COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Virginia Tech

Electrical and Computer Engineering

Major Design Experience

Sponsor Handbook

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Major Design Experience Sponsor Handbook

This document provides information and serves as a guide for prospective and returning sponsors of projects for the Electrical and Computer Engineering (ECE) Major Design Experience (MDE) at Virginia Tech. This document applies to projects sponsored by external organizations as well as by Virginia Tech faculty.

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The ECE Major Design Experience

The Major Design Experience (MDE) is a two-semester sequence of courses that provides students with an "industry–like" experience emphasizing technical, management and professional development. Students are enrolled in ECE 4805 and ECE 4806 where they work in small teams to complete engineering projects sponsored by industry or a faculty member. Also called "senior capstone design", students learn and put into practice skills such as teamwork, project management, communications, ethics, and engineering professionalism.

MDE Outcomes

Customer sponsored projects are critical to the success of the MDE program. Projects should enable students to achieve the following learning objectives:

- Identify, formulate, and define an engineering hardware or software problem with multiple, realistic constraints
- Apply engineering design to produce solutions that meet specified needs, including public health, safety, and welfare, as well as global, cultural, social, environmental and economic factors
- Develop and present oral and written technical reports and presentations for a range of audiences and review and revise written and oral communication
- Function effectively on a team environment on a real-world project, interacting with external stakeholders
- Establish goals, plan tasks, and meet objectives
- Acquire and apply new knowledge using appropriate learning strategies, for example, establishing the state of the art by performing patent searches and other research, including evaluation of the accuracy and trustworthiness of information
- Assess and apply an ethical approach to the design process

Sponsors

MDE projects can be sponsored by organizations external to VT, VT affiliated organizations, or VT faculty. Faculty of other colleges and universities are encouraged to contact the MDE course director or an ECE faculty member to discuss the potential of a collaborative partnership through which a project might be arranged.

All project proposals are subject to the approval of the MDE course director.

Students

The MDE program prepares students by using elements of engineering best practices in project management and design. Students are organized into 4-5 person teams to provide a balance of skills and experiences. ECE conducts two MDE cohorts a year. One cohort starts in August and graduates in May, while a second cohort starts in January and graduates in December. The course structure is identical for both cohorts.

MDE Roles and Responsibilities

Each MDE project is executed by a collaborative triumvirate. While the students in the design team are at the core of the project, they are supported by their project's customer, a subject matter expert (SME), and a mentor.

Student Design Team

Teams consist of 4-5 students. These students are typically seniors in any of ECE's 14 majors and have completed most of their course work. Typically, these students are full-time (in other words, taking other classes) as they work on their MDE projects.

Students are assigned to projects based on interests and skills. They then organize their responsibilities and plan their project as a team. The minimum requirement is that one of them will act as the Team Lead, but this role may be switched after the first semester. The Team Lead interfaces with the sponsor, the SME, and the mentor. The team leads are also responsible for running meetings and monitoring the team's budget.

Sponsors and Customers

Organizations that sponsor projects often nominate an engineer or project officer to engage with the student design team. This person is called the customer, and they provide the project's problem statement and requirements. Throughout project, they meet with the students to monitor progress, answer questions about the student's implementation, and provide feedback on prototypes and presentations.

Customers typically spend an hour or two a month in video calls with the students. Customer satisfaction is a factor considered in the students' final grade.

Subject Matter Expert

The SME is an experienced engineer, faculty member, or researcher who provides information and guidance to the student team. The SME consults and advises the students on their designs and tests, helping them implement according to best practices. While the SME is usually a faculty member or a doctoral candidate, it is not uncommon for industry sponsors to also provide SMEs.

SMEs meet with the students at least twice a month to answer questions, review designs, and advise on test plans. It is not uncommon for SMEs to meet more frequently at certain phases of the project. The SME provides input to the students' final grade.

Mentor

Each student team is assigned a mentor. This person is an ECE faculty member. They oversee several teams at the same time and are responsible to:

- Communicate course objectives
- Monitor design team progress and customer relations, foster open communication
- Coach and advise students on their project and academic performance
- Resolve issues within student teams and between students and external contributors
- Evaluate student performance and assign grades

The Project Lifecycle

Defining an MDE Project

Projects should be:

- Technical in nature, require an application of engineering standards, and involve elements of design, implementation, and testing. Research reports are not acceptable MDE projects.
- Supportable by the customer in terms of time and manpower to work with the students.
- Outside of the sponsoring organization's production workflow. MDE projects have a strictly defined timetable of milestones and deliverables that cannot accommodate other deadlines.
- Feasible to be completed by 4-5 students over the course of two semesters.

Projects proposals utilize the form in Appendix A and are emailed to Mrs. Afroze Mohammed (afroze.vt.edu) or Dr Joe Adams (wjadams@vt.edu).

Project Funding

Sponsors are asked to provide $7,500 per project team. This amount is to help defray the costs associated with MDE such as, but not limited to: instrumentation, components, fabrication, travel, printing, and so forth. Payments are due Net 60 Days after a project team has been finalized.

Intellectual Property and Non-Disclosure Agreements

Students may not sign any Intellectual Property agreements. Students may not sign any Non-Disclosure agreements. These are ECE departmental policies and there are no exceptions. No project work may include elements that are deemed For Official Use Only, Proprietary, Sensitive, or Classified.

Citizenship Requirements

The Sponsor may specify that their project team be comprised of US citizens or US persons (permanent residents).

Project Execution

As mentioned earlier, ECE runs two cohorts of MDE each year. Over the course of two semesters (totaling 30 weeks), a cohort progresses their project to achieve the following milestones:

1. Project selection and team formation
2. Problem definition and requirements analysis
3. Preliminary design review
4. Detailed design
5. Critical design review
6. Protoyping
7. MDE Expo

Each milestone is described below.

Project Selection

During the first week of their first semester of MDE, students review the descriptions of all the projects accepted for their cohort and rank order their choice. They are placed in teams based on their major and interest in a project. Once placed in a team, they cannot change projects.

Problem Definition and Requirements Analysis

Working with their customer, the project team distills a problem statement from the proposal that defines the project's purpose, impact, and outcomes. Using that statement, they elicit and refine requirements that meet the customer's needs and comply with engineering standards and other regulations.

Preliminary Design Review

The students create a module-level design that satisfies the project requirements. They document test cases to ensure both verification and validation of each requirement. They also present an initial project plan that details their implementation of the project through delivery. This milestone is a formal presentation, accompanied by documentation, to the mentor, the SME, and the customer.

Detailed Design

Once the preliminary design is approved, the team progresses to create a detailed, component-level design of their solution. They evaluate alternative solutions and use that evaluation to make recommendations on their design. They also document use cases and test plans they will use to validate their solution. The detailed design document is essentially the blueprint for their solution.

Critical Design Review

The team considers their detailed design and revises their previous project plant to incorporate the additional tasks and time constraints. Delivered to the mentor, the SME, and the customer at the end of the first semester, this formal presentation maps out their solution's implementation.

Prototyping

As the team works on its project, it is required to prototype aspects of their solution to demonstrate the viability of their design. Prototypes are required at the Preliminary and Critical Design Reviews in the first semester. In the second semester, students are encouraged to plan for two-week sprints of development and testing to continually implement and demonstrate their design.

MDE Expo

The MDE Expo is the culmination of the project. The team presents their results in a technical presentation, accompanied by a poster session and demonstration. Mentors grade these activities. SMEs and customers are encouraged to attend. More information on the MDE Expo can be provided by the MDE course director or the team mentor.

Appendix A: MDE Project Request Form

Project Request Form

[Customer Input] Company Project Title Here

POINTS OF CONTACTS: [Customer Input] Name, Email, Name, Email

DATE: [Customer Input]

1.0 Project Description

[Customer Input] Please provide a short description of the work to be completed, including clearly defined goals, deliverables, and potential impact. Include why this project is important to your company.

2.0 Technical Complexity

[Customer Input] Please indicate any special skills or desirable course backgrounds that students should have in order to contribute to the team. Please indicate if there are any restrictions on student citizenship

There are three categories of restrictions:

- US Citizen only
- US Citizen or Permanent Resident (also called US Persons)
- All students, no restrictions

3.0 Resources

[Customer Input] Please indicate any special equipment or software required.

4.0 Mentorship

[Customer Input] Please indicate your availability to act as a Subject Matter Expert and guide the team if needed.

5.0 Terms and Conditions

5.1 Work Location

Projects will be performed in Virginia Tech Labs, Blacksburg, VA, unless other arrangements have been negotiated. The student team is encouraged to visit the customer provided their travel authorization is pre-approved by the class instructor.

5.2 Best Effort Basis

This work scope is to be performed on a best effort basis.

5.3 Handling of Restricted Data

Students, faculty, and administration are prohibited from signing any Intellectual Property agreements or Non-Disclosure agreements. These are University policies and there are no exceptions. No project work may include elements that are deemed For Official Use Only, Proprietary, Sensitive, or Classified. Posters will be publicly displayed, and Project Notebooks will be publicly available. The Sponsor has the right to specify that their project team be comprised of US citizens; however, this does not imply allowance of Import/Export restricted information flow. Students nor faculty nor administration can receive ITAR restricted information or data. Should a company require approval of the Poster or other materials before public display, it is the responsibility of the Sponsor to ensure that such approval is secured in a proper and timely fashion and according to the requirements of the Sponsor's firm. Sponsoring companies must assume widespread discrimination of provided technical and project information. This includes other students, faculty, administration and even competitors in the marketplace as this is a totally open project. In any event, VT shall be held harmless for the public display of project materials.