CURRENT COMMUNICATION TECHNOLOGIES–AN OVERVIEW

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Abstract

Like most of the current interdisciplinary technologies, advances in computer and communication are influencing many different areas such as printing, photography and mass communication. As a result of these developments, in future, one may read newspaper on computer screen using electronic mail, use high-definition or digital TV, filmless cameras, and telecommute to work.

Introduction

Communication is a basic human need. The need to communicate more quickly and more efficiently has become a central focus in our technological society. Communication is central to the human experience. Personal communication is an interchange of ideas and information involving words, gestures, body language, and speech patterns. The existence of an ever-expanding information base play a dramatic role in our need to develop better communication technologies.

Technology permits us to extend the 'human potential' to almost unlimited possibilities in dealing with information between people and machines. Today, we have enormous capability for communication because of the advancements in technology. Communication is the accurate transfer of information from a sender to a receiver it is a two-way process. To achieve good communication with some one else, one must be sure that the message transmitted has been received and clearly understood at the other end. We live in the information technology era. As the trend goes, in future more and more jobs will require the ability to manipulate and process information. The economy, industry, education, and security of the in-

dustrialised nations are going to depend heavily on the use of latest means of communication for rapid exchange of information.

Electronic Publishing

Electronic publishing does everything which has traditionally been done in the image assembly operation up to paste-up stage. It combines typesetting with the electronic creation and manipulation of line art and half-tones in one system. This term in a broader context includes other communication techniques such as E-mail, videotext, teletext, electronic journal, etc. The trend is towards quick publishing where the document is created using computer and disseminated electronically over networks in the final form. Since the dependence on paper is still a habit, these have to be supplemented by hard copy production using computer printers and conventional printing processes for mass distribution for quite some time.

DTP

The term DTP indicates that entire publishing is done on one's desk top which is quite possible at present. But generally this is used for the production of documents at the working place itself, using computers and publishing softwares such as Ventura and Page-Maker. The author creates the documents on computer using wordprocessing software, edits and makes pages, adds graphics, designs cover and pages, on a single desk and the document is produced on laser printer which may then be used as camera-ready copy for printing large number of copies through conventional means.

Publishers are searching for ways to produce printed material faster and more economically, and they are linking the authors and editors directly to the phototypesetters. Authors submit their work on floppy disks which can be edited and coded for phototypesetting by the editor. The editor can telecommunicate the text via modem to the phototypesetting house. This procedure can reduce the time for producing galleys from original manuscript to about one third. The job can be distributed to different places and the workers can telecommunicate the text back to the home/office computers by facsimile machines and satellite. Facsimile machines can transmit a page of text in five or six seconds. Thus an entire book can be transmitted in less than an hour.

Computer Printers

New varieties of printers are constantly being developed for hard copy output from the computers. One such latest device is called an ion printer, the technology of which is similar to that used by laser printers, but is more durable and less expensive. The ion printer is a small flat cartridge, having three layers. The top two layers are made of electrical wires at right angles to each other, forming an electrical grid. The bottom layer is a metal screen containing over 2,000 tiny holes, each positioned under one of the intersections of the wire grid. When electricity flows through the wires, it ionises the air around the wires. The negatively charged ions speed through the holes in the screen onto a printing drum. Toner is attracted to the ions and adheres to the drum and gets transferred to paper, as the drum rotates.

Due to the developments in the DTP software which can mix text, illustrations and colour images, the demand for

high resolution printers is being felt badly. Already laser printers with resolution upto 1200 dpi are readily available in the market. To achieve the quality of typesetters for printing, imagesetters which use special photopaper or film for output, are being developed. These imagestetters give resolution upto 3600 dpi with colour separation for multicolour printing. The trend is towards integration of high quality colour scanners with DTP to have complete pre-press capability on desk top.

Electronic Photography

Latest electronic still cameras (ESCs) are similar to camcorders in their operation. Like camcorders and video cameras, these cameras also use charge-coupled devices (CCDs) as light sensors. The output of the CCD is stored on a two square inch size video floppy disk. These disks spin at a speed of 1800 rpm and can store between 25 and 50 images. The disk can either be played back directly from the camera, or can be inserted in a player. The image can then be seen on a TV screen, or outputted to a colour printer to give an instant print. ESCs will have capabilities beyond those of ordinary cameras. For example, the shooting speed can be fast enough (20 images per second) to enable the camera to be used for time-and-motion studies.

As the photographs will be in digital form, these can be transmitted over telephone lines almost instantaneously to remote locations using devices called 'transceivers,' which are similar to computer modems. Another possibility offered by these electronic cameras is the ability to store an image, alter it, and print the new version. Since the image is available in digital bits, the information can be fed to a computer and manipulated. Artists would be able to easily change the colour, or modify parts of a photograph. But this new technology also raises certain ethical implications which are considered seriously. Because there are no film records, it would be easy to manipulate an image and so it would be difficult to identify the original. Digital security code technology has been proposed as a way of providing 'proof of originality' of digital photographs produced by ESCs.

Camera Developements

Advances in material science and electronic technology have been influencing camera designs. The new quartz shutters would use a thin slice of quartz as a window in front of the film. When electricity is applied to the quartz plate, it would change from transparent to opaque. Thus enormously fast shutter speeds, up to one millionth of a second could be attained, since there will be no moving part in these shutters. A follow focus feature provided by these artificially intelligent cameras would allow the photographing of a rapidly moving object. The picture will be taken only when the object is in sharp focus. Optically pure glass which is produced in zero gravity of outer space, will be used to produce lenses of near perfect quality. Another new feature will be image size selection where the photographer will be able to automatically select a full-height, waist-up, or head-and-shoulders image.

Film Developments

The new colour films of future will be marvelous. Colours will be even more vibrant, and the sharpness of prints and slides will be fantastic. Companies like Kodak, Agfa, etc are developing films with 'T-Grain' technology. These films

position particles of photosensitive material parallel to the film surface. In this way, light absorption during exposure is maximised. An example of this new film is the Ektar film produced by Kodak. The Ektar film has very low image grainness providing excellent image quality. The film will be made up of nine layers of plastic, five of which will be image-recording. The new films can be push-processed to get four-fold increase in the film speed.

Chip Technology

Wafer scale integration, a new chip technology, holds the promise of greatly increasing chip capabilities. At present, many integrated circuits are made on thin, semiconductor wafers that are several inches in diameter. Each integrated circuit is cut out of the wafer, and mounted in a protective package that greatly increases the size of the chip and slows down its operation. In wafer scale integration, the individual circuits would be left on the wafer and interconnected. Several wafers could then be stacked up before being mounted on a printed circuit board. One application of this technology is to shrink billions of bytes (G bytes) of computer memory that currently occupies ten cubic feet into a few cubic inches of expensive semiconductor material. Interesting things will happpen in the computer world as we move into the decade ahead. Because so many technological processes involve computers, a great deal of research is devoted to improving their capabilities. Both computer hardware and computer software will become much more powerful. New kinds of computer programming will greatly change the computer capability. Parallel processing allows computers to work faster on problems that require the same calculations over and over again. Instead of performing sixteen, thirty-two, or more calculations one after the other, parallel processors perform them at the same time, giving the result in a fraction of the time. Future computers will be structured with more parallel parts, often connected by special networks. These machines will use parallel processing hardware and software.

Artificial Intelligence

In addition, artificial intelligence (AI) programming gives computers inference rules to arrive at conclusions. These conclusions, just as with human intelligence, are not always right, but expert systems have the ability to learn from their mistakes, once the mistakes have been pointed out. Artificial intelligence systems will become more widespread in some kind of occupations. Computers are now able to recognise vocabularies of several hundred words routinely. The IBM Corporation has developed an experimental voice recognition system that has a vocabulary of 20,000 words which is about 38 per cent of the average person's spoken vocabulary. Voice recognition technology will change the way people work and live. Spoken commands will control machines in the factory and appliances at home. Typewriters and word processors will be spoken to, rather than keyed. Using special interfaces, computers will be able to recognise human gestures. With sensors that monitor head position, the image on a computer screen can be made to shift as the observer changes the viewing angle. NASA has developed a new helmet that astronauts could wear. It would project a visual picture of a scene outside the spacecraft. As the astronaut's eyes move, a robotic camera

outside the spacecraft moves in the same direction.

Hand movements can also be interfaced to the computers. Wearing a glove, made with special tactile-feedback sensors, a user can do a set of mechanical operations that can be duplicated by a robotic device at a remote location. Fibre-optic cables, carrying light, run through the glove. When the fingers bend, light escapes from the cables. The more the fingers move, the more light escapes. Light sensors detect the amount of light and thus monitor the hand position.

For financial transactions or security applications, sensors which can recognise a person's fingerprints or the pattern of blood vessels in a person's eye (retina scanning) have been developed. These are more positive forms of identification than code words or numbers that can be forgotten or stolen. This field of computer measurement of personal characteristics is called 'biometrics'.

Cellular Telephones

Telephones and telephone lines will play a much more important role in the future of communications. Telephone lines will be used to support online communication of all types. New telephone services will be commonplace, as well. Among these will be an increase in the use of cellular telephone technology. Cellular telephones are now found mainly in cars. These telephones are really radio transmitters that broadcast a signal to a receiver in a geographic area called a 'cell'. The signal, once received, is connected directly into the telephone network. Thus, cellular telephones can be used to communicate with any other telephone in the world.

The new trend in cellular phones is to use small portable telephones that can be hand-held. Portable phones give power outputs of about half a watt, compared to mobile phones which produce about 3 watts of power output. Portable phones are rather expensive. In England, a new system is under development that will be made up of tens of thousands of small transmitter/receiver units located in public buildings and along roadways. These will be used as base stations for even smaller, lower power, and less expensive telephones that will easily fit in pockets or pocketbooks. Because the telephone system will be used for so many types of communication, the sales of portable telephones will most likely rise steadily. With a portable computer and a portable telephone, users will be able to access online data bases from almost anywhere. It means that whenever there is a need for information, it is available on demand. The new era of telephones will be able to provide video as well as audio signals to users. A video camera built into the telephone will send video pictures as people talk to each other on the phone. In future, this two-way video telephone system will become common. Some proposed systems transmit black-and-white slow scan video. This means that the video camera scans the person to be televised at a slow rate. A still picture of the person at the other end, which takes about five seconds to create, is displayed. Other systems can transmit full-motion video.

Telephone companies are experimenting with new technologies that will expand services to customers. One service allows many different callers to talk to each other on a conference call. This conference service has been in usage by

business users for some time. Using these new services, strangers are able to simply call a local number and join a telephone conference where the discussions may centre on any topic of interest to the participants. Another new service can trace calls made to one's telephone number. Using a device already available to telephone customers in some parts of the countries, the number of the calling party is displayed before one picks up the telephone, so as to know who is calling before answering the phone. This service has raised objections from groups who think that personal privacy may be sacrificed by the system. Soon, telephones that translate one's voice into other languages will be available. The moment one speaks into the telephone, a computerized voice synthesizer will digitize the voice, store it, and be able to translate it into any number of foreign languages on command.

Digital recording is going to be the technology in future. Already digital audio tape is being introduced for commercial and home applications. It is possible to access compact disk in home audio and video recorders. These will be used in personal computers for large memory. Developments in integrated circuit memory will make it possible to replace tape and disk for computer applications, audio and video recording equipment. Small integrated circuit memory packs may replace tapes and disks for storing music.

Television Technology

Because of changing technology, the television industry is undergoing many changes. In its formative period, it was dominated by major networks of stations that carry a relatively small selection of programs at any one time. The spread of cable TV systems and satellite broadcasting in the 80s have resulted in a much wider choice of programs for viewers. and in some cities, more than 100 channels are available.

Direct broadcast satellite (DBS) systems were introduced with the launching of satellites for this service. A DBS broadcasts programs directly to home receivers that are connected to small satellite antennas mounted on roofs or chimneys. These special satellite antennas are now upto less than three feet in diameter.

In stereo TV transmission, two different audio channels are sent with the picture. The receiver decodes the two separate channels and produces the audio in two speakers. The sound is more natural than conventional TV with monaural, or single-speaker sound.

High-definition TV (HDTV) has been demonstrated by several manufacturers, and transmission standards are being developed so that it can be universally available. As compared to a conventional TV set which uses 525 scan lines to produce a picture, HDTV uses 1125 scan lines, producing a much smoother and more detailed picture. As the picture is enlarged to fill a large screen, the individual lines become visible, giving a grainy look to the picture. Bigger TV screen having larger width-to-height ratio and higher resoluion like a 35 mm movie enhances the viewer's sense of reality. These high resolution pictures carry about five times the data than conventional TV picture. HDTV broadcast is being demonstrated for the European Community countries for the Olympics Games of 1992 and its commercial broadcast is planned to begin in 1994.

Telecommunication

The usage of newer technologies in the telecommunication has reduced the distances have reduced and made the world smaller. The people in future will no longer be required to live near their workplace for easy commutation. They will be able to live in the place of their choice and telecommute to work, i.e., exchanging information and conducting business via computer, modem, telephone, fax, etc. Thus an author can still submit his book to the publisher through telecommunication while living in a remote place. In Britain, some companies are already encouraging their workers to telecommute from home.

The developments in fibre-optics and local area networks (LANs) will give rise to telecommunities. The residents will have access to complete telecommunication capabilities. Such communities have already come up in USA. Another plan is for an electronic village, a carefully planned community inside a beautiful forest, designed for the information age. Each home here will be a centre of an electronic network. This network will control appliances, lighting, electrical and alarm systems. A household management and communication centre will provide for teleshopping, financial planning, bill paying and electronic mail. The electronic network will provide leisure activities and entertainment, educational activities and a computer station for work-related activity.

Data Compression

For the ever growing amount of graphic and textual data, a new data compression technique based on fractals holds great promise. It would provide a whole new generation of image compression methods. The fractals are based on compression algorithms that describe a pattern. Data compression uses the reverse of this called fractal transform which identifies the fractals that make up an image, and finding the fractal formula that can create it. Using this technique a grey scale image can be compressed to only 3 KB size; colour image to 10 KB and video frame to 800 byte size achieving a compression ratio of 77:1. Even further compression ratios can be achieved without loss of quality. Fractal transform technique can be combined with the existing data compression techniques.

This technique finds appliction in fascimile machines, scanners, DTP, graphics, as well as multimedia applications such as games and entertainment systems. Analysis of seismic data and satellite imagery, video phones and fast graphic modems have lot of scope for this technique. It is possible to transmit voice, full motion video and other data over the existing telephone lines. Already the first 'Floppy Book' on a 3.5 inch floppy disk with 100 page text with 100 colour illustrations was published in September 1991 which can be accessed on a 286 or better PC with VGA display.

The future is going to be the information age with the developments in communication technologies. The information is going to be recognised as a major resource and the economy of many nations will depend upon the use of advanced information.

The advantages of these developments have a darker side too, the ability to control information and telecommunication by a select few and the total dependence of society on those few has its own dangers. Let us hope that these

developments will bring the people of this world closer and will be used for the betterment of the society.

Additional Reading

1. Fractals transform image compression. *Electronics & Wireless World*, 1992, 208-11.

2. Corcoran, Elizabeth. Picture perfect. *Scientific American*, 1992, **266**(2), 95-103.

3. Spring, M.B. Electronic printing and publishing: the document processing revolution. Marcel Dekker, New York, 1991.

4. Barden, R. & Hacker, M. Comunication Technology. Delman Publishers, Inc., New York, 1990.

5. Chowdary, T. H. The cellular sizzle for mobile phones. *Computers Today*, **8**(87), 52-58.

Freedom is nothing else but a chance to be better
-Albert Camus

Fortune gives too much to many, enough to nobody
-Martial

When patterns are broken, new worlds can emerge
-Tuli Kupferberg