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13. ABSTRACT (Maximum 200 words)

Elizabeth City State University (ECSU) Computational Science Research Lab
(Computational Science - Scientific Visualization Lab: CSSV-Lab)

The primary objectives for establishing the CSSV-Lab was to provide a laboratory setting for doing state-of-the-art research training in computational science and scientific visualization. Students and faculty from mathematics, computer science, physics, biology, chemistry, geology, and technology meet bi-weekly in a seminar setting in the CSSV-Lab to share, discuss and critique each others work. Moreover, several students work in the CSSV-Lab directly under a faculty mentor (or mentors) in their own discipline on a computational science-oriented research project (with visualization components). Faculty associated with the Seminar have been requested to consider research projects which they believe will be exciting and motivating projects for students as well as appropriate for the computing platforms in the CSSV-Lab. The bi-weekly seminar has the potential of becoming one of the most exciting vehicles in the University for getting a significant number of mathematics and science students involved in undergraduate research and motivating them to pursue graduate study in their discipline area. This is particularly significant since most of our students are African Americans. Moreover, this project can serve as a model for doing undergraduate research and research training in computational science and computer visualization at other colleges and universities. Under this grant, several state-of-the-arts SGI (unix-based graphical workstations) were purchased for the CSSV-Lab along with associated software pheriphals.

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FINAL REPORT

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Elizabeth City, North Carolina

Report
Submitted By,

Johnny L. Houston, Ph.D.
Professor of Mathematics and Computer Science
Principal Investigator
December 30, 1997

FINAL REPORT

ECSU'S COMPUTATIONAL SCIENCE RESEARCH LAB

A. PURPOSE OF PROPOSED PROJECT

Since Computational Science - Scientific Visualization is rapidly becoming an essential aspect of scientific inquiry, undergraduate mathematics and science programs are being challenged to incorporate these tools into their curricula; especially in upper division classes and in research activities. However, applications of computational - visualization methods to scientific disciplines often require computing and graphics visualization only afforded by high performance workstations. ECSU was clearly deficient in making high performance workstation technology available to a significant number of mathematics, computer science and science students. Furthermore, faculty outside of the Mathematics and Computer Science Department (and some within the Department) at ECSU have little or no experience with scientific computing, computing languages, numerical methods, computer architecture, scientific visualization or experience with high performance workstations. Unless the majority of the mathematics, computer science and science faculty become aware of the scientific potential of high performance workstations and develop the skills necessary to use them effectively, the mathematics, computer science and science faculty and students at ECSU will fall behind their scientific peers. The development/expansion of the proposed Lab under this project was designed to be the first step to remedy this problem and permit many of the faculty and students to begin doing state-of-the-art research using computational science - scientific visualization tools.

Under this project, there was to be purchased equipment to help establish a permanent Computational Science-Scientific Visualization Laboratory (CSSV-Lab) for doing research and research training to facilitate the development of a sustained computational emphasis in our undergraduate research programs in mathematics, computer science and the sciences. The initiatives proposed were intended to begin to raise the level of computer usage in the upper division undergraduate mathematics, computer science and science curricula and in particular familiarize more of the mathematics, computer science, and science faculty and students with computational methods and visualization techniques which are currently used in research areas in their given disciplines. Specifically, the project was designed to promote more application of these tools in fields of mathematics, computer science, physics, chemistry, geology, biology, and biotechnology at ECSU, by emphasizing the use of new algorithms, computer languages, modeling/simulation and computer visualization in doing research projects in these discipline areas.

B. MOTIVATING INTEREST FOR DOING RESEARCH TRAINING AND DEVELOPING RESEARCH PROJECTS IN COMPUTATIONAL SCIENCE - SCIENTIFIC VISUALIZATION, USING THE CSSV-Lab

The primary objective in establishing the CSSV-Lab was to provide a laboratory setting for doing state-of-the-art research and research training in computational science and scientific visualization. To get a significant number of persons doing that, we proposed to conduct a bi-monthly seminar in the CSSV-Lab. This seminar has the potential of becoming one of the most exciting vehicles in the University for getting a significant number of mathematics, computer science and science students involved in undergraduate research and motivating them to pursue graduate study in their discipline area and later to pursue technical research careers. This is particularly significant since most of our students are African Americans. Moreover, this project can serve as a model for doing undergraduate research and research training in computational science and scientific visualization at other colleges and universities.

Some students and faculty from mathematics, computer science, and the sciences are meeting monthly in a seminar/lecture series setting in the CSSV-Lab to hear a series of background lectures in computational science - scientific visualization topics. These presentations, which are sufficiently general to be of common interest to all participants, are establishing both a common vocabulary and are providing insight about the fundamental tools and recent developments in Computational Science - Scientific Visualization. Moreover, a few students are beginning to work in the CSSV Lab on some computational science-oriented research projects (with visualization components).

The emphasis in the CSSV Seminar and use of the CSSV-Lab is on introducing a more scientific approach to learning and doing research by taking advantage of the powerful capabilities of high-performance workstations to explore complex relationships through enhanced visualization and increased computing power.

There is a move nationwide to promote this type of educational and pedagogical shift, and research emphasis. As was projected, the Principal Investigator sees that faculty and students are more willing to participate in these efforts since there is a state-of-the-art lab that provides an easily accessible avenue to both demonstrate and implement what is being advocated.

C. EQUIPMENT REQUESTED - PURCHASED

Computer workstations for expanding the scope of interdisciplinary undergraduate research at ECSU must provide high-performance computational and visualization capabilities at a reasonable cost. In order to be consistent with current scientific standards these machines should have UNIX, Windows environment, high-resolution graphics, and must be able to execute the industry's leading computational and visualization software. Furthermore, in order to accommodate student projects, associated with faculty research, these machines must be able to run numerical solvers that are computationally intensive, incorporate many numerical methods and generate an immense amount of data in a reasonable period of time. Of course, the data generated by the numerical solvers should be quickly displayed in a way that is easily and effectively visualized. This will require 3D graphics and the ability to rotate, translate and highlight data in various ways. The ability to do this in a reasonable amount of time will help the students and/or instructor to discuss and analyze the model interactively.

The SGI Workstations produced by Silicon Graphics (SGI) provide the above needs. The SGI Workstations are dependable machines that can be upgraded easily and will remain state-of-the-art for several years. They have one of the fastest and highest resolution 3D graphics on the market. Since the principal investigator has had extensive experience with SGI Workstations and ECSU has access to scientific applications and graphics software that runs on these machines these are the better choice of machines to purchase. In addition, there is some public domain software for scientific modeling that will only run on the IRIS Graphics Library (GL). The SGI IRIS GL is becoming an industry standard.

In this project we requested funds to purchase six (6) workstations, a printer, some accessories and some software for helping to develop the CSSV-Lab for the seminar and research activities discussed. This equipment has been purchased, installed and is being used in the CSSV-Lab.

The workstations are equipped with FORTRAN90, C++ and ada compilers. Moreover, the workstations are connected to the Information Super Highway (the Internet). Additionally, ECSU now has several visualization software packages and has access to several other visualization software packages through the state of North Carolina Super Computer Center in Triangle Research Park. The workstations also have a CD ROM DRIVE for putting software on the workstations. The workstations are also connected to a server. ECSU has provided a large laboratory/classroom (room 122) in Lester Hall, the Mathematics and Computer Science Building for the CSSV-Lab. This Lab is sufficient for research training and for research activities.

D. FUTURE PLANS

Room 122 Lester Hall, which has become ECSU's CSSV-Lab, is being projected to be the corner stone for a structured and sustained research and research training program in computational science - scientific visualization in mathematics, computer science, and the sciences at ECSU. Future efforts will be focused on developing the research thrust.