Proposal for Quality Enhancement Plan Project
Cover Sheet

Department Name: ELECTRICAL AND COMPUTER ENGINEERING

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We understand that the project proposal elements listed below must be included in all proposals considered by the UWF Quality Enhancement Steering Committee. Refer to the Rubric for Evaluating Programs for guidance in developing each program element.

- Abstract (100 word limit)
- Project Rationale
- Relationship to the University's QEP Goals (See Appendix A)
- Project Student Learning Outcomes Associated With This Proposal (See Appendix B for University level outcomes for Project Management)
- Instructional strategies and evidence of rationale for their selection
- Assessment Plan for the Project. (How will student learning be measured? See Appendix C For Suggested Format for SLOs. How will the success of the project be measured? What is the relationship of this assessment to the University's outcome assessment effort?)
- Plan for Formative Assessment (how will ongoing assessment be used during the life of the project to improve the process and/or outcomes?)
- Information Dissemination Plan (How will the strategies and results be shared with the campus and the broader academic community?)
- Institutionalization Plan (How likely is that this project be extended to other programs/disciplines? How can this project be institutionalized at UWF?)
- Resources Needed (Include all resources required. See Appendix D for suggested budget format. Budget requests should be specific and appropriate to the project. Budget requests should be for direct support of the project. Budget requests should be thoroughly justified.)
- Timeline for Project Activities and Events (What is the sequence of project activities? Include proposed implementation date.)

We understand that the UWF Quality Enhancement Plan Steering Committee will recommend funding only if the project is consistent with the intent of the University's Quality Enhancement Plan. We further understand that all funds must be expended in accordance with the terms and conditions of approval.

__Rachid Manseur____	_____	_____	_____
Print name of contact person	Signature	Date	Phone
_____	_____	_____	_____
Department/Division Head	Signature	Date	Phone
(Signature signifies departmental endorsement of the project.)			
_____	_____	_____	_____
Dean/Vice President	Signature	Date	Phone

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Date and time application was received: _____

Signature: _____

University of West Florida Quality Enhancement Plan

Project Proposal Narrative

Project Title: Project Based Engineering Knowledge Integration

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Abstract

The Robotics Laboratory at UWF offers undergraduate students the possibility to actively engage in challenging projects that require integration of knowledge obtained in a variety of courses in their curriculum as well as their own experiences. Students are tasked with project management and collaborative design of autonomous systems including robotic underwater, aerial, and ground-based machines. Many of these projects are designed for national and international competitions and presentations that allow a comparative assessment of UWF students' level of technical education and communication and presentation skills to those of students of many other institutions. The cross-institution comparative assessment feature of these projects offers a strong measure for accreditation.

Project Rationale

Robotics is a multidisciplinary field of science and technology that requires knowledge from mathematics, physics, computer science and engineering among others. UWF has established a small robotics lab as part of its electrical and computer engineering program to promote project-based learning and knowledge integration and offer a platform for undergraduate students to engage in these projects. Many of the robotics projects require that a web site be established and an article be submitted that describes the design and development effort. The students are also required to give oral presentations to describe their projects and answer questions from judges, other participants, and the general public. These aspects of the projects allow students to actively develop their written, technical, graphical, and oral communication skills as well.

Students engaged in robotics projects generally work in teams. They choose a team captain and learn to manage their projects, divide tasks, and cooperate to design, develop, demonstrate, and present their work all under the guidance and supervision of a faculty member.
Current robotics teams include the Unmanned Underwater Vehicle (UUV) team which is comprised of 8 students, the newly formed Unmanned Aerial Vehicle (UAV) team with six students, and four students working as two teams on the design and development of mobile autonomous robots for a yearly competition organized by the Institute of Electrical and Electronics Engineers (IEEE). Other students are engaged in smaller robotics projects as well either for individual study credit or for the ECE capstone design course credit.

The main characteristics of robotics projects are:

- The problem statement is established by a national or international organization that is external to UWF. For example, the Unmanned Aerial and Underwater vehicles projects are issued by the Association of Unmanned Vehicle Systems International (AUVSI) [9] and the student hardware competition is organized by the IEEE [10].
- Projects inherently require active learning as students are confronted to unfamiliar problems that lend themselves to a variety of design solutions. Successful completion of a project requires many choices in equipment, components, strategy, and general design.
- Student progress in a given project is subject to an established schedule with pre-arranged milestones and regular verifications.
- The project typically requires that students work in teams and learn to manage, divide tasks, and cooperate. While students work on different subsystems or parts of a project, they must cooperate to make sure that each component interfaces well with all others. Students learn not only to be responsible for their own part but also to depend on the work of others.
- The project requires knowledge integration and acquisition. This engages students in seeking needed information and learning on their own thereby promoting the need for life-long learning.
- Projects provide a high level of motivation to learn because they give students a well-defined objective that requires them to learn. For those projects that relate to a competition, students are further motivated by the competitive nature of the project.

A short description of typical projects at the robotics laboratory follows.

UAV Project. The students, working as a multidisciplinary team design and build a model airplane fitted with the necessary autopilot control electronics and mechanics for the plane to fly autonomously using GPS, a compass, and an inertial attitude and acceleration sensor. Students must apply their own knowledge and, where insufficient, acquire on their own the necessary knowledge, to complete the project. For example, ECE students must learn about aerodynamics and airplane control. This project is a recent addition to the

robotics laboratory activities. For more information, please see the team's web site at http://uwf.edu/uavteam

UUV Project. The autonomous submarine team is tasked with the design and development of a submersible capable of reacting to changes in its underwater environment while completing a pre-programmed mission. This project requires vehicle control and the integration of several sensors including sonar, compass, depth and attitude sensors, and computer vision. Many of the subsystems are outside of the undergraduate curriculum and students must research and acquire much of the knowledge needed to complete this project. For more details on this project, please see the UWF-UUV team's web site at http://uwf.edu/subteam

IEEE Student Hardware project. UWF has been sending a team of two to six students to participate in the annual IEEE southeast conference nearly every year for several years. IEEE provides an engineering problem to be solved by the design and development of a small robotic device acting autonomously on a track. The problem specifications change every year. ECE students have obtained some success in the past ranking first, second, and third out of about twenty participating engineering schools at different times. As an example of the challenges offered by these projects, the specifications of the 2007 IEEE southeast conference student hardware competition are available at http://southeastcon.org/2007/doc/SoutheastCon_2007_Hardware_Rules.pdf

Relationship to QEP Goals

The Robotics projects described above relate directly to the stated goals of QEP. When engaging in robotics projects:

1. Students must manage a well defined project from inception to full operation while greatly improving their knowledge and learning skills.

2. In robotics project management, students must elect a team leader, assign and assume tasks, define goals, actively engage in learning, and regularly assess their work with their teammates and their faculty advisor.

3. Faculty and staff involved in the supervision of robotics projects have the opportunity to improve and refine project management and student involvement based on yearly assessment of general projects operations and results. This includes refining project scheduling, advising teams to modify their priorities, and resolving team friction if necessary. For example, observed lack of aeronautic knowledge on the part of the UAV team may lead the faculty supervisor to organize a series of short lectures on aeronautics and airplane control given by an invited local expert on the subject.

Project student learning outcomes

The ECE department, as part of its accreditation efforts, has established a list a student learning outcomes. Many of these outcome overlap significantly with the Academic Learning and Project Management outcomes listed in Appendix B of the proposal template. The following Includes those outcomes that students involved in the robotics projects will satisfy.

- Engage in project management
    - Work assignment in accordance to established priorities
    - Strategy and Task identification for efficient results
    - Timely delivery of partial results

- Function effectively on multi-disciplinary teams. Practice reliability and dependence on the work of others for overall project success.

- Recognize and apply concepts, principles and theories of core electrical engineering topics: basic circuit analysis, electronics, digital logic design, electric power and computer programming.

- Use modern engineering techniques, skills, and tools, including computer-based tools for analysis and design of electrical engineering problems.

- Apply knowledge of mathematics, science, and engineering to the analysis of electrical engineering problems.

- Design and conduct scientific and electrical engineering experiments, as well as to analyze and interpret data.

- Identify, formulate, and solve novel electrical engineering problems, including the planning, specification, design, implementation, and operation of systems, components, and/or processes that meet performance, cost, time, safety, and quality requirements.

- Communicate effectively in writing and convey technical material through oral presentation of electrical engineering topic and interaction with an audience.

- Recognize and apply concepts, fundamental theory and practice of computer science and electrical engineering, as it applies to computer hardware and software, and identify the interaction between hardware and software

Instructional /learning strategy enhancements

Students work on the design and development of a project that satisfies specifications given national or international organizations such as the IEEE or the AUVSI. These problem specifications typically lend themselves to several different engineering solutions forcing students to make choices at many levels. Students are therefore given a task that they have not been specifically prepared for, to accomplish in a limited period of time. In this situation, students must engage in active learning as they are required, not only to put into practice the training and knowledge they have already acquired, but to learn about any other topics required for successful completion of the project.

The instructional strategy consists in leading the students through brain storming sessions where several ideas are compared and debated in order to emerge with a project design strategy, and then through several technical and strategic discussions during the development of the project.

Students consult regularly with the faculty supervisor and with their teammates and engage in periodic review of their design and development choices.

Assessment Plan for the Project

The assessment plan for the robotics projects is multi-faceted and includes the following assessment tools:

1. Students are required to maintain an activity log book in which they record their work and progress on the project.
2. Students have to give a presentation on their project.
3. Students submit a project report or article describing their project and their results [5] [6] [7].
4. Students must demonstrate their working projects to the faculty supervisor.
5. Student typically participate in competitions where their projects are contrasted to those of students from several other engineering schools. The students' ranking at these competitions serves as an external assessment measure.
6. Students have to establish a web site describing their design choices and results [1] [2] [3].

Plan for Formative Assessment of the Project

The faculty supervisor is given an opportunity to assess progress for each team of students through regular bi-weekly or monthly meetings with each robotics team to discuss recent activities and project improvement, difficulties, or other issues that may arise in the team's work. Project progress, goals and outcomes, team organization, and other issues are then assessed, reviewed, and if needed, modified. Faculty guidance and assistance is provided accordingly.

Information dissemination plan

Robotics projects are impressive due to their high technology, novelty, and modern applications. In general, they attract much attention from the media and the public. In the past few years, there have been several news articles, faculty television interviews, and public demonstrations of robotics projects that have served to disseminate information about the UWF robotics projects within the campus and the community. The following lists possible proven venues for dissemination that will continue to be pursued:

- ECE Department open houses. On some occasions, the ECE department invites the campus and local communities to visit the department laboratories and distance learning classroom. Robotics projects, completed or in progress, are featured and demonstrated by their student designers.
- Fall Frenzy. Robotics projects are now a constant feature and display at the student Fall Frenzy and have resulted in students from other departments and colleges joining robotics teams.
- The UWF news media, UWF-TV, the Voyager, UWF main web page, and other UWF publications will be alerted to the achievement, participation, and demonstration venues of robotics projects as they occur.
- UWF robotics projects will be used in recruiting trips to middle and high schools to help generate student interest in science and engineering.
- The Pensacola News Journal has published several short articles on robotics projects at UWF and will continue to be alerted to these events as they occur [8].
- Local television stations, Channel 3, in particular, cover a few robotics events and projects at UWF.
- Faculty publications on the role and importance of project-based learning based on robotics projects are published in national and international conferences [4].
- Robotics teams set up web sites for their projects [1] [2] [3].

Institutionalization plan

A plan for institutionalization of the robotics lab activities considers the following options:

- Development of a project-based robotics course that will teach students the fundamentals of design and realization of robotic devices.
- The establishment of a certificate in robotics option for students. Students interested in robotics can complete a set of courses and labs and be awarded a certificate in robotics to accompany their diploma.
- Encouraging students from other majors in the sciences to joint robotics teams. In particular, students in Mathematics, physics, computer science, and even in business can contribute to the teams' activities.

Resources needed

The requested funds will be used to assist in supporting all the robotics projects rather than completely fund one particular project. Therefore the funds will be distributed based on project needs among the different projects discussed previously and cannot be divided exactly in pre-set categories. The budget distribution listed below is based on estimates and is limited to a total of $5000.00

Budget Item	Description	Unit Cost	Total Item Cost
Parts and components	**Electronic and mechanical items needed for robotics projects**	**$1000**	**$1000**
Services	**Machining, painting, assembly, and manufacture of mechanical frames and other components.**	**$2000**	**$2000**
Student travel	**Student teams travel to robotics competition sites nationwide**	**$2000**	**$2000**
Total			**$5000**

Timeline for project activities and events

Students work on their respective teams all year round. A typical yearly project timeline follows:

August	Teams are formed and organized. A team captain is elected
September	Teams are appraised of the problem specifications of their respective projects and develop an initial project development strategy.
October 2006	Teams finalize a project solution strategy and provide a preliminary high level design proposal to the faculty advisor.

Nov. to Jan.	First development phase. Parts, components, and frames are acquired and subsystems are assembled. Initial programming for each subsystem is developed.
Jan. to Feb.	Final development and integration of the project.
March	Initial project testing and demonstrations.
April to August	Project presentation and participation in project competition.

References

1. UWF sub team. http://uwf.edu/subteam
2. UWF AUV team. http://uwf.edu/uavteam
3. UWF Robotics Laboratory. http://uwf.edu/ria/robotics
4. **R. Manseur**, " Hardware Competitions in Engineering Education," Proceedings of the 2000 IEEE Frontiers in Education Conference, Kansas City, Missouri, October 18-21, 2000.
5. D. Eaton, M. Bobbitt, G. Jarvis, N. Matzer, M. Bloechl, A. Loggins, C. Hunt, J. Showalter, **R. Manseur**, "The Nautilus: Evolution of an Autonomous Underwater Vehicle," 6th Annual Association of Unmanned Vehicle Systems International-Unmanned Underwater Vehicle Competition Journal Paper. San Diego, CA, July 2003. 9 pages.
6. D. Eaton, M. Bobbitt, M. Reid, G. Jarvis, S. Frame, J. Dowling, , M. Bloechl, M. Mentzer, **R. Manseur**, "The Nautilus-Sub Autonomous Underwater Vehicle" Journal paper for the Association of Unmmaned Vehicle Systems-Unmanned Underwater Vehicle Competition. July 2002.
7. K. Fagan, Q. Le, A. Kilpatrick, **R. Manseur**, "Louis, an Autonomous Submersible," Journal paper for the Association of Unmmaned Vehicle Systems-Unmanned Underwater Vehicle Competition. Orlando, FL. July 6-9, 2000.
8. Allison Mc Crary. "Reading Writing & Robots. Brown Barge youths build machines after visiting UWF" Pensacola News Journal article. Jan. 25, 2005 issue.
9. IEEE 2007 Southeast conference student hardware competition specs: . http://southeastcon.org/2007/doc/SoutheastCon_2007_Hardware_Rules.pdf
10. AUVSI. Association of unmanned Vehicle Systems International Student competitions web site: http://www.auvsi.org/competitions/