Chameleon Tables:
Using Context Information in Everyday Objects

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ABSTRACT

The Chameleon Table project created a set of hexagonal tables. They are modular and are able to snap together. The design portrays some goals that can be achieved by having a table that is aware of changes in its surroundings and includes this as part of its technology. By creating this infrastructure, we have been able to make several scenarios including musical instruments, sending messages between tables, and menus that change with apparent use in a food scenario. This paper also shows the use of a network for broadcasting context information

Keywords

Context aware design, ubiquitous computing, sensor design, information appliances.

INTRODUCTION

When we think about a table the first thing that comes to our mind is a flat surface and four legs, where we can work, and put stuff. Tables have been designed over the years for many purposes, some tables raise up and down to become drawing boards, others turn into chairs or ladders.

This project is an exploration of a set of laboratory infrastructure tables that allowed computation to be inserted into them for enhanced functionality. We developed tables that sense contextual information **[1]** about their environment and surroundings through sensors and networks, such as: where they are being used (In the world, city, location); how they are being used (Coffee table, game table, or art table); when they are being used (Time of day or time specific to the location, such as happy hour); who is using them (Number of people, gender, age, level of interest).

DESIGN

The design of a table that would change its height under manual or automatic control was deliberately made as a system that would allow a laboratory to be reconfigured. The tables were designed as hexagonal modules that can be interconnected with each other; Gorbet **[2]** shows some ways it can be achieved. The height of a bar counter and the height of a coffee table were considered. The tables can raise from 19 inches to 39 inches, [see Figure 1]. Tables are clear and have a black interior bottom, and are used to store design artifacts from our laboratory, while still being useful as working surfaces. They have been used as a corral to contain robotic toys and other moving objects so that those objects cannot fall off while moving around inside them.

Some tables have been outfitted with computers that allow for an interactive surface, enabling for interaction.

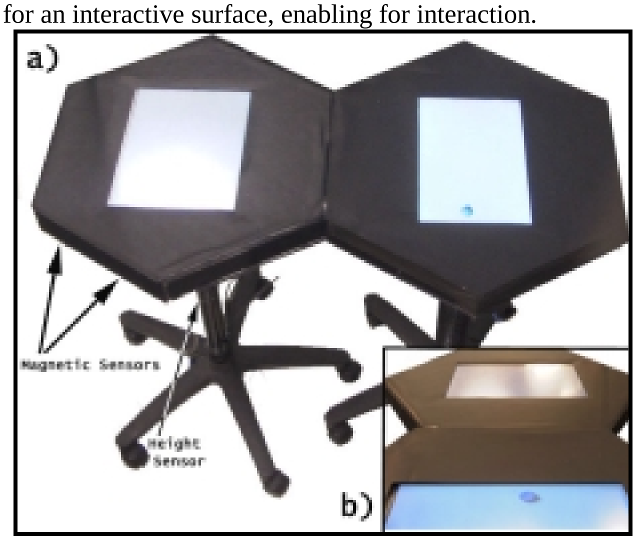

Figure 1. a) Tables snapped together (indicating where sensors are located). b) Virtual ball going moving from one table to another

Sensor

A special sensor has been designed to measure the height of the table. It consists of a capacitive pole sensor, comprised of a spring that holds the sensor against the leg of a hydraulic table. It also includes a metallized mylar sheet used as the capacitive sensor, which is pressed against the leg of the table. A micro-controller circuit measures capacitance across the surface of the mylar. By raising the pneumatic leg, the capacitance changes as the height of the table changes.

Information Network

A main server connected to our network of computers is constantly broadcasting information about the locality, such as time, settings, modes, uses, geographical position, etc.[see Figure 2]. This information allows our tables to detect environment changes through the network, and to find out information about the new place to which they were moved. If the network broadcasts "Location description: fast food restaurant, Current activities: lunch time, Users' type: kids, Users' age: 7-12, then the tables will select the appropriate mode presentation for such environment (video game, menu, etc.).

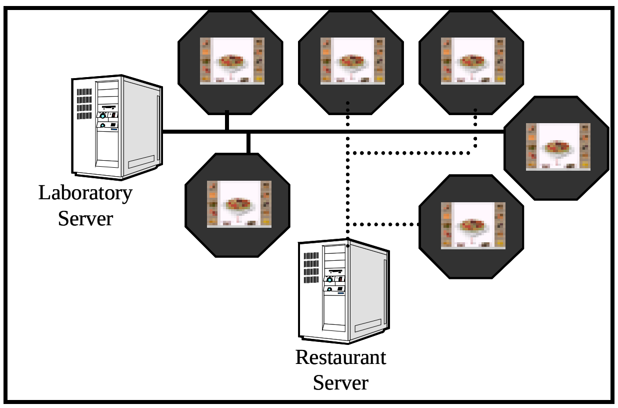

Figure 2. Each computer network broadcasts local information about its locality, such as time, type of place, activities, etc

Scenarios

The first scenario is the use of the table to demonstrate a physical-based food selection system. At a restaurant network and at a restaurant table height of 34 inches, a touch screen in the system allows a patron to create his or her own food by moving ingredient imagery to a plate that is shown on the middle of the display. This physically based menu system eliminates the need for the patron to understand the words that describe the food that they are selecting. It also allows them to create a picture preview of the food they will be eating, giving them more connection and experience with the food before they purchase it. For example, one can make a hamburger by putting the lettuce, cheese and a patty on the bun. In our tables, a custom fruit salad is created. When the table is raised to its top position of 39 inches, it displays wine selection. In a bar-room setting before dinner, we provide the ability to order drinks and other appropriate items. When the table is lowered to the bottom, it automatically changes to demonstrate the coffee table height scenario in which coffee and desserts are portrayed as selectable items accompanied by beautiful coffee table book images.

Our second scenario uses speakers inside of the table to turn the table into a musical instrument, such as a drum. The table dynamically selects or "tunes" your instrument based on its height. Vertically tuning music has shown to be a useful technique in the work done by Overholt in the emonator project **[4]**. At the lowest level the drum is a bongo. As one raises the table, it becomes a snare. And when one raises it up to the top, it becomes a kettledrum.

The third scenario demonstrates another utility of the tabletop. It uses magnetic sensors at the sides of the tables. The sensors are side specific, which allows them to tell which sides of a table are adjoining to them. Once a table detects there is another table next to it, they can collaborate and use their displays as a common display interface. In our scenario, a virtual ball on the table's surface travels from one table to the next using the link provided by the magnetic sensors. This shows the possibility of having a multi-table display surface.

FUTURE WORK

Our goal is to create and use new sensors embedded into our tables to promote interactions. If the table detects that there are no conversations between people around it, and notices everybody is engaged in something else, such as eating alone, then the table itself will become another member of the group and it will try to get people to interact with each other. First it might get someone's attention such as shown by McFaralene **[3]**. Inviting him or her to play ping-pong against the computer. Then, the table will try to get more people to play by "accidentally" sending the digital ball to another person around the table. And so on, until every body around the table has had a chance to participate. Therefore, the table can stimulate interactions that otherwise would not have happened.

CONCLUSION

This paper describes a set of uses for a computer in a table in which the display is touch-sensitive and the height of the table itself is part of the computer interface. The design portrays some goals that can be achieved by having a table that is aware of changes in its height and includes it as part of its technology. This paper also shows how the use of a network broadcasting context information about certain location, allows everyday objects to use that information to react to their environment and select the appropriate mode for such place.

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