

A USER INTERFACE FOR HOME-NET

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Abstract

This paper describes a user interface for networks in the home. The main idea is to develop a user interface with high acceptance by the user and flexibility. This user interface is based on a network we call Home-Net but can obviously be employed with any other Home System like the European ESPRIT HOME SYSTEM [EHSA92], the American Consumer Electronics Bus (CEBus) [EIAU92] and the Japanese HOME BUS SYSTEM (HBS) [EIAJ86].

Introduction

Although there has been research going on in the field of Home Automation for several years, implementations of successful products are very rare considering the potential market. The author feels that one reason for this insufficiency is the little effort spent for the design of an integrated user-interface. Actually, the main concern of designers is how to incorporate the diversity of products from different companies into the home system. However, the key requirement for a successful product is to meet the expectations and desires of potential users. First of all, the user interface should be flexible, expandable, and user-friendly.

Many designers of Home Automation Systems seem to consider a PC the most convenient control device for their networks. This assumption is correct for long and complex dialogues with a system. Such dialogues are usual in an office and working environment. The main advantages of a PC

are its flexibility, the availability of existing software environments and advanced user interface software tools (e.g. Windows, Icons, a.o.).

In a household the perspective is completely different. Users of a Home Automation Systems want to receive the services of the system as fast and convenient as possible. The dialogue with the user interface should be as short as possible since it is, in most cases, only necessary for starting and configuring a device. The running time of the service itself is comparably long.

The worst disadvantage of a PC as central control device of the HA (Home Automation) system is that all control action is restricted to the location of keyboard and monitor. Since a PC is hardly transportable, interaction with the HA system is bound to a small space. This workspace is perfectly fine for an office but rather inadequate for a dynamic household.

Although there are more and more PCs in homes, they are mainly used for working and playing by a computer trained minority. Still the waste majority feels insecure and rather obstinate with respect to computers. It is likely that this attitude will only change little by little within the next years.

Of course, controlling an entire Home System from a PC can already be considered an improvement to operating every single device separately. However, for the sake of user friendliness and flexibility, we propose a different approach in this paper.

Home-Net

Home-Net is a medium range network (up to max. 500m) for the home. The main concern is that control information as well as user-bandwidth for up to video requirements can be provided by the network.

Here, Home-Net is to be considered a synonym for a reliable network for the home. Since most specified HA systems fulfill the necessary requirements, the described user interface is universally usable in other networks, too.

The HA network shall provide support for following services and applications¹:

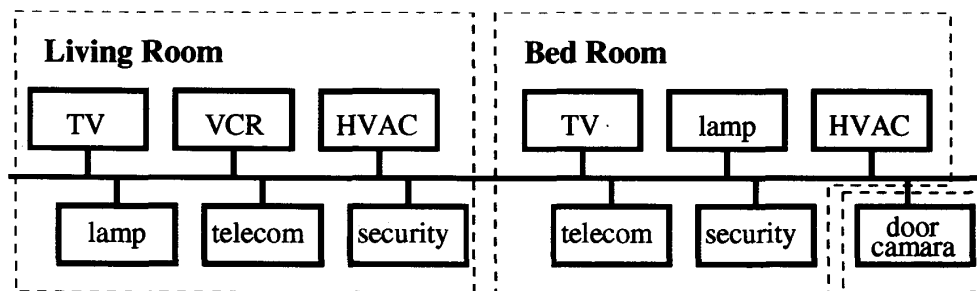
- Access control
- Data communication
- Domestic appliance system
- Environmental control
- Entertainment and education
- Home office
- Lighting control
- Load management
- Safety
- Security
- Voice communication

Remote Control

The most convenient solution, which commonly many user already accept for controlling single audio and video devices, is a Remote Control. It is usually wireless and not bound to a specific location in the room. Even most ignorant and unskilled people have learned to operate their entertainment equipment with remote control.

Nowadays, a common problem is that many devices have their own remote controls. With an increasing number of remote controlled devices the number of remote controls increases. On the other hand, some smart manufacturers try to make money out of this disaster: They produce flexible remote controls for multiple devices. Their main disadvantage is the rather complex method of operation that is due to the number of devices and therefore functions they should substitute. Moreover, the producers of these remote controls cannot know the exact number and kind of functions these devices provide. Thus, this problem usually result in a reduced subset of functions or a disturbing number of unused functions and buttons such a remote control provides.

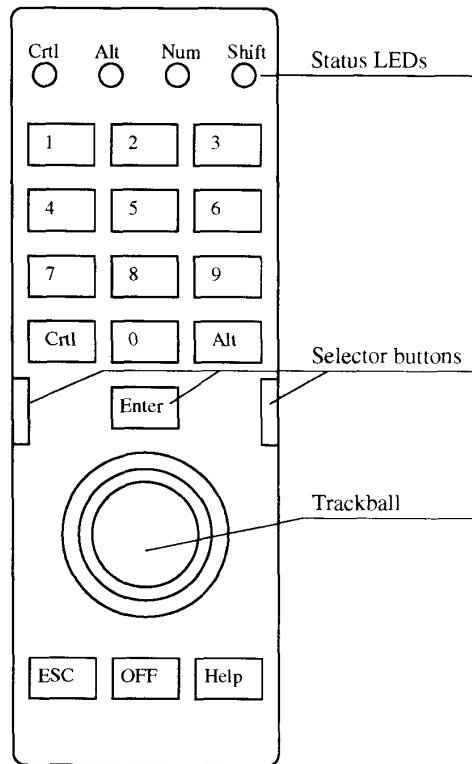
The solution for a practical user interface for Home-Net involves the combination of the advantages of a PC with these of a well-



Picture 1: Example configuration of a Home Automation system

accepted remote control.

¹ from: "Applications for Home Systems", J. L. Ryan



Picture 2: Example of a remote control for Home-Net

The User-interface

From the previously written we can conclude that the central problem is to provide the user a well-known and as easy as possible to use interface to control a rather complex environment of devices and the Home-Net system itself. Besides, its appearance and handling should better not look like a common PC, considering possible resentment against PCs, but provide its flexibility and software development background.

In view of the complexity of controlling that many devices and functions, we consider an interactive dialogue between user and the control device as the only practicable way. Realizing this fact, some manufacturers offer

(high-end) remote controls with LCD-displays.

The author suggests a different way. Why not use the television screen as other part of the interactive dialogue? With a special remote control the user can manipulate menus, windows and any information displayed on an ordinary television screen (Home-Net must obviously be able to control the TV set and display information on it). A similar procedure is sometimes used to tune the TV-Set and nowadays to program high-end VCRs. From a different point of view, the suggested user interface is an improvement to the already established Teletext for the use in Home Automation systems.

A problem concerning this solution may be the availability of TV-screens but nowadays TVs are increasingly used in almost any room and the overall number is still increasing.

For the Home-Net, there is a box called "Menu Generator Box" or "MGB" that executes the user interface software. With the help of the Home-Net the generated images can be distributed to and displayed at any connected television set. Manipulating information at this user interface is as easy as playing a game at a home computer but with the difference of using a "regular" remote control.

Besides, the user still has the possibility to use the remote control directly to operate devices without invoking a dialogue with a television screen.

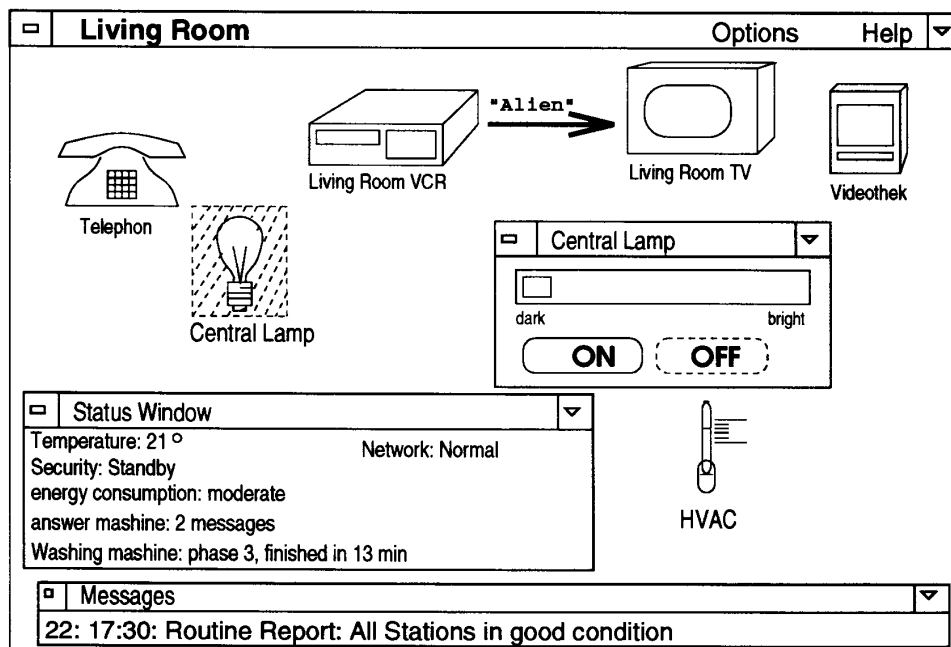
Although, obviously, the "Menu Generator Box" (MGB) has to contain a computer, the user is not directly confronted with this fact. As well that already most electric household devices incorporate a more or less intelligent computer does usually not bother the user.

The MGB as the central device responsible for the user interface provides lots of place for further improvements. First of all, most promising is the incorporation of a speech synthesizer. With a digitized voice the system can give information to the user over any loud speaker. Furthermore the system can answer to commands issued from the remote control or react to special situations like fire or intrusion.

Last but not least the MGB will be a good place for device initialization, software backups and restores, maintenance and system monitoring in a HA network.

system can associate the user and his command with a unique room and a set of devices most likely to be operated by the user.

If necessary, the system chooses a television screen to display information. This procedure is only necessary if the user asks for a complex service, support or dialogue with the system. With the help of Home-Net the TV is turned to the MGB-Channel. The MGB displays the most important features that can be activated in this room besides important status information. The author believes that icons and status windows are appropriate. By selecting an icon, the user



Picture 3: Example of the Dialog with Home-Net

The Dialogue

The interactive dialogue with the MGB starts by activating a remote control (i.e. by pressing the 'Help'- button). The initial state of the dialogue depends on which infrared receiving unit the command receives. So the

can even activate complex system or user defined services. Generally, the fastest way is to press a function key on the remote control to send commands to various devices. This even works for some frequently used and simple tasks without a MGB session. A different way is to move the cursor with an in the remote control build-in

trackball to the icon and press the selector button.

If the user wants to deal with safety or security related functions he has to enter a password or a special combination of function keys. In this way, the supervisor can employ arbitrary access restrictions. A supervisor defined hierarchy of personal identifications and passwords may be used for gaining control over, for example, maintenance functions or setting up timed events.

The described user interface solves the customary problem that each device has a different way to be handled and therefore to be learned separately. This user interface will greatly diminish these efforts since any device will be operated in the same way with this graphical, computer supported user interface.

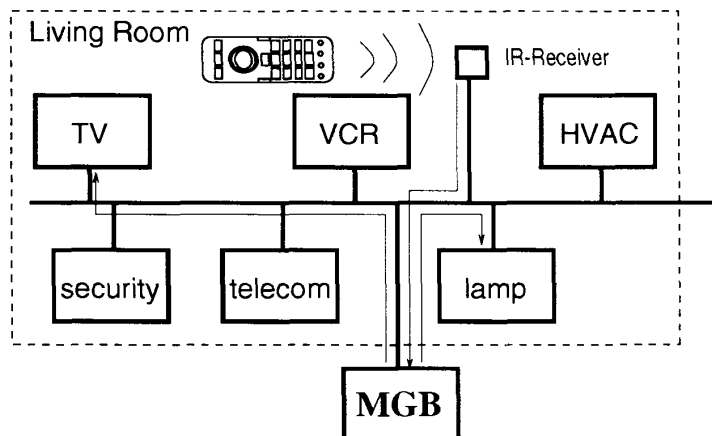
The author does not want to go too much into software details because still each company, developer and even user has its own view of the appearance of an optimal user interface on a display. The objective of this paper is to provide a base for further research.

Conclusion

The main value of combining the advantages of a common remote control and the possibilities of a PC system in a user interface for HA systems is that a user can simply operate all of the functionality of a home automation system. Since for complex functions a dialog with the user is necessary, the user has to watch a monitor or TV-screen.

The user is neither bound to specific locations in the home nor is the interface restricted in functionality and expansion. The inherent expandability and flexibility of this user interface conception at least provides space for incorporating the controls of newly created services for the next ten years.

Such a user interface fulfills almost every requirement a user can think of. Besides, it is extremely flexible and maintainable. Even it diminishes customary problems through the different way of how devices are operated. The users already know to control devices via a remote control. The software can easily be improved with ongoing research in the field of user interface software design. Furthermore, adding a speech synthesizer will open the gates for a great variety of helpful services. Even systems developer and maintenance people have got a helpful tool for developing, installation and testing of a HA system.



Picture 4: Operating a lamp from the remote control with the help of MGB.

Acknowledgment

The author wishes to thank professor G.H. Schildt from the Institute for Automation, professor D. Dietrich from the Institute for Computer Technique (ICT), Dipl.-Ing. J. Prinz and last but not least Clark Pope, Devon Brooks and Tom Hilquist students of the University of Illinois at Urbana-Champaign for their contribution to this work.

About the author



Gunter Leeb received a Masters degree in Computer Science from the Technical University of Vienna in October 1992.

He is currently pursuing his Ph.D. at the Institute for Automation in the group of professor G. H. Schildt. In the academic year 92/93 he did research at the University of Illinois at Urbana-Champaign. He is interested in Home Automation System design, user interface design, networks and real-time systems. He is a member of IEEE.

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