Portuguese Participation in the RACE TeleCommunity Project

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Resumo - **O projecto TeleCommunity, no contexto do programa RACE, é um conjunto de experiências de comunicação avançada que tem por objectivo o estudo da implementação de novos serviços de comunicação para pessoas deficientes. O artigo apresenta os serviços de apoio social e o equipamento terminal desenvolvido para a experiência portuguesa no âmbito do TeleCommunity.**

Os serviços (Aprendizagem e Treino, Supervisão e Acompanhamento de Casos, Colaboração na Tomada de Decisões e Comunicação Interpessoal) foram projectados com a finalidade de explorar o potencial da RDIS para melhorar o apoio social a deficientes, nomeadamente idosos, deficientes visuais e deficientes mentais.

Os equipamentos terminais são terminais multimedia modulares, baseados em computadores pessoais com codecs, os quais apresentam a capacidade de providenciar, em simultâneo, videofonia ponto-a-ponto e ligações de dados. Diversos terminais foram distribuídos por diferentes Instituições portuguesas.

Abstract - **The TeleCommunity project in the context of RACE program is a set of Advanced Communications Experiments that aim to study the implementation of advanced communications services for disabled people. The paper presents the support services and the terminal equipment developed for the Portuguese experiment within the TeleCommunity Project.**

The services (Learning and Training, Remote Delivery of Expertise, Collaborative Decision Making and Interpersonal Communication) have been designed to exploit the potential of ISDN to support and improve the professional care of disabled people, namely elderly, visual and mental impaired.

The terminal equipment are modular multimedia terminals, based in personal computers with video codecs, that present an integrated capability to set-up, simultaneously, point-to-point videophony and data connections. Various terminals have been distributed among several Institutions, which are major Portuguese social care Institutions.

I. INTRODUCTION

The technological evolution of multimedia systems will help to shape the human environment in the near future. A multimedia system is characterised by putting together images, video, audio, text and numeric processing in a desktop computer. The ideal multimedia system should be capable of handling both motion video and synchronised audio. For the full-motion video presentation, systems should be able to process and display several frames per second, together with the sound. Those systems should also record (live video from a camera and sound from a microphone, for instance), compress the data and store it on disk. Finally, they may be capable of transmitting data, real-time video and audio across a digital communication network. This digital communication network could be the Integrated Services Digital Network (ISDN).

ISDN is a full digital communication network designed to provide access to all telecommunication services, using a set of standardised access interfaces, and whose cable infra-structure is compatible with present telephone subscriber lines.

Those technologies present big potential of changing the environment and can contribute in a very positive way for a more independent life and a better social integration of disabled people.

The intervention for disabled people should comprise aspects such as restoring the loss of functions, compensating for the disability by enhancing other skills, compensating for disability through the use of technical and not-technical aids and changing the environment to adapt it to the skills of the person. The transmission of life and still pictures, sound and computer graphics have a great potential in developing systems that enable better co-ordination between the needs of the population and the intervention that is provided to them. The TeleCommunity project in the context of RACE II (Research and technology development in Advanced Communications technologies in Europe) is a set of Advanced Communications Experiments (ACEs) [1] which aim to carry out pre-competitive and pre-standardisation work in advanced communications and is concerned with how the transition to Integrated Broadband Communication (IBC) affects the implementation of advanced services for disabled people.

These experiments comprise field trials conducted in real-life scenarios and operate in Portugal, Germany,

Finland, United Kingdom, Ireland, Sweden, Norway, Belgium and the Netherlands.

The Portuguese ACE exploits the potential of ISDN in the support of the care of disabled people, namely visual, mental impaired and elderly. It provides different services that allow the target users the access to specialise support.

The terminal equipment for those services are modular multimedia terminals, based in personal computers with video codecs. Each terminal offers an integrated capability to set-up, simultaneously, point-to-point videophony and data connections, typically between a service provider and a client, providing the means to transfer and process image, voice and data, which is adequate to interactive remote care services.

II. END USERS

In certain countries there is a trend to integrate mental impaired people into the work place and home environment. This puts pressure on the rehabilitation programmes and there is a strong need for systems to support this process as most of these people require individual training. The relatively cheap personal computers with good graphics, high resolution, colour and sound facilities together with usable and cheaper software and telecommunication facilities are able to offer remote learning and training aids such as identification, repetition, monitoring of their learning progress and better visual and hearing possibilities, which can be used for memory reinforcement, task learning and sequencing, identification of new concepts and application to problem solving.

The visual impaired people can have, through telecommunication, access to specialised remote care. The remote care can be the support in social interaction skills and community living, occupational therapy and training, support and advice concerning domestic management and everyday tasks, assistance in maintaining education, improved access to other services and their acquisition and management.

The world geriatric population is increasing, mainly in industry countries. The increase of life expectancy and the reduction of birth rate caused modifications in population distribution according to age. Dealing with all the varied and additive problems acquired with age, means that elderly people require increasing assistance with everyday matters. A general trend amongst support organisations is to assist in the continuance of independent living since it is a common aim of the elderly: it is more resource intensive to move people into residential care, and institutionalisation often accelerates the process and consequence of ageing. New technologies can be used to improve the provision of the professional care to the elderly people in their resident context.

III. SERVICE SPECIFICATION

According to the literature and characteristics of the target groups, the following services had been considered relevant for the Portuguese ACE [2]:

- Remote Delivery of Expertise;
- Learning and Training;
- Interpersonal Communication;
- Collaborative Decision Making.

The Remote Delivery of Expertise aims to provide cooperation between experts (Team Work and Collaboration) in what concerns for instance the discussion of the better teaching methods for children with special needs in order to improve the assessment process, for a small group with a particular disability. Another objective of this service is to guide the teacher or the family (Supervision and Follow Up) to deal with difficulties concerning the intervention with the individual, contributing, thus, for the correct prosecution of the educational program.

The Learning and Training services can include sessions on a one-to-one basis, either providing direct information or transmitting stored information. Those options depend upon the nature of the training, the level of privacy and the homogeneity of the users regarding their needs. Different programs can be provided.

Mental impaired people usually have poor speech associated to language disorders. A large number of them depend on communication aids with non-orthographic written systems. The use of graphics in telecommunications (Interpersonnal Communication) may improve the social integration allowing them to communicate at distance to other persons, developing their communication abilities.

The Collaborative Decision Making service includes Counselling service, aiming advising family or careers, and Information service aiming helping the users to overcome problems. The time of this scheduled service is settled beforehand, concerning the period during which general guidance is available upon request.

IV. SYSTEM OVERVIEW

In order to accomplish the aforementioned services, modular terminals, based in personal computers with video codecs, have been developed. Different workplaces can be linked by point-to-point ISDN connections.

When two workplaces are connected, the all system works under a master slave relation: the control facilities (connection management, image and communication commands) are provided by the service centre terminal (service provider). A particular service centre terminal supervises the service centre and also provides the functions needed by the servicers to operate the local system and control the remote operation of the client equipment. The client terminal runs the local activities in the client Institution, or, eventually, in the client home.

Both the service centre terminal and the user terminal include telecommunication and control facilities, and easy-to-use multimedia user interfaces with text, graphics and images, and are constructed of a number of different modules, which are environment dependent, and may be mandatory or optional. The modular design is necessary either to adapt the terminals to specific users and to enable the re-use of the modules in different services and by various groups. Optional modules may be added inside the terminals (e.g., software packages and expansion cards) or may be connected to their output ports.

A. System Hardware

The basic configuration of each terminal includes [3] (fig. 1) a personal computer, a codec (a Tandberg Vision Model 15), an ISDN network controller (PCbit), a touch screen, a frame grabber (Video Blaster), a video camera, a document camera, a video switch, a hand-free telephone unit, and a lightning unit. Optionally, additional video cameras and/or document cameras may be included.

Each terminal is able to use two basic ISDN accesses. One of the basic accesses is reserved for the continuous real-time image transmission (codec operation), and the other one is used either for computer to computer (one B channel) and voice communication (the remainder B channel). This configuration is the most efficient, since three B channels are reserved for videophony and one for data communication, but it is also an expensive solution because it requires two basic accesses.

B. System Software

The system software manages the various local applications and, through telecommunication facilities, dialogues with remote terminals. The system software also manages, through interfaces, the hardware and software input and output devices, in order to provide the ability of special configuration mechanisms to recognise relevant user needs (e.g., sound and brightness control).

For the user interface, both the service centre and client terminal user interface, a consistent metaphor for user interaction has been established: the Virtual Resources

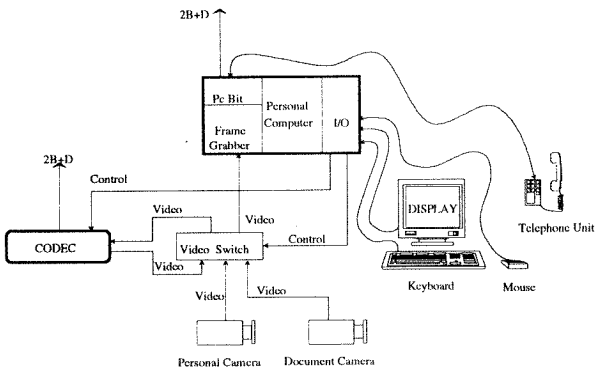

Fig. 1 - System hardware

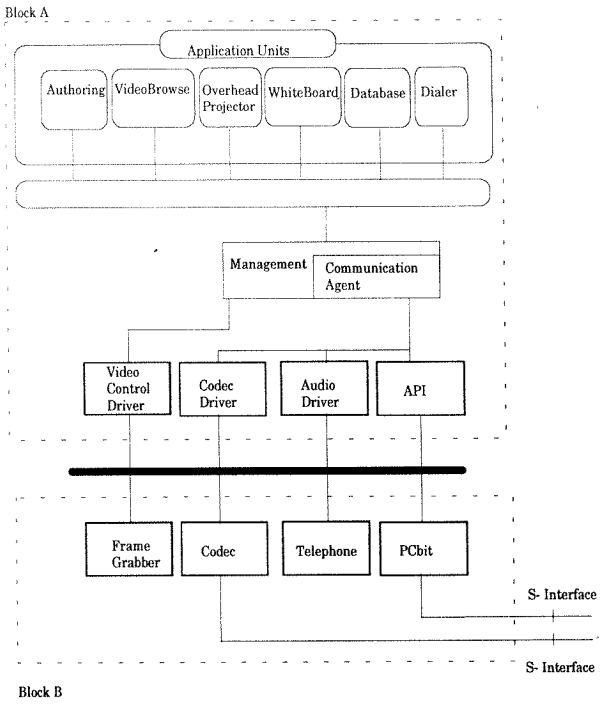

Fig. 2 - Software Architecture

Centre. This metaphor is based on the notion of a three dimensional room with different pieces of furniture and equipment, each one representing a different application (tool) with functions to establish connections over ISDN and with facilities for preparing, presenting, accessing and discussing information.

Shown in figure 2 is the Software Architecture, which has been designed with the objective of keeping the management functions isolated from the applications, the network and the hardware support.

The modules within the block A are the software units located on the personal computer, while the modules within the block B reside in the respective add-on boards or are stand-alone modules (video codec and hand-free telephone unit). The upper part of figure contains the environment dependent modules (Applications Units) with adequate user interfaces. The Application Units operate to control the different media in order to provide the different services types, upon the user requests.

The module Management provides control functions, and comprises the Communication Agent. The remainder units of the block A are software drivers for the dialogue with the special purpose hardware.

C. Communication Agent

The user can issue an invocation primitive to any of the available Application Units that will establish a permanent dialogue with the Management. A connection request primitive implies the participation of the Communication Agent that will issue an invocation request to remote site to ask its counterpart to invoke relevant process.

The Communication Agent controls the set-up, the dynamic reconfiguration and the progress of the communication, with inputs from the Application Units.

On the other hand, the Communication Agent, as a daemon running on each station, is also able to accept requests for communication establishment.

A flexible and robust module is necessary to make the application easy to use and much more acceptable. Furthermore, the Communication Agent must provide an environment that can support different types of participants. Hence, it supports asymmetrical communications in which the participation of users differs with respect to different media types, and control resources that are either local or remote.

Due the above mentioned reasons, communication management functions can be divided into two categories: establishment, and control of the communication. For the communication establishment, we have developed a procedure that consists of three phases: invitation, negotiation and set-up. In the invitation phase, the initiator of the communication sends out requests to the potential participant and accumulates their responses. The negotiation phase is important in accommodating heterogeneity among the communication participants. In this phase, the participating entities exchange information about their capabilities, their requested mode of participation. The connections between participants are set-up based on these exchanges.

When a video transmission is required, the set-up is finished after the establishment of a second ISDN connection reserved exclusively for the inter-codec communication. Contrary to the first connection, that is established through the ISDN controller board, this second connection is established through the codec.

After the set-up phase the Communication Agent has the responsibility to monitor the state of both connections and it is also involved during the disconnection phase.

V. APPLICATION UNITS

The Application Units provide means either for documents preparation and distance communication between the service provider and the client, which should comprise the integration of voice, video, screen-based communication tools, and presentation facilities.

The following Application Units have been developed for the Microsoft Windows environment: Authoring, Dialer, OverheadProjector, WhiteBoard, VideoBrowse and DataBase.

A. Authoring

The documents in the ACE environment might contain:

- A lesson that can be downloaded on the client terminal during the remote Learning and Training services.
- A general purpose material that can be used in Remote Delivery of Expertise and Collaborative Decision Making services.
- Pictograms suitable for the Interpersonal Communication service.

Documents can be loaded, prepared and annoted by means of the Authoring Application Unit. Authoring presents a balanced solution providing tools for browsing the information contained in a specific document, together with other tools to create and change multimedia compositions. These compositions can be entirely created by the user, supported by other applications, and improved from raw material from a library. The added information can be any type of media, such as text, graphics, images and sounds, and there are some composition mechanisms that allow groups of objects to be represented as unique entities and functions to create virtual structures. In order to be possible the communication between different applications a client-server scheme was used. The Authoring application is the client and it is able to import information from different servers. Since this server-client scheme has been implemented with Object Linking and Embedding (OLE) technology, Authoring acts as a client that is able to receive data from commercial OLE servers.

B. Dialer

The Dialer presents facilities to invoke a communication connection and to retrieve, in an association with a database, the destination number.

C. OverheadProjector

The OverheadProjector is an application without a balanced amount of browsing and authoring support, since it is polarised for the navigation through the document (browsing), which allows the selection of a pre-prepared lesson and the navigation through its different pages.

The information contained in the OverheadProjector window is private information, which means that the service provider is the only one who has access to it. When the service provider wants this information to be common to both terminals, he must "project" the related page in a public screen (WhiteBoard).

D. WhiteBoard

The "projection" of a specific page in the WhiteBoard corresponds to the download of information from the terminal of the service centre to the client terminal. After the download of the information, both the service centre and client terminal have the WhiteBoard windows with the same common information.

During such presentation the participants, both the service provider and the client, are allowed to perform the following actions on the screen combined with spoken

comments: draw with a virtual pencil, write with a virtual text, erase with a virtual erase and move with a virtual hand. Furthermore, information from a document camera can be "projected" in the WhiteBoard.

The use of these functions is permitted to both participants, but is always the service provider who has the control over them. Because of that, the WhiteBoard of the service provider terminal presents a Tool Box with the referred functions, which does not appear in the client terminal. This means that when the service provider requires a specific action of the client, such as drawing with a virtual pencil, he must choose the drawing icon of the Tool Box.

E. VideoBrowse

The VideoBrowse is a window in the upper left corner of the screen showing the communication partner or the self-view of the user and that presents several commands (Connect/Disconnect, Zoom/In, Freeze/Unfreeze, Local and Remote):

- The Connect button activates the Dialer, for the connection establishment. After a connection establishment, the name of the button is changed for Disconnect, which finishes the connection;
- The Zoom In/Zoom Out and Freeze/Unfreeze are also toggled buttons and they are, obviously, related with the zoom and freeze commands;
- The Local and Remote commands allow, respectively the selection of the cameras both of the remote and local sites, and enables the self-view.

F. DataBase

In intervention with disabled people it is a common procedure to collect information for the characterisation of the person itself and of its problem in order to get a better overview of the situation. A database that can contain all the information that can affect performance or illustrated special handicap situation, for instance on the use of the system, can be of a great help to understand common problems and find common solutions between different types of impairments. With that objective we have developed a database in order to allow afterwards data treatment permitting to get a better description of the population and a better understating of the problem.

Furthermore, additional information may be retrieved from the normal ACE operation, related to service acceptance, call patterns, call duration, destinations, service usage, user's difficulties and interviews. A software tool has been specially prepared to collect, process and analyse such data, which is invaluable in facilitating the evaluation of the services, in order to ensure that they are user-driven, rather than technology-driven services.

VI. DISABLED USER TERMINAL

The software architecture already described is the same for the service centre terminal and client terminal. However, concerning the client terminal special efforts have been made to achieve a user-friendly man-machine interface.

When a demanding call from a remote terminal appears, the client is signalised by an audio signal and symbolic picture indicating that a transmission is being established. If the client accepts the call the VideoBrowse and WhiteBoard applications will be activated after the set-up procedures. These applications have the same graphical aspect of the related applications of the service centre terminal, but they do not present control functions.

The Dialer application already mentioned during the description of the Applications Units is, in this case replaced by a special Dialer: when the application is started up, photos of the persons, that the user might want to call, appear on the screen. By pointing one of the photos a call is initiated. Special symbols are presented for signalling if the connection call has or has not been successful.

In addition to a face-to-face interaction, allowed by the videophony, and the possibility of sharing information, it is interesting to have skills for pictogram transmission. For this reason an additional application has been considered, SymbolPad, that includes a user-interface for pictogram's acquisition, transmission and reception. The client must select, from an available collection, the pictogram he or she wants to transmit. After this selection the client is able to put the pictogram on an adapted document camera [3]. The pictogram will be transmitted to the remote place and it is presented on the screen of both terminals.

VII. SITE NETWORK DEFINITION

Considering the dissemination of the ISDN in Lisbon area, the services viability and availability, the target groups, and the available terminals, several social care Institutions were selected for the Portuguese ACE. The first phase of the experiment was conducted in the first semester of 1994 with the participation of FMH (the service centre), Cercizimbra (mental impaired), Cerci Mira-Sintra (mental and visual impaired) and Cerci Lisboa (mental and visual impaired). During the second phase (second semester of 1994, additional service centres will be considered and two more Institutions will join the experiment: Centro Feliciano de Castilho (visual impaired) and Centro de Dia de Telheiras (elderly).

VIII. CONCLUSIONS

We have referred a experience concerning the development of remote care services for disabled people, in which ISDN is used as communication infra-structure.

The paper presents aspects related with service requirements and focuses the technical description of the terminal equipment that has been developed. During the field trials that are being conducted, most of the users had demonstrated satisfaction and present good performance in the use of the interface facilities.

Considering the staff opinion they considered easy to use the equipment and when asked about the viability of the services they referred that the disabled users could benefit very much from these types of services. Furthermore, they considered essential the use of the videophony, otherwise they could not see the users that could cause a lack of "human contact".

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