is the successful merger of high-tech sensing devices with the sense of elegance and style of high-class restaurants to give customers superb service without disturbing conversations and romantic dinners. To allow customers to feel secluded, all tables at the restaurant are placed in separate alcoves and the only other person visitors will notice during the dinner is the waiter.

All the sensing technology in the Moody Blue restaurant is completely hidden from customers, and few customers even realize that Smart-Its are used to improve the service in the restaurant. Customers' privacy is maintained as sensors only detect low-level context information such as the average level of sound and light at a table instead of using image and voice recognition techniques. This context information, together with motion sensors in the cutlery, chairs, glasses, menus, temperature sensors in the plates, pressure sensors in floor and table, allow waiters to follow the progress of dinners without directly observing the customers.

The use of Smart-Its in Moody Blue is totally invisible to visitors. They work in a paradoxical way – collecting important but not private information – to inform waiters when they can interrupt the guests, either because there is a lull in the conversation or because someone has spilt something.

The Feedback

The Feedback restaurant is a restaurant that serves the environmentally conscious by working in close co-operation with local farmers to offer a wide selection of dishes that consist of locally grown foodstuffs. When customers arrive to the restaurant they are given their own menu, an information appliance that is set to match the customers' food habits (regarding e.g.

allergies and diet requirements) and creates a custom-built list of available dishes. In addition to describing what dishes consist of, the menu offers information to interested parties about nutritional values as well as the source of the ingredients and how they were transported to restaurant. For products that have been transported longer distances (e.g. wines), additional information about the place of origin and its' refinement history are available. The menu also provides information about the current state of the kitchen, e.g. that a stew just has been prepared or that a blueberry pie will be ready in 30 minutes, and customers can take printouts of the information with them when they leave.

The restaurant has two principles for its operation: making the process of preparing food as ecological as possible and providing high quality food. In line with the first principle, the chef maintains continuous contact with local farmers and bakeries to buy fresh foodstuffs (which are used at once to avoid using energy-consuming techniques e.g. freezing). In order to guarantee high quality of the food, Smart-Its are attached to purchases to keep track of their storing environment and follow the process of preparing dishes (e.g. supporting the personnel to avoid over-cooking vegetables or using a knife to cut lettuce after having cut a chicken). The preparation information is also passed on to the customers to inform about the freshness of prepared or soon-to-be prepared dishes.

The use of Smart-Its at the feedback restaurant is usually not noticed by customers, the exception being customers that wish to talk to the people in the kitchen. The use of Smart-Its are passive as they do not initiate any actions but instead provide information to support the people working in the kitchen and the customers, e.g. storage time, storage temperature, cooking temperature, energy consumption, freshness.

Discussion

Although the above scenarios may seem farfetched from some perspectives, e.g. commercially, the process of creating them gave several results at several different levels. Besides the actual scenarios, which can be used as a concise way of describing the visions, goals and objectives of the project, the results of creating them can be summarized as:

- Quickly getting project partners to collaborate around the Smart-Its idea. By doing this from a future application/user-driven perspective, potential interests of conflict due to technological platforms, working methods etc., could be avoided.
- Finding a viable context for Smart-Its applications, restaurants, to be used in later workshops (see Gellersen 2002)
- Identifying several different type of sensing that is required by applications as well as what activities different forms of sensing can detect (either alone or by aggregating data from several sensors)
- Raising issue of privacy vs. quality of service in several defined contexts, and showing how different contexts have different trade-off points between the two

Looking at the scenarios, one can make a number of observations which reflect on the participants preconceptions:

- In most cases, the scenarios did not make use of Smart-Its ability to be attached on-the-fly to objects. This showed how easy it was for participants to fall back to thinking of the "traditional" view of ubiquitous computing as being built into various devices.
- Most functionality that Smart-Its provided in the scenarios can already be provided by existing technology. Although this shows that it is difficult to think of totally new use for

new technologies, have the scenarios opens up for the possibility to compare the benefits of different technologies and helps identify the areas where the use of Smart-Its would have the greatest impact.

Thus, the scenarios provide a way of letting project participants to identify their own preconceptions and move beyond them. An example of this was that the third scenario was identified as having the most innovative use of Smart-Its, and has been the focus of the application specification to result from later scenario workshops (see Gellersen 2002).

Concluding, the use of scenario generation was found to be a fruitful and effective method of working to find application areas and variations of the method have been used in later work in the project (see Gellersen 2002, the workshop “Designing Ubiquitous Computing Games” at UbiComp 2001, and the up-coming Research Atelier “Exploring Fun and Entertainment with Ubiquitous Computing” within the DC project). In each of the cases where scenarios have been used, the general method has been modified and future work will lie in analyzing the different benefits and disadvantages of each variation.

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