Engineering Tripos Part IIA Project, GM1: Multidisciplinary Design, 2024-25

Leader

Dr P J G Long [1]

Timing and Structure

Lent term: Wednesday 2-6pm (wks 4-5 + 7- 8) Easter term project period: Thursdays 9-11 & 2-5pm (wks 1,2,3) , Mondays 11-1 (wks 1.2) Thursday 1-4pm (wk 4)

Prerequisites

One (or more) from 3C8/3F2/4C4/3F8 useful but not essential.

Aims

The aims of the course are to:

- Understanding the requirements of medical device design
- Obtain an introduction to rapid analysis of design requirements
- Experience the planning and development of the prototyping/testing stages of designing a product
- Experience of using manual and computer based design tools (as required) 2D/3D CAD systems, FEA, CAM, standard and 'bespoke' DAQ & sensor systems, electrical/electronic CAD and simulation
- To assemble one or more prototype systems, using: ?Additive/Subtractive rapid manufacturing techniques ?PCB manufacture ?Sensors ?Low cost/low power micro-controllers where appropriate

Content

Working with mentors from local consultancies, NHS, care organisations and CUED staff, student teams will be tasked with developing a concept and prototype for a new 'medical' product for use in the heathcare, e.g. NHS, medical research, Assistive Technologies, care homes or domicillary care.

The brief will be relatively open but it is expected that each task will require a range of engineering techniques, typically inc.,

- Mechanical Design
    - Materials
    - Mechanism design
    - Ergonomics
- Electronic Design inc
    - Sensors
    - Signal conditioning
    - Data Aquisition
    - Use of microprocessors
- Software
    - Data Analysis using statistics/AI/ML
    - UI Design - development

Support will be given in the form of a number of short lectures/videos/documentation - given by staff and mentors on

- medical device design,
- project planning,
- presenting
- use of specific commercial software(where appropriate)
- Use of AI/LLM/.. in engineering design. Students will be encoraged to inverstigate the use of AI reources to undertake their project.

Mentors and staff will be available during the sessions/on-line,

Feedback from the stakeholders will be available in person/text/on-line, depending on availability

The project ends with a poster/presentation event, held a the begining of the last week of the Easter term project period, for the mentors and interested stakeholders

NB The project only runs for 3 weeks + 1 day during Easter, rather than the normal 4 weeks+1/2 day.

NB The team nature of the project means that the it is important that all members of each team are available for all the timetabled sessions, especially those in Lent term, expected to be Wednesday afternoon 2-6pm, wks 4,5,7,8. If you think you may be unable to attend for any reason please add a note to the project coordinator when you apply for the project.

(For further details please contact the course leader)

FORMAT

Students will work in multidisciplinary teams of typically 4/5

ACTIVITIES

Lent Term

- **Week 1**
  - Introduction to Medical device design
  - Setting of tasks and teams
  - Initial research, brainstorming of ideas (Supported by mentors)
  - Generation of questions for stakeholders
  - Were appropriate access to test equipment/components
- **Week 2**
  - Discussions with, access to feedback from stakeholders, clincians
  - Introduction to NHS data systems and access
  - Problem investigation and concept development
- **Week 3**
  - Further concept development
  - Were appropriate, simple experiments
  - Planning of experimental stage during Easter term
  - Development of presentation and initial report
- **Week 4**
  - Submission of draft presentation
  - Team presentation of plans for Easter term sessions, inc
    - Work to date
    - Overall concept(s)
    - Plans/Timeline for Easter term

        - Resource requirements
    - Feedback session with mentors, stakeholders
    - Submission of team report (inc resource requirements, updated as required)

NB No scheduled work from the end of Lent until beginning of project period in Easter

Easter Term Project Period (typ starts week 3)

- **1st Week**
    - Access to requested resources
    - Start experiments and software development
- **2nd Week**
    - Further development work
    - Short interim report (individual)
- **3rd Week**
    - Coninuing work on prototype(s)
    - Draft poster
    - Lecture on poster design and presentation
- **4th Week** (First day only)
    - Lunchtime poster session
    - Team Presentations
    - Final report submission (Individual and team)

Further notes

Examples of previous projects

- Instrumented/data logging Walking sticks
- Automated system for detection of Urinary Tract Infections
- Automated antibiotic sensitivity system
- Next generation of Stethoscope
- Remote monitoring of ear conditions
- Real time monitoring of body fluid flows
- Chyme reinfusion
- Open data collection system for the NHS
- Music therapy for stroke patients
- Nutrition monitor
- Rehabilitation monitor
- Remote monitoring of physiotherapy
- Monitoring weight loss in the community
- Instrumented commode/weighing chair
- Automated reading of ward based instrumentation
- Active sitting for rehabilitation
- Instrumenting a walking frame
- Improving safety of a electric wheelchair
- Automated medical dipstick reader + data transmission ,
- multimedia remote with medical logging for the elderly/infirm

Coursework

Coursework	Due date	Marks
Presentation/Budget/Report	Lent: Term	15 (5 Individual,

	Wednesday week 8 (Last day of Lectures)	10 Group)
Interim report 2	Easter Term TBA	20(12 Individual, 8 Group)
(1) Poster Session / Presentation (2) Final individual report & Team documentation	Easter term (1) TBC, but normally Thur week 6 [First day of the 4th week of projects] (2) TBC, but normally Friday week 6, [4th week of project period]	45 (25 Individual, 20 Group)

Examination Guidelines

Please refer to Form & conduct of the examinations [2].

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Links
[1] mailto:pjgl2@eng.cam.ac.uk
[2] https://teaching24-25.eng.cam.ac.uk/content/form-conduct-examinations