HandSmart Mediaphone, Advanced Interface for Mobile Services

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Abstract

Evolutions in technology have provided a variety of new opportunities for exploring and discovering virtual 3D worlds. Head-mounted displays (HMD) and data gloves enable us to interact and immerse much better into the artificial generated 3D environment. Such devices have been advertised in the entertainment media and are recognized by the public as the symbols of virtual reality (VR). Augmented Reality (AR) that has the attribute of being more related to real world than VR by overlaying virtual sounds, feelings or visions onto our senses within the real world, can therefore extend our natural experiences. The authors believe that the new generation of mediaphones can embed these new techniques. HandSmart is one example of wearable device that can be used as a user interface for advanced mediaphones and it is based on MARISIL a Mobile Augmented Reality Interface Sign Interpretation Language. This paper will describe the interface and some of the applications of these new types of personal devices.

Keywords: Augmented reality, mediaphone, human-computer interaction, mobile services, user interfaces, ubiquity, sign language, access services.

Introduction

This paper addresses the concept of a smart device called HandSmart mediaphone. This type of devices has the characteristics of being deviceless and intelligent (uses intelligent agents). A definition of the term deviceless could be: "a deviceless interface is the interface between user and an information appliance that has no physical interference with the user." It doesn't mean that we are not using a device to make that interaction possible (see Figure 1) but instead the user is not using a pen, a touch screen, or mouse. The interface comes from the research in the area of Augmented Reality and has inherited many applications from it. The focus is placed on designing the sign language and applications that fits this type of interaction.

The deviceless interfaces, that are described within this paper, has the opportunity of reengineering the user interface in such a way to become more closed to the person that is using them. They have to be personal, customizable, open for various applications, portable and handy [8]. To accomplish these characteristics the HandSmart is assisted by intelligent agents [5]. Examples of them are presented in section 3.

The person that is using this type of device should be able to change or upgrade it like a pencil, without having to learn again how to write. This is achieved by separating the User Interface from the appliance. The authors call this "User Interface Appliance".

The HandSmart device has the interface described within Mobile Augmented Reality Interface Sign Interpretation Language (MARISIL). Some of its core functions are described briefly in section 1. MARISIL is supported by a combination of Augmented Reality techniques, which overlay the interface image on user's hands. Advanced Image Processing techniques and see-through glasses enable the integration of virtual into real. Also, having the network (mostly wireless since the emphasis is on mediaphones) and therefore the opportunity to interact with other devices (ubiquity) leads the authors to call this type of appliance "HandSmart". Hand because the use of hands to interact with the computer, Smart because they are using the interaction with the user to optimize their interface but also because they are able to interchange data with other devices (see Figure 1, Figure 2 and Figure 5).

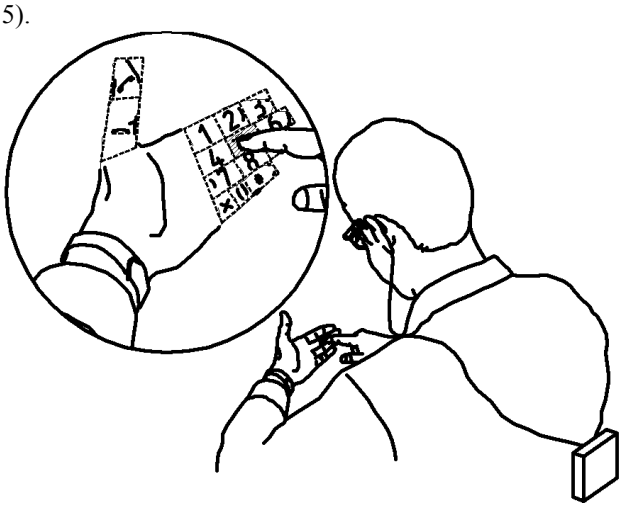

Figure 1 MARISIL – The user hand becomes the interface when Augmented Reality techniques and Image Processing are combined. (Device scheme)

Another concept presented is the "services usage". The type of services that are needed and how to adopt them within MARISIL design is the subject of present and

future research. Browsing and accessing the mobile services, and also the type of services that are available for this device are detailed in the sections 2 and 3.

The next generation of mobile terminals will have to take into consideration more carefully the user needs. Also, the devices have to be much smaller and smarter while the displays bigger and simple. The current status of the research has shown that more usability and portability can be achieved with current technology. Services will become useful at different level therefore an easy way to integrate them is to use a smart interface than will not make the difference between services and applications. Everything will be seen as service, even if some of them are running locally while the rest are remotely accessed (see Figure 4).

1. Marisil Core Functions

One topic of the paper is focusing on user interfaces. It has become a fact that the computers and the ways to use them are too complex. We spend far too much time learning how to use it, learning what are the shortcuts, maintaining it and upgrading it [2]. All this is taking time and money. A key to a more friendly mobile device is to address all the daily needs of the user, adopting their habits and virtually being available everywhere.

Today's mobile devices, like cellular phones or palm top computers, are very popular in some communities (business, engineers, etc.). Typically these devices are hand-held and have a keypad for user input and also a display to see the results of the inputs. But users do not always like to have them in their hands and they are not always easy to enter data.

The classic input devices are real. They have a form and a shape. In our approach the input device is Virtual. It is using the Augmented Reality techniques to overlay the computer generated interface and the video image processing techniques to grab/detect the hand signs interpreting them as instructions [1]. The users appreciate an interface that will not have to be taken from pocket and then, after use, to be placed back. Also this kind of interface can adapt to the user habits and needs. It can also be expanded or contracted based on the user level and desires. By using Augmented Reality techniques we can achieve a very flexible input device (see Figure 2).

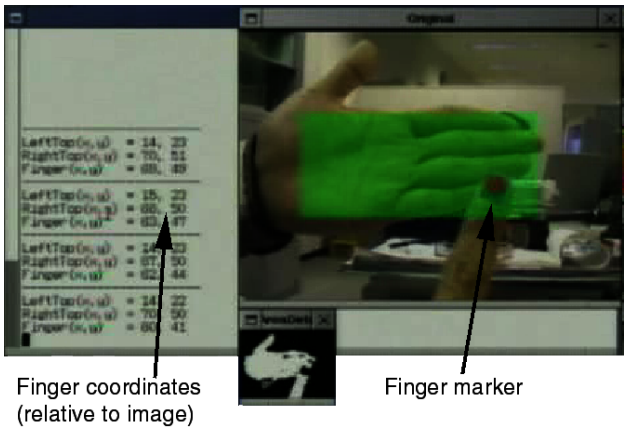

Figure 2 The fiducci/marker finger is recognized than relative coordinates in image are displayed (courtesy to NAIST – Nara Institute of Science and Technology, Hiroshi Sasaki et. al)

Combining the concepts presented before, we have invented a method (Patent Pending) for user to interact with the environment based on their hands and Augmented Reality. The user, having our proposed device, will be able to see their hand as a panel. This is done by using Augmented Reality techniques and overlaying the interface image on the user's hand. The detection of the other hand, which is called pointer, will also be taken care of by the device. The distance processing will be done by using techniques like stereo range sensing, or by using image recognition tracking devices like in Figure 2. The research is carried out and several methods have been deployed to achieve a good wearable interface by using these techniques [9].

Following this invention the user hands are used as a keyboard, panel, display, pointer. The user has a hand language that will be interpreted by the device. The language descriptions are described under MARISIL (Mobile Augmented Reality Interface Sign Interpretation Language) [1] and the device behind is named HandSmart. By using the hands the user does not have to carry a special plate or pen with him. Also the interface can be separated from the devices that are targeted. In this way, the HandSmart becomes a "User Interface Appliance".

The sign language within the interface will provide different browsing extension for the use in the interface. In order to speed up the input and to add ergonomics to the usage, a set of gestures are detected by the computer as shortcuts (predefined by user) and used to execute a special function. The language contains a core functions and an extension, depending on the users customized needs or preferences. Using this type of interface, a high level of personalization can be reached.

The core functions that are the basis for the user to interact with the interface are some simple gestures that are standard and they are seen to be natural. These gestures will describe the language to operate within the interface. In the next list you can see the list of the core functions that are supported by the device by default:

- ☑ Open/Close
- ☑ Up/Down
- ☑ Left/Right
- ☑ Next/Previous
- ☑ Cancel/Abort
- ☑ Select/Multiple select

The application of these core functions has been targeted to various fields. From normal terminals to complex application several scenarios have been drawn. In the section 3, some of the latest ideas of application are described.

2. Customization

The HandSmart interface has been considered as a personal interface. The language description, the interaction and the services are design to accomplish the goal of personalization. The user defines the shortcuts and the interface should adapt to its habits. Using the interface all the time within various applications the

device has more opportunities to adapt to user habits therefore reaching a higher level of personalization.

By separating the interface from the device, a higher level of adaptability for the user is achieved. To understand this concept better, a comparison with a pen usage will reveal the idea behind this separation. A normal person needs 2 to 4 years to learn how to write. Once this level achieved, that person will change many pens, pencils and other tools but won't spend 2 years in order to learn again how to write with that tool. Currently the interfaces are embedded in the OS by hardware and software. A small separation has been achieved when using Java or when working on the www. Still, a better separation can be done when using a hardware device like HandSmart with MARISIL to set the sign language.

Once that the interface is separated from the applications it can "understand" and learn more easily from the user. That property will increase the level of customization.

Another effect from the use of a personal interface is the ability of filtering the information based on the user profiles. Based on predefined or custom-made filters the information displayed using this type of devices can be a filter on the fly.

One example of application has been tested in the Cyphone Project [8]. The WAP compliant phones were used as an interface to access the information on locations and for navigation. Due to the reduced size of the screen a special method has been deployed for filtering the information and display. The use of a table with icons has been considered optimal for these kinds of filters (see Figure 3)

Figure 3 Table based screen-shot from a mobile phone browsing for some links (courtesy of Cyphone project)

So far the customization has been residing on the application level, but we can apply it also on the service levels. A service is defined as an application that is running on the 3rd party side. Because of that, services need to be customized to the user, in most of the cases.

The mobile services defined in this paper are services available to the end-user all the time when the access device is on. The characteristic of being available all the time can conflict with the user status. This can be solved when using a smart device to set the preferences and the behavior of the device.

There are multiple ways for users to access a service or to subscribe to one. They can access it from different networks, they can access it from home or they can access it from abroad. It is not uncommon for people to access various services while working or during leisure time (i.e. a business man will need to know the shares charts in order to be in touch with the markets or email...). How to integrate them is a question that many research labs are studying and will be a topic for further research. Still, what it can be seen is that services can be accessed and handled more easily if agreed that the user will have the same interface and that interface will know how to select and browse based on our user personal description.

The difference between applications and services is that the user owns the application, while 3rd parties provides a service. In the past years it has been identified that the services has shifted from service provider's side to user devices (i.e. becoming applications). In Figure 4 it is shown how future devices will embed more "local" services (applications) than today's portable devices. This is achieved due to the processing power of the devices and also the need of customization. The picture suggests how the power of the services is switched from the service providers or operators back to the devices. The services that are on the operator side are the network related services or database services. Also some high level processing applications can be run on the operator side. These two layers, the network and the processing power are seen to be the most used at the operator side. Meanwhile the devices are focusing on the user preferences and needs. The services become more personal.

One approach used is to let the power users customize their platforms. These can be seen on many portable devices that have included many ways to enclose custom applications.

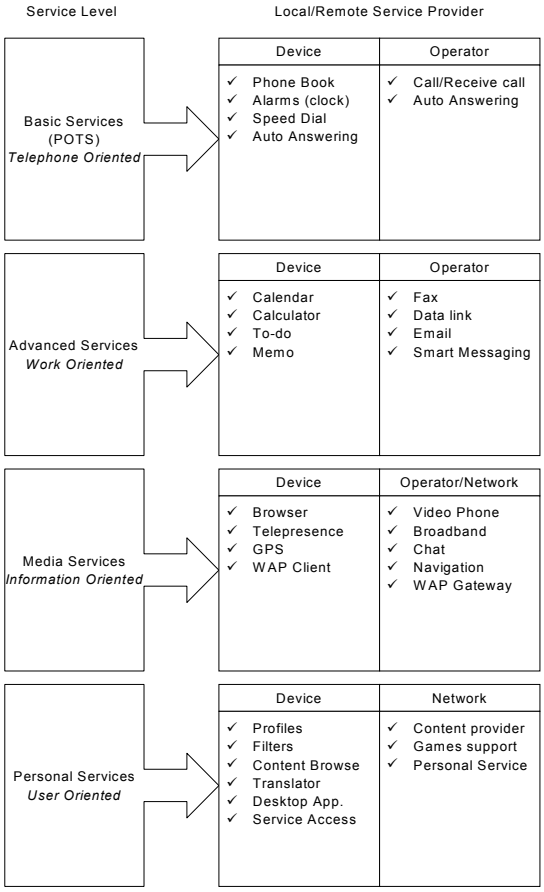

Figure 4 Services shift back to devices once that processing power available

Another approach is to use a more intelligent interface. The smart agents are doing the job. They are grabbing the user habits and they are negotiating the needs with other service provider agents. This approach will make the interfaces more open for common people than they are in our days.

Also, by using the concept of the HandSmart and the separation between the interface and the system, the devices will be able to apply the same pattern to other new applications. That will integrate the user preferences between different platforms.

3. Applications and examples

To prove that the ideas and the concepts presented before are valid several example and applications are to be described within this section.

3.1. User Profiles

One of the first application that was considered as a valid research was the use of the profiles and filters. The research has been carried out in two projects. The Paula project, where the emphasis was placed on the user requirements and user interface, and Cyphone project, where it was focused on the navigation and wearable computing.

The application was developed to run on a mediaphone with a small screen (see Figure 3) but the extension was easily seen to apply also to HandSmart interfaces (see Figure 5).

The experience gained from mediaphones demonstrates that icons can represent keywords on the screen better (for an average computer user). Unfortunately, the resolution implies a careful design of the icons [2]. There are also many others constrains in the case of mobile phones. Still, when looking to the deviceless interface based on MARISIL, the user hands can become a very powerful instrument to browse big amounts of data within a small part of users sights (see Figure 5). This can be used by mobile users but also by common users that want to browse fast big amounts of data.

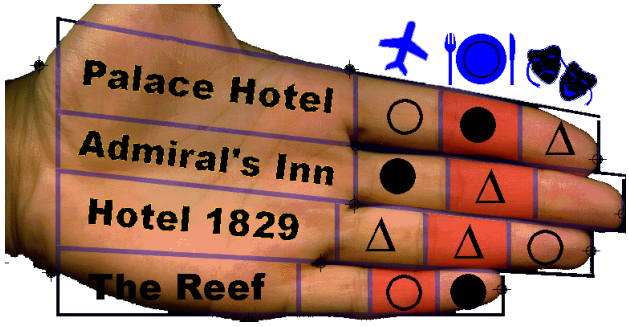

Figure 5 Advanced browsing of information using HandSmart

Once that the browsing enhancements have been achieved the next step was to look on how to apply this design to a more user centric approach. The research has showed that when using a predefined profile for the user it is very easy to enable a filtering mechanism. The methods to do that were based on the database functions and they were static. Still, the design of the application was targeted through intelligent agents usage.

3.2. Guardian Angel agent

Many people, in order to find information faster, are willing to register their personal profiles to a certain service provider to notify them when useful information is available.

Useful information for a mobile user is perceived as information that relates to the place where the person is. Under the ubiquitous computing environment, the useful information may exist in a system embedded to the place (the local terminal).

However to obtain whole data from the local terminal or to submit a query with the user personal profile require much mobile communication bandwidth. A software agent, which holds the personal profile and travels among local terminals along the user as “a guardian angel”, may help. When this guardian angel agent “parasites” a new local terminal in the vicinity of the user, it browses information on the terminal and reports information, which may be useful for the mobile device.

When requests to search information matches a certain query, the agent negotiates with the information provider’s agents in order to find the best point to access the information. When requests for use at a large amount of computation power, the agent will try again to negotiate a place where to hook a certain powerful server system on the Internet to fulfill the request using the computational resources of the server.

The conventional hand-over technique enables to hand-over personal profiles and guardian angel agents. Cache pre-fetching mechanism proposed by Sato et al [3] may be applicable too.

This guardian angel agent approach saves the mobile communication traffic as a mobile terminal exchanges only the reports and requests with local terminals.

Moreover, as the agent hooks on the local terminals and servers for computation, the mobile terminal can concentrates its computational resources for providing a smarter interface like HandSmart.

3.3. Virtual Office

Another application of the HandSmart that has been studied was the scenario of a mobile virtual office. This section discusses a possible scenario when the user is taking advantage of the mobility of such devices as HandSmart to enhance his work place with better flexibility.

Based on the requirement and studies of the current working time spent in a company, one service that was proposed to study was the idea of a virtual office. The user of this system was having access from his mobile mediaphone to virtual office services like:

- Setting up reviews of the documents (revisions)
- Running the reviews (presentation/lobby)
- Sharing the documents (virtual sharing space)
- Multi dimensional document database (mobile information)

Each of the services enumerated above are encountered in the daily life of an employee (with a certain level of responsibility) from managerial position to programmer or marketing.

Under this scenario, concepts like service integration are obvious. The user will like to have access to services [4] and these services are also supposed to communicate between themselves.

The scenario consists of a busy family person, that has to go and get the children from school, but just before leaving the office, an asynchronous event has occurred. His boss asked about a review of an important topic. He has no time to spend anymore in the office in rewriting parts of a previous document and also get the kids from school. So, he decides to use the Virtual Office HandSmart. He is going by car, and at the same time he is creating the voice presentation of a document that has been built based on the latest work that he was doing (the HandSmart device is personalized, so it can easily keep tracking of the user activities). He sends the document that is going to be presented to a meeting while he is just entering the school garden. Next morning he is reviewing the meeting and the participants' comments on his review.

The conclusion on this scenario was the necessity to use an interface that has the access to multiple types of data. The user input history and the document revisions have to be synchronized and using an intelligent interface like the concept of HandSmart to access the data more easily. The language provided within the interface (MARISIL specifications) can be used so that the work can be done also from a car.

These types of services are seen more and more as useful for the people to gain control of their work. The time slices of busy time can be distributed more uniformly when using this type of interface. Also, the way to tag the data is obvious and that will lead to a better versioning system. The versioning systems are used for a long time within developers' communities and it is very helpful when the organization has people working on the same document/data.

Conclusion

Applying new user interfaces design has opened new opportunities to integrate services and applications. Other than this, mobility has become more and more desirable for common people. Augmented Reality and mobility used together offers a new range of services that can enhance the personal experience and communication capabilities within its community. The authors believe that devices like HandSmart will become more and more present on everybody's pocket. Having a personal user interface that access all other devices in the same, personal manner, increases the way that people can communicate and share information with current devices. Also, once the separation is achieved, the user interfaces appliances will decrease the time to learn. This is very important when looking of expanding the information appliances usage.

The current work is focusing on the separation and on increasing the friendliness of the user interface appliance. Future work will have to deal with a usability tests and other application connectivity.

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