

Overview

Each design project team will choose a biomedical instrument or service[†] (hereafter referred to as a ‘product’), study the relevant technologies, analyze the business potential for a new product, and develop a design concept for a new/improved product. Teams should approach this project as if they were planning to start a company to produce their new product.

[†] A *service* is a capability provided by manpower, software, etc. to facilitate biomedical applications. Your project may focus on a service rather than an instrument as long as the service can be linked in application to an existing or anticipated biomedical instrument.

Example Project Areas

The following list provides some example biomedical applications and instruments that your project could target. There are many suitable choices not on this list.

Applications

- sleep disorders; avoidance of sleep while driving
- advanced warning of strokes or heart attacks
- blood analysis (for one/several important biochemical markers)
- sports medicine -improving performance, physical therapy
- biomedical instrumentation training kits (new lab experiments)
- medical monitoring instruments for infants

Instruments

- retinal implants
- breath analyzers
- hearing aids; silicon cochlea
- personal heart-rate monitors; in-home monitoring services
- prosthetic limbs; neural interfaces for prosthetics
- wireless interfaces for implants or body area sensor networks

Design Project Requirements

Project will be done in teams of 3 students. Each student is expected to contribute an equal share of the workload. How the project tasks are divided among students is up to each group to decide.

Projects must address the following three areas

- Technology Assessment
 - identify existing technologies to address your chosen biomedical application
 - assess weaknesses/limitations of existing technologies
 - research upcoming technologies to address weaknesses/limitations
 - * propose new technology to advance your chosen biomedical application
- Market Analysis
 - identify the market (potential customers) for your product
 - identify businesses that do/could compete with your product
 - * prepare a business plan for a company to develop your product
- Product Design
 - propose a new product/service to address your chosen biomedical application
 - develop your design concept with technical illustrations, simulations, etc.
 - * implement your product/service or some component(s)/feature(s) of it

All projects should address the basic elements of all three areas and provide a more in depth effort into at least one of the areas. The starred (*) items are examples of more in depth effort. When reporting/presenting your project, you should always note which of the areas were in depth for your project.

Grading

Design projects are 25% of your overall grade. Overall project grades will be divided into the following components

50% Project Quality 25% Presentation 25% Report

Deliverables

- Wed. Nov 3, Confirm project area
 - Submit by email to Prof. Mason your tentative project title, project team members, and 2-3 sentence description so that the instructor can confirm your project is suitable for the class.
- Mon. Nov. 15, Project Overview (HW6)
 - 2-3 page overview of project objectives and work plan to achieve these objectives. Details provided later in HW6 assignment.
- Wed. Nov. 24, Project Status Report (HW7)
 - ~1 page report of progress toward your project goals. Details provided later in HW7 assignment.
- Dec. 6, 8, 9; Presentation
- Wed. Dec. 15 (noon), Final Report

Important Considerations

- Start early! HW6-7 should assist in encouraging you to start making progress ASAP.
- If you need components for a model/demo circuit, generate a parts list ASAP so we can order what you need (and ensure it's available and within budget)
- Divide and conquer: It is suggested that you organize your activities so each individual can make progress toward project goals without needing the whole team to meet. Periodic team meetings can assist in keeping individual tasks progressing as planned or address unexpected complications.
- Keep it fun! This is a chance for you to pursue next-generation "stuff" and explore areas outside your normal coursework, like business plans. Hopefully you will have a lot of fun while learning and expanding your understanding of biomedical instruments.
- Although your project should be fun, it will be graded. So make it good! Projects will be ranked based on the effort, detail, and depth shown in your presentations and reports, and grades will be assigned on how well you did compared to the other teams. So have fun, but work hard!

Presentation Guidelines

Each team must prepare and deliver a ~15 min presentation of their project to the class on the week of Dec. 6. Each member of the project team must participate in the preparation and delivery of the presentation.

Cover the following aspects (you can adapt the order of presentation to your project)

- Motivation
 - describe and quantify the application area or biomedical instrumentation problem your project is addressing (how many people affected, how many lives lost per year, etc.)
 - outline the "background", related work done by others to solve the application/problem your project seeks to address
 - define the challenges that your work will address (or open problems you plan to solve)
 - define the goals of your project and outline your methodology (how you planned your approach to solve the challenges)
- Technology review
 - give detailed analysis of the technology(s) related to your project, highlighting strengths and weaknesses
 - describe new and/or forthcoming technologies in the field
 - (if applicable) describe the new technology you have developed to enable your product
- Business/market analysis
 - identify companies working in the field of your project, highlighting strengths and weaknesses

- expand on market for your product (what is the cost or similar products, how many are sold annually, etc.)
- (if applicable) present a business plan for starting a new company to produce your product (how/where will it be manufactured, how will it be advertised, etc.)
- Product design
 - describe in detail the product you have designed
 - demonstrate how it solves the challenges and meets needs
 - (if applicable) describe and demonstrate the prototype you have developed
- Conclusion
 - summarize the motivation for and results of your project, highlighting how you have solved key challenges and/or developed a new product that will have impact on biomedical instrumentation

Final Report Guidelines

Each team should submit one final report by email to Prof. Mason by 12pm-noon on Wed Dec 15 (finals week). The report should be type-written and should include a cover sheet with your project title and names of all team members. It should be generated in a single electronic file (PDF or MS Word) of reasonable size (~< 3MB). If you include any material from other sources (text, figure, etc.), you must provide a complete reference citation. Also, please double check for typos and spelling mistakes: 25% of your project grade is based on the *quality* of your report.

The report should cover the same aspects outlined above for the presentation but written out in paragraph form and presented in a professional manner. Try to keep your reports as concise as possible while still providing the details necessary to understand the motivation, methodology, and results of your research and design efforts. Include figures, embedded or appended, with descriptive captions, to enhance your description or highlight features of your work.

Formatting

While there are no specific formatting requirements, you are encouraged to make your report look professional and easy to read. Use tables, figures, etc. to highlight important features of your work and break up long sections of text. Single or 1.5 line spacing and 10-12 point fonts are generally preferable. Good organization and clearly identifiable headings for sections and sub-sections are encouraged.

Team Assignments

Team 1:		
Team 2:		
Team 3:		
Team 4:		
Team 5:		
Team 6:		
Team 7:		
Team 8:		
Team 9:		

Exchange email/contact info and start planning now!