Information, Computing and Communications Division COMPUTER SCIENCE: SYSTEMS, ARTIFICIAL INTELLIGENCE & MEDICAL APPLICATIONS IMAGING 1:30 PM - Saturday, April 23, 1994 Health Education Room 110 Deborah L. Whitfield, Presiding

1:30 PERFORMANCE GROWTH OF 80X86 PERSONAL COMPUTERS SINCE 1981 VERSUS PRICE. D. Kaur, D. Shaheen and Yong Park, Electrical Engineering, University of Toledo, 2801 W. Bancroft, Toledo OH 43606-3390.

The paper evaluates Performance Growth of IBM Personal computers since the introduction of IBM PC in 1981. Currently the highest performing 80X86 personal computer platform is 80486DX2- 66MHz. A synthetic bench mark called Dhrystone was used to measure the performance of these computers. Throughput of X is n% higher than Y, where, n the percent difference in execution of X and Y is calculated as follows: n= ((execution time B - Execution time A)/Execution time A)*100. Throughput is computed for all the IBM relative to IBM XT- 4.77 MHz. Our computation shows that the throughput of 80486DX2-66MHz is 9800% higher than the IBM XT. The 80486DX2-66MHz machine became available in early 1992, so the average growth rate of the 80X86 personal computers can be determined using the following algorithm: Yearly Growth=(Total Growth)$^{(1/\text{number of years})}$=(98)(1/11)=1.52. The 80X86 personal computer platform performance increased an average of 52% per year. Assuming this rate of growth will continue, the performance of the 80X86 in the year 2000 can be predicted to be 2750% relative to IBM XT.

1:45 A METHOD TO OBTAIN OPERATING POINT INFORMATION FOR TERTIARY STORAGE SYSTEMS. Gerald R. Heuring, Dept. of Computer Science and Engineering, University of Toledo, 2801 West Bancroft Street, Toledo OH 43606.

The use of tertiary or near-line storage for files, only found on large computer systems in use at the national laboratories at one time, is becoming increasingly common on smaller computer systems. To determine the economic feasibility of such a system and the desired operational characteristics of a suitable storage device it is necessary to have information on the behavior of the files on the system. Previously, systems considered for addition of tertiary storage had reached a saturation point where the question was moot. Today, with the wide range of tertiary storage devices and their capabilities, determining if and when a system will benefit from tertiary storage is not as clear. A method utilizing sampling and multivariate analysis has been developed for and verified on existing file behavior data and will be presented. The results provide guidance on the specification and implementation of tertiary storage systems on computer systems with little information on previous file behavior. Results study will be presented along with observations of how the needed data may be gathered and analyzed.

2:00 OPTIMIZING COMPUTER PROGRAMS USING POWERFUL TECHNIQUES. Deborah L. Whitfield, Dept. of Computer Science, Slippery Rock University, Slippery Rock PA 16057.

Currently, interest in parallelizing optimizations is growing with the recognition of the necessity of performing optimizations to effectively utilize parallel architectures. To exploit parallel architectures, powerful optimizations must be applied at the most effective location in the program and in the most beneficial order. Few guidelines exist for determining when and where to apply optimizations to produce the most efficient code; the order of applying optimizations can have an impact on the efficiency of the final code. However, determining the appropriate optimizations is difficult due to the complex interactions among the optimizations, scheduler and architecture. The introduction of more powerful parallelizing optimizations that consist of a combination of conventional optimizations further complicates the situation. Before the affects of powerful optimizations can be experimentally investigated, the properties which permit optimizations to be combined must be investigated and a tool that automatically generates these powerful optimizers must be designed. To aid in selecting appropriate optimizations, an optimizer generator (Genesis) is presented that produces an optimizer from specifications of optimizations. This paper describes the design and implementation of Genesis and demonstrate how such a generator could be used by optimizer designers that are interested in investigating the properties of optimizations that permit their combination and how Genesis could be used to automatically generate combined optimizers from the specification of simple optimizations.

2:15 ROBOT DESIGN: FROM START TO FINISH. John K. Estell, Thomas A. Owen, Craig A. Szczublewski. Computer Science and Engineering Dept., University of Toledo, Toledo OH 43606.

An autonomous microprocessor-based controller, SCORPIO, was designed for operating a low-cost, multi-legged robotic system. SCORPIO is based upon the Stiquito hexapod robot developed at Indiana University. The main goal of the SCORPIO project was to provide a completely self-contained robotic system capable of interacting with its environment. Since the Stiquito's load capacity was limited, a new body was developed to accommodate a controller, sensor array, and power supply. The controller, based on the 80C32 microprocessor, was provided with all necessary resources to allow the robot to be programmed. To accomplish this programming, a new pseudo-assembly language was developed. The SCORPIO Language Assembler is a general purpose robot controller language designed to aid in program development. The sensor array consists of multiple IR emitter/detector pairs. These are designed for wave front detection, and allow for simple object avoidance. The basic controller design is flexible enough to be included in future robot designs with little or no modification to either hardware or software.

2:30 KNOWLEDGE SHARING BETWEEN EXPERT SYSTEMS. Mary Lou Dorf, Computer Science & Engineering Dept., 2801 W. Bancroft, University of Toledo, Toledo OH 43606-3390.

The current information age demands new approaches to the acquisition, transfer, interpretation, processing, and use of data. With the assistance of networks and of known data formats, it is now possible to access, copy, and move information back and forth between databases, spreadsheets, word processors, and/or computer programs. However, the sharing of knowledge between expert systems remains at the primitive level. This sharing of knowledge can take place either by sharing knowledge bases between expert systems, or by allowing systems to query each other for information. However, there are impediments to this sharing of knowledge: representations, dialects, lack of communication conventions, and lack of shared vocabulary and domain terminology. Although this paper covers each impediment and suggest mechanisms for handling the difficulties, the concentration is on mechanisms for solving the difficulty of sharing vocabulary and domain terminology.

2:45 VISUALIZATION OF AIR FLOW IN COMMERCIAL KITCHEN ENVIRONMENTS. Wayne E. Carlson, Peter Carswell, David Reed, Lawson Wade, Wen Seun, Advanced Computing Center for the Arts and Design, Ohio State University, 1224 Kinnear Rd., Columbus OH 43212.

An interactive environment for designing and analyzing heat collection and dissipation in a commercial kitchen has been implemented. KitchenVIEW is used in the design of energy efficient kitchens, allowing a designer or architect to set up a *virtual* kitchen using a graphical interface, and then to compute and visualize the airflow and other information that would occur in a real kitchen with that design. Using kitchenVIEW, many different kitchen setups can be tested to find one that optimizes efficiency, without the need to physically build and test them. KitchenVIEW is tailored for use with commercial kitchens; however, it could be used to visualize other environments. The user specifics a floor plan for the room, interactively positioning various appliances within the 3D space. After the initial design is completed, there are graphical tools for specifying a gross computational grid and related initial conditions, such as temperature, pressure, exhaust and inflow rates. These tools display a cross-section of the room including the appliance, which is used to the user specify a two dimensional grid and the initial conditions at the grid points for that slice. The program then creates a 3-dimensional grid by connecting the 2-dimensional slices. This information is given to a separate computational fluid dynamics (CFD) program which refines the grid and computes the airflow, temperature and pressure at the grid points. KitchenView is finally used to visualize the output of the CFD program (currently as a vector plot.) Particle animations and contour plots are being added to the visualization.

3:00 SIMULATION OF VIRTUAL ENVIRONMENTS FOR USE IN WHEELCHAIR USER PROFICIENCY. Wayne E. Carlson, Donald Stredney, Edward Swan, Edward Sindelar, Cynthia Hayes, Advanced Computing Center for the Arts and Design and Ohio Supercomputer Center, Ohio State University, 1224 Kinnear Rd., Columbus OH 43212.

This experimental project examines human performance in negotiating barrier free environments through the use of computer generated virtual simulations. Architectural plans of public and commercial buildings are entered into the system to provide a complete three dimensional environment in which the wheelchair user must navigate. A powered wheelchair is connected to a computer workstation, and the outputs of the operation controls are converted to commands to the graphics software. A resulting three dimensional view of the building is presented to the user via a stereo view image device. User performance data is collected and integrated by the training system to give feedback to the user, as well as to provide essential information regarding the design of these technologies. The project will be instrumental in defining standards for use in evaluating user proficiency, which will provide information for more suitable selections of enabling technology for the disabled. In addition, this research will demonstrate direct implications to the development of enabling technology through virtual testing and analysis. The system developed for this project can be used by architects, developers, designers and builders to assure barrier free environments in order to assure unlimited access to these environments (public buildings, shopping malls, homes and offices, retail stores, etc) by the disabled.

3:15 BIOMEDICAL SIMULATIONS OF HIGH PERFORMANCE COMPUTING. Don Stredney, Roni Yagel, Greg Wiet, M.D., Edward Swan, Ferdi Sheepers, Ohio Supercomputer Center, 1224 Kinnear Rd., Columbus OH 43212-1163.

At the Ohio Supercomputer Center, and the College of Medicine and the Advanced Computing Center for the Arts and Design at The Ohio State University, a system is under

development to provide an intuitive interface for manipulating and experiencing virtual data sets, specifically volume reconstructions of multi-modal medical data. This design requires a minimum of setup time and user calibration. Initial user settings are stored on-line, and can be readily modified to accommodate user differences. Current research topics include the following: The Correlation of functional (EEG) and structural (MRI) images to investigate the pathophysiology associated with drug addiction (in collaboration with the Alcohol and Drug Abuse Research Center, Harvard Medical School). Teaching regional anesthesia, specifically the technique of an epidural block (in collaboration with the Department of Anesthesiology, The Ohio State University Hospitals). Visualizing and determining tumor morphology in patients with skull based and intracranial tumors (in collaboration with the Departments of Neurosurgery and Otolaryngology, The Ohio State University Hospitals, and The Arthur James Comprehensive Cancer Hospital and Research Institute).

3:30 REMOTE DIAGNOSIS USING VOLUME VISUALIZATION OF SATELLITE TRANSMITTED MEDICAL DATA.

WAYNE E. CARLSON, RONI YAGEL, STEPHEN MAY, STEPHEN SPENCER, DON STREDNEY, CHARLES BENDER, ADVANCED COMPUTING CENTER FOR THE ARTS AND DESIGN AND OHIO SUPERCOMPUTER CENTER, OHIO STATE UNIVERSITY, 1224 KINNEAR RD., COLUMBUS OH 43212.

An experiment is underway to provide tools and techniques for medical diagnosis of patients in a medically deprived remote area of Hawaii by utilizing the NASA ACTS satellite to transmit medical scanner image data for visualization and analysis by experts at a separate site. In this experiment, a mobile unit employing very-low field MRI or ultrasound imaging is used to obtain two dimensional images of an injured patient. These image data sets are then transmitted over the High Data Rate terminal to the ACTS satellite, and then to the Ohio Supercomputer Center where a parallel volume rendering algorithm is used to construct a three dimensional model of the patient. These resulting images are broadcast back to the initial remote site for the attending physician to view and manipulate. In addition the images are simultaneously sent to Georgetown University for evaluation and analysis by a team of expert radiologists. Their resulting treatment plan is sent via the satellite with other collaboration information to the remote site to be used in a medical triage situation. In addition to real time parallel rendering, the experiment will allow for segmentation of these data sets, resulting in the ability of the physician to concentrate attention on certain tissues or organs that might be affected by the injury. The experimental rendering algorithms are also able to combine data from multiple modalities (eg, MRI and EEG data) in a single three dimensional rendering, providing an even greater opportunity for correct diagnosis and treatment planning.

3:45 MAP SCALE CHANGE, "RADICAL LAW" AND FRACTALS.

YU ZHOU, DEPT. OF GEOGRAPHY, BOWLING GREEN STATE UNIVERSITY, BOWLING GREEN OH 43403.

Scientists need to look at the world at a very wide range of spatial scales. This task frequently involves scale change—a traditional operation in cartography. Automation of map scale change, however, has many unsolved problems. Friedrich Topfer, a German cartographer, declared that the relationship between map scale and map information content can be expressed, fundamentally, as a "square root" function. His idea, although not examined to any high level of criticism, has been generally accepted in the cartographic community as "Radical Law". By analyzing U.S. Geological Survey maps at different scale levels, this investigation finds that the relationship between map scale and information content fits a power function rather than radical one. The so-called "Radical Law", therefore, needs to be adjusted. This power function, furthermore, suggests that the scale-information relationship is fractal in nature. Like the D-value (a parameter employed by fractal geometry as a measure for the character of a line or a surface), the p-value, a parameter derived from Topfer's equation, can be served as an indicator to describe the degree of information reduction caused by scale change. An important contribution to the problem of deriving a map at any required scale from a single large-scale database has, therefore, been made.

ERGONOMICS, COMPUTERS, and LIBRARY & INFORMATION SCIENCES

9:00 AM - Saturday, April 23, 1994

Health Education Room 110

Bruce A. Leach, Presiding

9:00 RANDOLPH GREENFIELD ADAMS OF THE WILLIAM L. CLEMENTS LIBRARY: SENTIMENTAL BOOKMAN-SCHOLAR.

ROBERT A. SHADDY, WARD M. CANADAY CENTER, CARLSON LIBRARY, UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

Randolph Greenfield Adams (1892-1951), historian and librarian, became the first director of the William L. Clements Library at the University of Michigan in 1923 and served there until his death. During his tenure he took up the cause of the rare-book collector and devoted himself to the preservation of rare books and other special collections thus opposing the major trend in American librarianship at that time of the primacy of service to the reader. His numerous publications, addresses, and other works repeatedly stated that the care of rare materials should be put before the desires of readers and librarians. His most famous statement on this theme was the classic article "Librarians as Enemies of Books," which was published in 1937. His efforts contributed to the institution of reforms throughout the country which helped convince collectors that their collections would be cared for properly by librarians. By the middle of the twentieth century, more collections of rare materials were institutionalized by their owners (rather than being put up for auction) than at any other time in American history. This paper briefly explores Adams as a "custodian of culture" and his views regarding rare books librarianship.

9:15 IDENTIFYING CD-ROM USE PATTERNS AS A TOOL FOR EVALUATING USER INSTRUCTION.

BRUCE LEACH, BIOLOGICAL SCIENCES LIBRARY, OHIO STATE UNIVERSITY, 1735 NEIL AVE., COLUMBUS OH 43210.

All CD-ROM database use in the Biological Sciences Library is recorded on daily workstation "reservation" logs. Workstation logs from January 1987 through June 1991 were used to determine use patterns of individual database searchers. Names of searchers and dates of use were entered into a *WordPerfect™* file, then sorted. For each individual, the number of days on which databases were searched, the interval between first and last database use, and the number of academic quarters in which the user searched databases were calculated. 1501 individuals were identified. More than half of the observed CD-ROM searchers recorded all database use within one month. Over one-third recorded use on only one day. Results suggest that the library emphasize brief basic instruction for all first-time searchers and de-emphasize workshops.

9:30 USING THE INNOVACQ LIST CREATION ABILITY TO OBTAIN LISTS OF PERIODICAL ARRIVALS.

DALE EBERSOLE, JR. CARLSON LIBRARY, UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

The list creation ability of the INNOVACQ system can be utilized to generate lists of arriving periodicals for interested faculty. At this institution a departmental identifier from the order record and the date of latest arrival from the check in record can be utilized to create such a list. Use of a definite time frame would allow only those issues that arrived since a specified beginning date to be listed. All issues that arrived during the past week, 2 weeks, month, etc. would be listed alphabetically by title with arriving issue identification. Some ways in which these lists could be utilized are mentioned. They will be constrained by equipment availability, cost, possible legal restrictions, and the availability of people to perform necessary input tasks.

9:45 ACCESSING ETHNIC INFORMATION SOURCES IN MIDWESTERN CULTURAL INSTITUTIONS.

LOIS J. BUTTLAR AND RAJINDER GARCHA, SCHOOL OF LIBRARY AND INFORMATION SCIENCE, KENT STATE UNIVERSITY, KENT OH 44242-0001.

Cultural pluralism in the United States is based on the appreciation of a rich variety of ethnic peoples—their traditions, arts, languages and histories. Changing demographics and the new immigration waves of the eighties and nineties have brought attention to various nationality groups. Unfortunately, librarians, scholars, and educators do not have access to the valuable resources in many of the ethnic institutions because their holdings are not analyzed by indexing and abstracting services. The proposed presentation is a description of the ethnic museums, archives, and libraries in the Midwest, including their collections, availability to the public, admission charges, programs, and services provided (guided tours, exhibits. lectures, loans, etc.).

10:00 MISCONCEPTIONS IN HUMAN FACTORS,

HENRY F. LEDGARD, PH.D., COMPUTER SCIENCE AND ENGINEERING DEPT., UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

The field of computers has seen a rapid growth in graphical user interfaces and an ever widening set of users. Many, many people spend hours a day using a computer. Ease of use is a paramount issue. We hold that there are major misconceptions in the field. They are largely unspoken, and may reflect a set of established attitudes in our profession. Some of these misconceptions are: 1. The primary goal of human factors is to help novices; 2. Ease of learning implies ease of use; 3. Regular computer users do not really need human factors; 4. Most graphical interfaces are pretty easy to use; 5. Users should help design systems; 6. Human engineering centers on a few key issues; 7. Users will be comfortable with subsets; 8. Human engineering is not particularly a technical matter; and 9. Human factors are chiefly a matter of taste; We need to make computers better for people. To do this we need to understand such misconceptions and make a serious attempt to improve the situation.

10:15 KNEELING, AN ALTERNATIVE TO SITTING.

HENRY F. LEDGARD, PH.D. AND BERNIE V. FALK, M.A., COMPUTER SCIENCE AND ENGINEERING DEPT., UNIVERSITY OF TOLEDO, TOLEDO OH 43606

Sitting is a major health hazard. Prolonged sitting induces general weakness, poor posture, poor walking habits, and lack of energy. Prolonged sitting is detrimental to one's health and well-being. Office work and the field of computers has resulted in a rapid increase in sitting. Many people spend hours a day sitting. I have been experimenting with using the computer kneeling down. It is wonderful. It takes time to develop the strength in the knees, legs, and feet in order to be able to kneel for periods of ten or twenty minutes. it hard at first. Frequent movement makes the situation much easier The results are directly visible. One definitely feels better. We need to make office work better for people. To do this we need to take the sitting issue seriously and improve the situation . This work is based on and derived from the work of Bernie V. Falk, M.A., of Grosse Pointe Park, Michigan.