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ABSTRACT

This report describes an interactive video system developed by Active Learning Systems which utilizes a cable television (TV) network as its delivery system to transmit computer literacy lessons to high school and college students. The system consists of an IBM PC, Pioneer LDV 4000 videodisc player, and Whitney Supercircuit set up at the head end of a cable TV network. Accessed via modem by a computer located in a school using a customized version of the communications package, CONNECT, the system makes it possible for interactive video designed to run on an IBM PC to be delivered on an Apple, Commodore, TRS 80, a dumb terminal, or any other computer that uses a TV as a monitor and uses a phone modem. The report includes a review of the system's technology; an outline of its benefits; and discussions of system difficulties and how they were addressed. Such difficulties included expense, crashes, response time, conflicting programs, readability, clarity, graphics, hardware, phone connections, switchboards, and distance. A final test in which lessons were delivered via microwave transmission from the head end of a cable network to a high school about 20 miles away is noted. Future implications of the system for education, entertainment, and marketing are discussed, and lists of personnel and companies involved in the research and distributors of interactive video computer literacy products are provided. (MBR)

FINAL REPORT

INTERACTIVE CABLE TELEVISION

March 31, 1985

Research funded by the National Institute of Education under Small Business Innovative Research Grant -- Contract #400-84-008.

INTRODUCTION

Active Learning Systems, Inc. of Minneapolis Minnesota (formerly called MicroMentor, Inc.) is a research and development firm that develops interactive video courses that teach people how to use the personal computer and software associated with it. With assistance from an SBIR grant by the US National Institute of Education, ALS has successfully delivered interactive video educational programs over a cable television network.

Interactive video is a method of instruction that combines video instruction stored on a laser disc and control programs and computer assisted instruction stored on a floppy diskette. The student interacts with a televised instructor using the keyboard to make choices, answer questions and do exercises.

DESCRIPTION OF THE SYSTEM

An interactive video system consisting of an IBM PC, Pioneer LDV 4000 videodisc player and Whitney Supercircuit set up at the head end of a Cable TV network was accessed via modem by a computer located in a school. The system uses a customized version of CONNECT, a communications package developed by Mainstream Software of Minneapolis, Minnesota.

The student simply turns on the computer with the communication's diskette in the computer's disk drive. The computer automatically connects to the program via the modem and phone line and a message on the screen tells the student which channel to select. The student is then instructed to press any key to begin the lesson.

The lessons delivered were taken from MicroMentor's Personal Consultant Series that teaches people how to use the Personal Computer. This interactive video series on computer literacy will marketed to schools and colleges by Harcourt, Brace Jovanovich (to be announced April 15, 1985). Microworx, a computer training facility in Minneapolis will market the program to computer training schools, and two other large publishing organizations will begin marketing the program to business and industry in May.

ACCOMPLISHMENTS

- o For the first time in history, interactive video was delivered over a cable TV Network transmitting data, sound and video over the same coaxial cable. Since this system was too expensive for school or home use, a more economical system was devised using a phone line.

- o A cable TV system was developed using a phone line and standard modem to control the delivery of the interactive video.

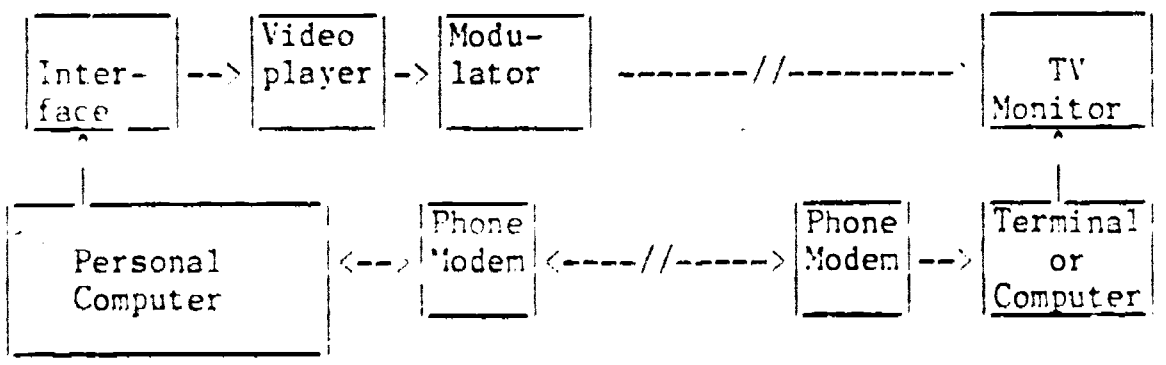
- o The system made it possible to transport interactive video designed to run on an IBM PC to be delivered on an Apple, Commadore, TRS 80, a dumb terminal or any other computer that uses a TV as a monitor and uses a phone modem.

TECHNOLOGY

The interactive video system consists of a personal computer that uses a television screen for a monitor, a laser videodisc player and an interface to enable the two systems to work together. The delivery mechanism requires a modem, modulator, TV channel and communications software. More specifically, the interactive video system consists of an IBM PC with 128K of memory and a color graphics board, Pioneer LDV 4000, Whitney Supercircuit connected by a Hayes Stack Smartmodem using a customized communications program called Connect by Mainstream Software of Minneapolis, Minnesota.

To deliver the programs via cable TV, the interactive video system is placed at the head end of the cable network.

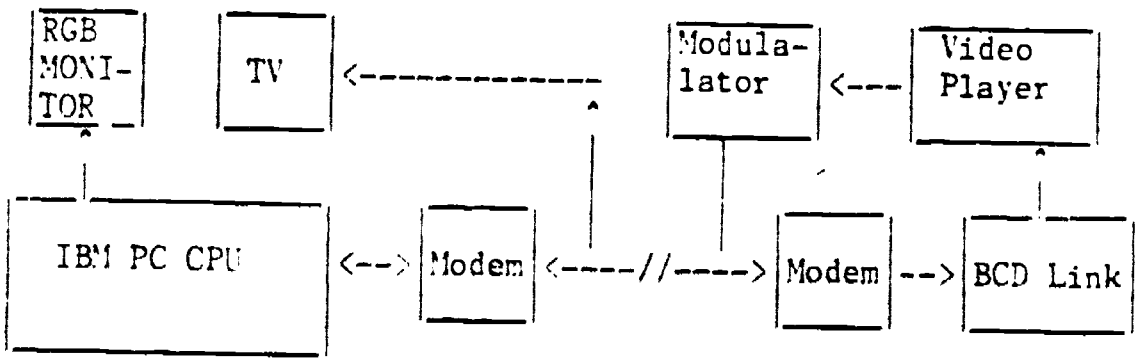
The system is fonfigured thus:



This system allows virtually any kind of computer (Apple, Commadore, TRS 80, IBM, etc.) to deliver interactive video from a remote site over a single TV channel and a telephone line.

The user at the school simply turns on the computer with the communications diskette in the computer. The computer automatically connects to the program and a message on the screen tells the student which channel to turn to. Then the student is then instructed to press any key to begin the lesson. Note: the phone number of the telephone at the head end must be manually added to the software when it is first installed at a new site. Once installed, the computer will automatically dial and connect to the TV station whenever the computer is turned on while the interactive video diskette is in the disk drive.

Several configurations were developed and trials made before this configuration was developed. The first workable system was configured like this:



This configuration allowed the video and computer data to travel over the same coaxial cable simultaneously. However, even though it worked, it was not cost effective. The 3M modems cost $500 each and the modulator costs about the same. Delivery of interactive video to a single user with this configuration usurps three video channels (one for video and audio, and one for data going each direction). While this system worked, the hardware cost as much as the entire interactive video system. Hence, it is too expensive and impractical.

THE TEST

Several configurations were developed and trials made before the final configuration was successfully tested. In the final test, the lessons were delivered via microwave transmission from the head end of their cable network at Cambridge High School to Princeton High School which is about 20 miles distant.

BENEFITS

This system enables any kind of micro computer with a modem and uses a television screen for a monitor to deliver an interactive video lesson via cable TV without additional equipment. However, each user requires a dedicated phone line, TV channel and system at the head end during the time he or she is taking the course.

This system:

- o reduces the amount and cost of hardware and software required to deliver interactive video, assuming that a cable TV network is already available.

- o increases the availability and flexibility of delivery of interactive video. Practically any personal computer could deliver interactive video lessons.

- o maximizes the schools return on investment in both the cable TV system and the interactive video.

- o Enables to use interactive video to:

  - tutor students who need individualized instruction because of handicaps or other special needs, but are unable to get the individual attention necessary because teachers can not spend enough individual time with them.

  - expand curricular offerings to include courses which might not otherwise be possible, such as calculus, economics, foreign languages, etc.

  - enrich their libraries, learning centers and individual study offerings.

  - revolutionize education by offering individualized assistance to students without constant supervision of a trained professional.

Although this project is designed for schools, it has applicability to adult education, training and development, federal re-training programs, business, industry and other fields.

A large amount of interactive video courseware is now being developed for schools. Most of this is being done by small companies or by universities, such as the University of Nebraska and Bringham Young University. Lists of courses available that could be transferred to the system described in this paper can be found in the Videodisc Book published by John Wiley and Sons, and in summaries published by The Videodisc Monitor, 3M Corporation, the University of Nebraska, Minnesota Educational Computer Consortium and manufacturers of various interactive video interfaces. Programs include subjects such as remedial math, remedial reading, foreign languages, economics, trigonometry, calculus, algebra, physics, science, rules of evidence (for law schools), computer literacy, welding, electronics, and many other topics.

DIFFICULTIES AND HOW THEY WERE ADDRESSED

EXPENSE - The first system we developed and tested was too costly because it used modems from 3M that cost $500 each and required the dedication of three TV channels for each user.

We developed another system that placed an entire interactive video system at the head end, and could be accessed by any microcomputer that the school district already owned.

CRASHES - Input statements caused the program to crash.

All programs had to be modified to accept input from the seriel port instead of the keyboard.

RESPONSE TIME - When the student made a menu selection, there seemed to be no immediate response. Users of interactive video usually see the diskette drive or videodisc player preparing to respond to them. Since the student didn't see these actions, it seemed as if the computer wasn't responding.

Menus were reprogrammed so the selection the student made was immediately highlighted. Except for the one instance with the menu choice, we were all very surprised at the speed with which the computer responded using a 300 baud modem. Response time was instantaneous except when a program was being loaded.

CONFLICTING PROGRAMS - The same function keys were used by the communications software as by the courseware, but for other purposes.

The function keys to the interactive video program were changed to the numbers across the top of the keyboard so the student could call for help, return to the menu, jump ahead and repeat sections.

READABILITY - After programming an entire course and mastering the videodisc we found that using an eighty column display width was not suitable for transmission and display on a TV monitor.

Rather than re-designed the completed course, ALS redesigned a course on Disks, Drives and DOS that was currently in development so it would use only 40 column display. Results made screens easily readable.

CLARITY - Some color combinations were invisable or unreadable on the composite monitor.

The colors were reprogrammed to avoid high intensity colors.

GRAPHICS - Programs containing RGB graphics crash or do not display on the student's terminal when using a TV monitor.

During the test, lessons without RGB graphics were used. However, this difficult can also be circumvented by using ASCII graphics instead of RGB graphics.

HARDWARE - The East Central Minnesota Educational Cable Cooperative did not have enough computer hardware.

For testing the cable TV component, we used our own computers. For actually using the software in the schools, ECMECC purchased a disc player, monitor interface cable and color graphics board. They now use an IBM PC purchased by the Pine City Schools to run the programs.

PHONE CONNECTIONS - After setting up the prototype, it was found that Braham high school had a phone system that did not support the typical plug-in phone jacks found in most houses and buildings, and consequently we could not hook our modems to their phones.

A phone repairman told us he could supply an adapter the next day. Rather than wait, we moved the PC from the Braham schools to the Princeton Schools.

SWITCHBOARDS - Both Schools used a switchboard. The system is set up for direct dial. Testing went late, both switchboard operators went home, and we had a frustrating time hooking up the system.

We manually connected the system and once the voice link was established, switched to the modems. The head end of the cable system will need a phone line that does not go through a switchboard in order for this system to operate unattended. However, having an telephone switchboard operator at the school end is not likely to create serious problems, since the computer can automatically dial out through the switchboard as soon as the computer is turned on.

DISTANCE - The distance between the school districts and Minneapolis proved to be more of a difficulty than had been anticipated. A two hour drive to Camebridge High School from our offices in South Minneapolis was a great inconvenience.

Early tests were done at Osseo public Schools which is between Minneapolis and Cambridge. On one occasion it was necessary to travel from Minneapolis to Cambridge and return to Minneapolis to retrieve some hardware and go back to Cambridge while a half dozen people waited in the classroom to run the tests.

FUTURE IMPLICATIONS

Interactive video itself is likely to revolutionize education and Training' during the next ten years. Interactive cable TV could eventually' grow into a whole new national delivery system for education, entertainment and marketing.

As fiber optics are introduced, read/write videodiscs are developed and the communications technology develops, it may be possible, for example to tap into a news network such as CNN and choose what news you want to find out about and watch only what is of interest to you, or watch interactive movies that enable you to participate in the movie by directing or making choices for the characters. You will be able to shop at home and choose items from a video catelog that you want to view or purchase by making a selection on your keyboard (charges will show up on a credit card bill). The future implications of this new delivery system are staggering.

Education of the homebound and handicapped could be facilitated. Curriculum could be expanded to enable enrichment and remedial courses to be delivered in the school or at home. Courses with low enrollement such as Calculus, Economics, advanced foreign language study and less popular foreign languages may be offered to individuals and small groups of students. Lifelong learning may be enhanced by offering courses at home in a wide variety of courses.

The development of this new convergent technology will enable people more and more choice regarding what they watch in their homes. In the future learning, communication, shopping and entertainment may be dramatically effected by interactive cable television.

In the short term, the potential demonstrated by this research are not likely to be exploited. Although technically successful, the system is at the same time primitive (requiring a single cable TV channel for each user) and too far ahead of its time (an immense amount of programming would have to be developed, and cable, microwave or fibre optic technology needs to be developed to support the system).

Qube, Inc. of Columbus Ohio, and Nabu Systems of Toronto Canada both attempted to market systems of this general nature, but did not have the financial resources to make the venture successful. ALS obviously (even with a phase II SBIR grant) would not have the resources to make such a venture successful. Such a project must be left to the IBM's and CBS's of the world.

The school market in our estimation is also not ready to invest the money needed to use interactive video at this time. The seven school districts involved in this research purchased only a few thousand dollars worth of equipment to use the program even though the superintendents, personnel and students were very enthusiastic about the programs.

Since the development of this technology would require more resources than an SBIR grant could provide, ALS has decided not to pursue interactive cable TV, or to apply for the phase II of the SBIR grant. ALS will continue to develop high quality interactive computer training programs that teach adults to use the personal computer, Lotus 1-2-3, dBASE III, Framework, MultiMate and other programs. These programs will be marketed through Harcourt Brace Jovanovich, the largest textbook publishers in the world, Advanced Systems Inc., the largest distributer of training videotapes in the world, large computer hardware and software companies, and other channels.

ALS would be happy to share its knowledge of this technology with a large corporation capable of capitalizing on it.

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