

CONTROL OF DEVICES IN THE HOME BY DISABLED PERSONS: HUMAN FACTORS GUIDELINES AND PUBLIC ACCESS PROTOCOL

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ABSTRACT

Described are two approaches to allow people with disabilities the ability to control their environment and to allow them to live more independently. The first is a set of human factors guidelines. The second is the development of a two-way electronic communication protocol which will allow many devices to be controlled from one central user interface. This user interface may be one currently being used by the resident (e. g. a touch talker) or it may be one specially produced. The adapters which allow communication between device and interface will be distributed free of charge to device manufacturers who will include them in their products.

INTRODUCTION

This paper is an interim report on work being done by a group of volunteers who are studying the needs of individuals with disabilities. For the past two years the team has been interested in applying controls technology, human factors engineering, and artificial intelligence to the design of augmentative devices for persons with disabilities.

We are particularly interested in providing access to all devices and controls in the home. Our philosophy regarding the special needs of disabled persons is based on the following problem definition: First, all persons need convenient and economical access to all important controls and devices in their homes. Second, most manufacturers of appliances and other devices do not understand the special needs of disabled persons. Third, most highly specialized user interfaces have low volume and high cost. And fourth, most of these specialized user interface devices do not have the ability to communicate with and control common devices in the home.

In response to these problems we have taken on two projects to assist persons with disabilities in reaching the goal of control over their home and work environments.

HUMAN FACTORS GUIDELINES

Our first approach involves the specification of a set of human factors guidelines that provide design options for products that can be used by persons with disabilities. The guidelines are cross-referenced for specific types of disabilities. The broad categories are hearing impairment, visual impairment, motion impairment, mental impairment, and speech impairment. The guidelines employ, as design constraints, data regarding mobility, strength of extremities, and ability to see, hear, read, etc. These guidelines are based on data from literature reviews, demographic analyses, and interviews and performance data from subjects with disabilities. When completed, they will be distributed to manufacturers of appliances and other devices used in the home.

Although we believe that the guideline approach will be helpful, there is danger in specifying design recommendations, and then waiting for manufacturers to implement them. Design guidelines are, after all, only recommendations.

Moreover, human factors guidelines, no matter how informative and precise, are an adjunct to product development, and do not guarantee that useful products will follow. In the case of people with severe disabilities, they may never be helped by a human factors guideline document if the highly specialized interface they need is never built. Our second approach, the public access protocol, addresses this problem.

TWO-WAY COMMUNICATION PROTOCOL

Our second project involves the development and specification of a communication protocol which allows people to control almost any device in the home via their current user interface (i.e., a touch talker). With one interface a person can control their heating and cooling, arm and disarm their security system, turn on and

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off their lights, change the channel and adjust the volume on their television or similar devices. Further, since the protocol is two-way, the user receives feedback about whether the command s/he issued was actually carried out.

The protocol defines bandwidth, message types, user requirements, and a set of interactions. As long as devices "understand" this protocol and can interpret the commands received, they can be controlled via one interface. The required interpretation is achieved by a communication adapter. Adapters are placed on the controller as well as on the device which is being controlled. The adapter decodes the commands it is sent into instructions that the device can understand.

The protocol can be used with any communication medium, including RS232, infrared, radio frequency, and Power Line Carrier (PLC). Our goal is to provide the communication adapters and the protocol free to any manufacturer who will install it in their products. Also, these communication adapters will be marketed independently so that certain devices can be retrofitted.

PROJECT STATUS

So far the team has developed and demonstrated a two-way infrared hand-held controller that can be used for the control of lighting, security, and environmental functions. Further, we have demonstrated that this can be done very economically.

Additionally, based on the concept of the public access protocol, we have developed and demonstrated several user interface designs for people with visual impairments, mental impairments, paraplegia, and quadraplegia. These concepts are implemented on a Macintosh using Hypercard to simulate the use of various specialized user interfaces.

Finally, we have developed a test plan to validate the design concepts. According to this plan people with disabilities will use installed prototypes of our system in their homes for a period of time. These prototypes will possess some subset of the total functionality. This strategy will serve to determine the ease of operation of our proposed products and the degree to which this type of product is helpful. The testing period will be used as a research project to gather additional information re-

garding the special design needs of persons with disabilities.

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