MIT Medical Device Design Course
2.75, 2.750, 6.4861, 6.4860, HST.552

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MIT Medical Device Design Course – Spring 2024 Call for Proposals

Calling healthcare innovators who want to build hardware!

We invite clinicians and industry sponsors to submit proposals to work with teams of MIT engineering students in our Spring 2024 Medical Device Design course.

The proposed project should entail a mechanical, electrical or combined challenge and fit within the constraints of a semester-long project. Past projects, listed here, have included surgical tools, rehabilitation devices, sports tech, medication compliance systems, diagnostics, clinical simulators, research tools and beyond! We look for a well-defined need, but space for creative problem solving.

Selection is competitive and if your proposal is chosen, from February – May you will work with a small team of eager engineering students and expert mentors. We follow a three-phase industry-modelled design process of Discovery – Development – Demonstration, which culminates in proof-of concept-prototypes. Project proposers *must* play an active role throughout the process and become part of our innovation community.

This course is offered jointly between Mechanical, Electrical Engineering and HST/IMES for graduate students, seniors and select juniors and, since 2003, has become an effective mechanism for prototyping new healthcare technologies, fostering research ideas and collaborations, sharing outcomes via peer reviewed conference and journal papers, and launching alums' careers in industry, startups, academia and medicine. Clinicians and other project proposers have gained valuable insights and also leveraged this work professionally.

Upon the close of this call, course staff will identify a subset that are suitable for pitching to the class. After the presentations, students will indicate their preferences and then the staff will form teams.

Key Dates

Two-page proposal deadline:	December 29, 2024
Submission via:	Course Website
Finalists notified:	January 19, 2024
Presentation to students:	February 7 & 12, 2024
Notification of teams	February 16, 2024

Proposal Guidelines

Your proposal is limited to 2 **pdf** pages, including pictures and references, and must contain:

1. Name, affiliation and contact information (direct phone & e-mail)
2. Background on the current clinical procedure, with pictures, links to videos and references
3. Statement of clinical challenge and its significance
4. Functional requirements of desired solution, but not a description of concepts already conceived
5. Disclosure of any relevant previous work (research notes, publications or patents filed)
6. Specific financial, facility and team resources committed to support the proposed project
7. Project continuation plan (if the prototype is promising)

We ask that proposers avoid specifying a particular conceptualized solution and, rather, present the problem as clearly as possible. Experience has shown that final solutions are more creative when the team starts with a blank slate and the proposer keeps an open mind.

Projects should require the development of new mechanical and/or electronic hardware and, while we are not able to support pure software development projects, software can be part of the solution.

Each project submission must have **one** clearly defined proposer, practicing in the area of the identified need, who will serve as the project champion and interface directly with the students. This person can facilitate interaction with other clinicians/personnel and resources as needed, but must be the lead contact.

Only **two** applications per proposer, per year will be accepted, so please choose carefully.

Do not hesitate to contact us to discuss shaping your proposal in advance or to seek further guidance.

Finalist Selection Criteria

Proposals are selected for presentation to the students by applying the following criteria:

1. Is there a well-defined need? In the past, the most successful projects began with a clear goal in mind, as opposed to projects that required significant research just to understand the need.
2. Will the students start with a clean slate? – There should be no obvious pre-existing solutions and, while proposers are encouraged to participate in idea development, they should not have settled upon an exact solution that they want built or have an existing device that only needs improvement.
3. Does the problem require the creation of new electronic or mechanical hardware? – The instructors seek to identify that a solution space exists within the realm of mechanical/electrical/biomedical engineering.
4. Can the solution be accomplished within time and budgetary constraints? – Working from problem to proof-of-concept device should take a student team on average 12-15 hours per week for the 14-week term. Parts, materials and custom fabricated components cost should not exceed a few thousand dollars.
5. Is the proposer ready to be an active team member? – Proposers must agree to frequent interaction with their teams and engaging in the design process as described in the following section.
6. Project Funding & Continuation – Preference will be given to projects where the proposer is able to provide financial support and/or has a clear plan for potential continuation. See *Path Forward*.

We will review proposals on a rolling basis and may reach out for clarifications. Proposers whose applications are selected as finalists will be provided with a PowerPoint template to assist in preparing a 10 minute “pitch” to the class. This should include ample time to answer questions. Students will indicate their top project preferences and then instructors will make the final selections and build teams consisting of 4 – 5 students. We aim to match our students’ interests and expert0000ise with each project’s needs.

Design Process

Once teams are formed, they will follow a fast-paced, efficient 14-week design process consisting of:

1. Understanding the clinical challenge and crafting of mission statement
2. Searching prior art and site visits, as appropriate, to understand current state of the art
3. Creating a set of *functional requirements,* capabilities that the prototype device should enable
4. Generation of potential Strategies to solve the problem
5. Analytical modelling, bench-level prototyping and experimentation to select the Strategy
6. Generation of specific design Concepts
7. Detailed mechanical/electronic design, with emphasis on the *most critical module* (MCM)

8. Fabrication and testing of the MCM and fabrication of supporting modules
9. Integration, testing and evaluation with respect to the functional requirements
10. Presentation and documentation, discussion of path forward, publication and IP (as applicable)

Responsibilities

It is essential that proposers are active team members throughout the course. *They must commit to meeting with students at minimum bi-weekly and to provide prompt hospital or laboratory access* to view procedures, engage in device testing in an appropriate environment and source equipment.

Each student team meets weekly, outside of class, for *design reviews* with course instructors. Teams assess the past week's progress, brainstorm solutions for current design challenges and help identify the crucial tasks for the next week. Course staff serve as mentors and technical advisors. Proposers are welcome (encouraged) to join these meetings, as well as classes, and generally enjoy participating in the design process.

The fuller the participation by the proposer, the more fruitful the experience for everyone!

Deliverables & Publications

In May teams will demonstrate their final prototype to a clinical and industry audience and proposers are encouraged to participate in these presentations.

Every team writes a conference-ready paper, which includes the project proposers and team's mentors as authors. We will work post-course to submit good papers to conferences / journals, including ASME, IEEE and clinical publications. Open access fees will be the responsibility of the project proposer.

Teams will also prepare a 1-page summary or may create a video demo of the prototype's function.

Intellectual Property

Project proposers are required to disclose any preexisting IP related to the project.

IP is sometimes generated in this course and *it is essential that all team members keep bound, signed and witnessed design notebooks to record individual contributions*. The more engaged a project proposer is, the greater the likelihood that he or she will contribute specific claims (features) and be considered an inventor if IP is filed. US Patent law states that merely framing the problem does not make someone an inventor.

IP should only be filed when there is a clear path forward for a technology, commercial interest and a committed team. We are guided by the MIT Technology Licensing Office and our officer Bennett Rockney, brockney@mit.edu

Path Forward

While clinician proposers are not required to provide financial resources for prototyping during the class, further *project funding is not available.* Moving forward from a proof-of-concept is surprisingly expensive. We especially welcome projects where the proposer has current (grant or commercial support) or has identified *specific* funding opportunities, where the work from the course would directly support an application. Course staff are happy to provide pointers and advice, but the proposer must lead this effort if it is to be successful.

Questions?

For proposal questions contact Nevan Hanumara, PhD: hanumara@mit.edu, +1.617.258.8541

The course staff can be contacted at: 2.75-staff@mit.edu

We look forward to receiving your proposals!
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Updated November 13, 2023