

# Smart Homes for Disabled People - The HS-ADEPT Project

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## Introduction

### Disability and Environmental Control

A fundamental objective of rehabilitation is to enable disabled or elderly people to live independently. To achieve this they may need to be given full control over their home environment and made to feel safe and secure in it. Integrated Home Systems or Smart Homes, offer an opportunity to realise this, giving control of standard consumer electronics to people unable to use readily the front panel or other controls supplied.

- ♦ The needs of disabled and elderly people in the home environment are essentially the same as the needs of everyone else.

We all seek in our homes: the control of heating and ventilation; the provision of security and safety alarms; the performance of domestic tasks and access to information and entertainment.

- ♦ The way these needs are met varies widely.

This may depend on the nature of the home, financial resources, and personal preference. Currently this choice is largely unavailable to many disabled and elderly people. They have to select from a limited range of adapted or specialised equipment.

It is anticipated that a wide variety of domestic equipment will become available over the next ten years supplied with Home Systems (HS) interfaces as standard.

- ♦ Disabled or elderly people can be provided with appropriate HS controllers.

Hence wider choice and flexibility in equipment for the home would be extended to them.

If true independence is to be achieved by the many disabled people who aspire to it, then they need to be offered the control of relatively complex consumer electronics. Little is achieved towards independence if a comprehensive alarm system is installed in the disabled person's home, for example, and they then need someone else to set it for them.

### **Overview of Current State of Environmental Control and Home Systems in Europe**

A range of equipment is available throughout Europe that gives control to disabled people, of mostly electrical appliances or consumer electronics with existing remote control facilities. This is a fragmented market with many different systems and suppliers including:

- ♦ Possum Controls
- ♦ James
- ♦ Protior
- ♦ Gewa
- ♦ Open Sesame
- ♦ Steeper

None of the systems currently available from these manufacturers provides a fully integrated home control. All the above listed systems implement direct control with either hard wire or infrared links from the controllers to the mains switches or other devices being controlled. These systems usually need to be installed by people specialising in the equipment although the increasing availability of "learning" infrared controllers has reduced the effort required for this.

### **HS-ADEPT**

The overall objective of the HS-ADEPT project is to develop the emerging Home Systems (HS) technology, making it accessible to disabled and elderly people. Appropriate end user interfaces will be developed and fully integrated Home Systems will be installed in the homes of disabled people. Through this access to Home Systems greater control and choice over domestic appliances and other equipment and services will be realised. This will lead to increased possibilities for independent living for disabled and elderly people.

A range of user interfaces, conforming to the European Home Systems Specification, is to be developed enabling disabled and elderly people to control readily the other equipment attached to the system bus. To date environmental control systems have catered principally for the needs of people with severe disability. They mostly implement control by single or dual rehabilitation switches, or basic voice control usually in combination with a scanning mechanism. While this can be an effective means of interaction for people with severe disabilities it can be very slow for people with a

mild to moderately reduced function. The HS-ADEPT project will develop 3 user interfaces which will cover a wide range of physical abilities but each enables access to the whole range of Home System control functions.

These interfaces or controllers will be enhanced by the facility to display menus and control options together with system information on an unmodified domestic television. Separate user interfaces will be developed giving full control of the system to people with either severe or moderate physical disabilities. A simple large button controller for use in conjunction with the TV display that can be readily operated by many elderly or disabled people who have a moderate level of manipulative control will also be produced.

A fully integrated security and safety alarm system, conforming to the HS specification, is to be produced that can be controlled by way of the Home Systems bus. Other components will be developed that meet specified user requirements and enable the full implementation of the systems. This includes general system elements such as routers between different bus media that are not expected to become otherwise available in the lifetime of the project and consumer goods as specified by the end users participating in the project.

### **User Led Philosophy**

The philosophy of the project is that it is led by end user requirements and not by technology. To this end the initial part of the project was to determine a user specification for an integrated home system. This gave particular consideration to the needs and wishes of the end users participating in the project but also considered the wider populations of disabled and elderly people. Papworth Trust, a leading provider of housing and occupational services to disabled people in the UK, co-ordinated the initial workpackage to determine the user needs for Home Systems. They have responsibility for over 300 housing units used by disabled and elderly people. Their work was supplemented by that of the APPC (the Portuguese Cerebral Palsy Association) with their clients. Both these organisations are members of the HS-ADEPT Consortium and will be providing sites for the pilot installations of the project in the actual homes of disabled people. Further co-operation with another related TIDE projects has been agreed in this area and a free exchange user needs information is planned.

### **Some Notes on User Needs Identified in the Project**

The results of this work in the HS-ADEPT project are currently being collated so a full presentation can not be given here but some pertinent comments from the findings so far are given.

The user needs survey of the HS-ADEPT project focused on the needs of those disabled people living in accommodation managed by and/or receiving day care services from the two end user organisations in the project, the Portuguese Cerebral Palsy Association (APPC) and the Papworth Trust in the UK. This was necessary so that the specific needs of those who would participate by having the developments of the project installed in their homes could be identified. It must be recognised that this is effectively a pre-selection and care should be exercised if attempting to extrapolate the findings to the wider population of disabled people. The survey sought information

on areas of daily living that the respondents considered could be made possible or much easier through the use of appropriate technology.

A carefully designed questionnaire was used in personal interviews with those participating. The survey at Papworth interviewed 56 people with a variety of disabilities aged between 20 and 80+, half of them being wheelchair users. 23 people lived in a residential care home, 23 in housing with a warden service and 10 in general housing. Through the APPC 19 people were interviewed with a translation of the same questionnaire used at Papworth. However the population profile was very different. Most of the respondents were young men aged between 20-24 and were all living with their relatives. The vast majority had cerebral palsy which had resulted in far greater problems with manipulation than those surveyed at Papworth.

### **Priority Areas to Address**

From the results of the surveys mentioned above priority areas that can be addressed by technology in the home have been identified. These are listed below with some brief notes.

- ♦ Operation of Doors (Both access to the home and interior doors)  
This was both the most wide spread area of need and one where the demand for easier use was very high particularly from those who use wheelchairs.
- ♦ Window, Curtain and Shutter Operation  
This was as an issue of difficulty of access as well as difficulty in operation.
- ♦ Access to Cupboards
- ♦ Control of Lighting  
This was principally a problem for those surveyed at APPC
- ♦ Control of Mains Power Sockets  
Many respondents were able to use TV or hi-fi remote control but had difficulty or found impossible the switching on/off of the power at the wall socket.

Among those surveyed the principal problems with domestic appliances such as cookers and washing machines and entertainment products TVs, hi-fis, videos were problems of access and manipulation rather than operation of the front panel controls. For example difficulty in loading and unloading the washing machine or inserting cassettes into the hi-fi. Areas of need highlighted by the surveys but not likely to be addressed by the project include: a door entry system that does not require the manipulation of a key; access and control of water taps and the safe use of a kettle.

### **Notes on use of HS Technology to Meet the Needs of Disabled People in the Home**

The key benefit sought for disabled and elderly people through the developing home systems technology is control over the routine activities of their daily lives and their home environment. The automation of the home is of a lesser importance to this user group. Being dependent on a computer

controlled house could be seen as a backward step from dependency on human carers. All of the areas highlighted as priorities above can be addressed by existing technology but the integration of different devices through Home Systems can lead to increased control and further opportunities than through direct control of each device. Further it is fundamental to the philosophy of the HS-ADEPT project to give access for disabled people to the HS Bus. This will enable the exploitation of the systems plug and play facilities so that any HS product that comes onto the market could be controlled without modification by many disabled users.

The facilities for automation inherent in the integration of devices through Home Systems can be employed to make control of the home environment more efficient. For example, the system may be configured so that if it is dark and the user selects to open the door to another room then the light in that room is automatically turned on. Such features reduce the number of control actions needed from the disabled user but still leaves them in full control. More complex exploitation of this automation and integration of home systems is also possible. An example of this could be that if the security and safety system detects a fire then the doors on exit routes are automatically opened and all windows are closed.

### **Work Plan**

A technical specification is currently being drawn up for systems architecture and specific devices in response to the assessment of user needs, described above. This is being undertaken with due regard to the requirements of the users in whose homes the systems will be installed; the wider disabled and elderly population; and the criteria of safety, reliability, and cost efficiency.

The work will then consist of the design, development and implementation of the hardware and software of the system. By working to the (European) Home Systems Specification and with the aid of conformance tools the compatibility of the system elements developed by different members of the consortium is ensured.

When developed, the systems will be installed in the homes of the participating disabled and elderly people. The technical developments of the HS-ADEPT Project will thus be subject to a full evaluation by potential end users in their day to day lives over a period of months.

### **Context of Work**

The proposed work is a vital part of the innovation contained in the development of Home Systems. The implementation of such systems in the actual homes of disabled and elderly people is necessary to forward the exploitation of this emerging technology to the benefit of these user groups. The project is a logical development of work already done in ESPRIT developing the Home Systems Specification, Components and Tools. The work of the project also takes forward that of the TIDE Pilot phase project ASHORD. This looked at exploiting Home Systems for blind and partially sighted people. HS-ADEPT is well placed to significantly forward this work mainly because of the general developments in the HS field. Development tools are now available and components are becoming increasingly so.

The adoption of a non-proprietary home systems standard inherently leads to an open market as different elements of the system may be obtained from different suppliers. This is an important objective of the TIDE programme and the project itself. Choice and flexibility are essential if the development of Home Systems products is to reach the potentially large market of disabled and elderly people. The results of this work, by fully considering the needs of disabled and elderly people, will thus lead to an increased market for Home Systems and compliant consumer electronics products.

### **Marketability**

The marketability of the developments of the HS-ADEPT project is linked to the penetration of Home Systems through the general domestic appliance and home electronic markets. If a reasonable penetration is achieved over the next few years then the flexibility offered by the products to be developed in the project will be very attractive. All the participants in the project are keen to see the developments go forward to market and the commercial partners are well placed for this.

## The HS-ADEPT Consortium

The HS-ADEPT consortium is a balance between industrial, research and end user organisations. Its members are listed here with some brief notes:

<b>University of Reading</b>	<b>UK</b>	<b>Co-ordinating Partner</b> The Department of Cybernetics providing research & development experience in distributive control systems and man machine interfaces as well as the overall project management.
<b>INESC</b>	<b>Portugal</b>	<b>Partner</b> Private research body providing world renowned expertise in testable electronic design and building on existing work in field of Rehabilitation Technology
<b>Possum Controls Ltd</b>	<b>UK</b>	<b>Partner</b> The UK's principal manufacturer and supplier of environmental control systems for disabled people. Over 30 years of experience in this work.
<b>I&amp;T Com</b>	<b>France</b>	<b>Partner</b> "Hi-tech" commercial research and development company that has been active in the development of elements of systems conforming to the HS Specification. A member of several ESPRIT Projects working in this field.
<b>A.J. Fonseca</b>	<b>Portugal</b>	<b>Partner</b> A company designing and manufacturing advanced car alarm systems seeking to move into the home security market using HS.
<b>Papworth Trust</b>	<b>UK</b>	<b>Partner</b> Leading provider of housing and occupation services to disabled people. With over 300 housing units for people with a wide range of disabilities they provide an excellent source of user needs information and evaluation for systems developed in the project.
<b>APPC</b> (Portuguese Cerebral Palsy Association)	<b>Portugal</b>	<b>Associate Partner</b> Further source of end user needs information and the provider of a test site with different challenges in the form of a residential and daytime rehabilitation centre.
<b>Kongsberg College of Engineering</b>	<b>Norway</b>	<b>Associate Partner</b> Experienced in top-down electronics design methodologies using hardware description languages leading to fast proto-typing. This will be necessary for the project to meet its extensive objectives within the planned time.

