FEEG2001 – Eurobot 2017 Project Outline

Project Overview
The overall aims of this project are to design, build, program and test an autonomous mobile robot as an entry to the Eurobot 2017 competition. The goal of this activity is to win the Eurobot (UK) Final on Thursday, 6 April (Week 8+ (Week 27)), win the UoS Final on Tuesday, 9 May (Week 11) and then go on to win the Eurobot World Final at the end of May 2017.

An example of such a robot from last year is shown below:

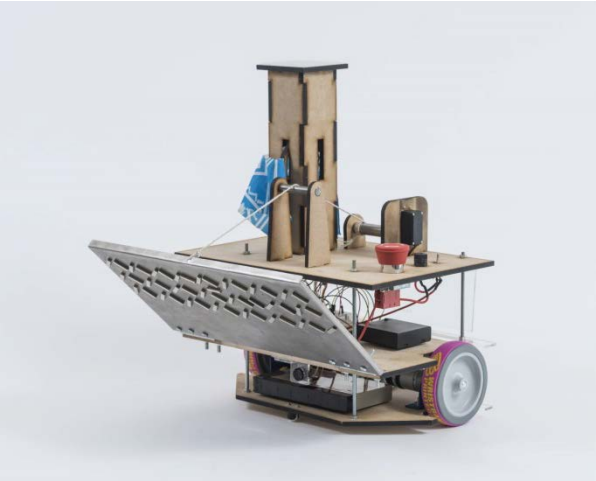


Figure 1 - An example of a mobile robot design from last year.

Components and Facilities
As part of this project, the RD02 drive system, the MD25 motor controller and a 12 V SLA battery will be **loaned** to each team and you will have access to various other components through the Design Workshop. You also each have an ARDX kit that was provided in Semester 1.

You will have timetabled access to the Design Studio (177/3011) at Boldrewood and access to the Design Workshop (177/2017) every Tuesday afternoon (14:00-17:00) during Semester 2 in order to undertake the work. As a student you will, in addition, be able to use space and equipment when available in the Design Workshop (13/1055), Design Studio (25/2045), EDMC Student Workshop (9/1036) and a designated area of the main EDMC workshop (9/1035), for self-manufacture, provided you **leave areas clean** and have sufficient skill with guidance from the Technician in the Design Workshop/Design Studio/EDMC Student Workshop, when they are available. Borrowed tools **MUST** be returned by the end of each day!

Technical support (177/2017) – Dave Hills

The Team
Your design team will consist of the five members of second year students, who you have selected to work with (see Appendix A). One of the first tasks is to select your team leader and a 2ic (second-in-command), this is the person who will assume responsibility for the team, should the team leader be unavailable or indisposed. I suggest that you select team member roles based on their strengths, interests and likely contribution to the success of the project.

Note: The team leader can be replaced **at any time** by the majority consent of the team, or at the request of the Project Leader (Dr Prior).

Team Name
The second task is to choose a Team Name. This should ideally consist of one or two words and should reflect both this year's competition format (Moon Village), the country of origin (UK) and where the World Final will be held (tbc). Try to be deliberately provocative, without being rude or crude. We like to tweak our European cousins, but not insult them!

Robot Controller
Although you have been introduced to the Arduino Uno microcontroller last semester, there is no absolute necessity to use this. Indeed, you can use Arduino, PICAXE, ARM mbed, Beagle Bone, Raspberry PI or any other microcontroller that you prefer. However, please note that the robot must be fully autonomous once started.

Eurobot Rules and Regulations
The Eurobot competition is a well-established, international event, consisting of teams from a number of countries around the world (not just Europe). As such, the rules are universal and apply to all teams that enter each year. The rules for this year's competition have been available online since October 2016, and a copy of this has been placed on Blackboard since the beginning of Semester 1. These rules dictate all the design constraints of this project. You **MUST** follow these rules explicitly, as failure to do so will **invalidate** your robot and may **prevent** your team from competing in the UK, UoS and World Finals.

Eurobot (UK) Entry – The Pilot Study
In order to enter the Eurobot competition, each team must complete a 'Pilot Study' and email this as a PDF to the UK organizer, Mr Michael Heeney (m.heeney@mdx.ac.uk) on or before **Tuesday, 7th February 2017** (cc'd to me also: s.d.prior@soton.ac.uk). The Pilot Study form is available on Blackboard under the Eurobot 2017 folder or via the Middlesex website.

Design Provisions
To assist with the design of the robot, a number of additional resources have been provided and are available on Blackboard:

- The Pilot Study – Eurobot Entry Form.
- The 2017 Rules.
- Guidance Files on Wiring MD25.
- Sources of likely components (Sensors & Actuators).

Eurobot Table
The Eurobot table and components have been manufactured in-house by Gordon Mills from the EDMC and is available for practice in the New Design Studio (177/3011). Please do not damage the surface of the table with your robot (castors are mandatory)!

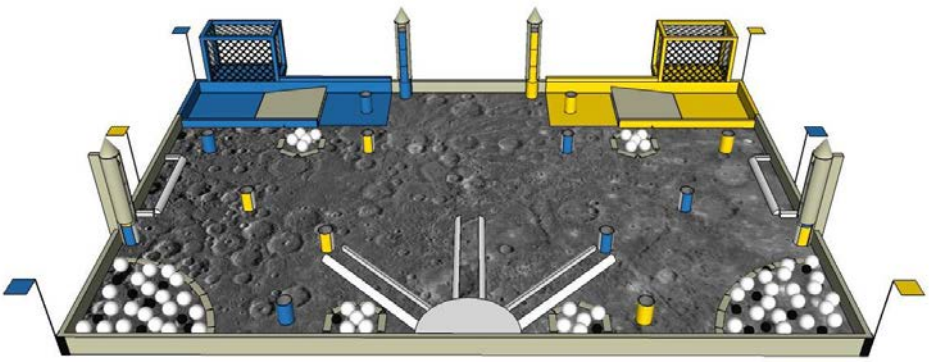


Figure 2 - Eurobot Moon Village Theme 2017.

Assessment Scheme
A total of 90% of the module grade for FEEG2001 will be assessed during this project exercise with the remaining 10% from the lab sessions attended during Semester 1.

The 90% will be broken down as follows:

- 10% - Conceptual Design Report – Week 2 (Friday, 10 February 2017)
- 0% - Interim Design Review – Week 4 (Tuesday, 21 February 2017)
- 0% - Poster (A3 Colour PDF - Portrait) – Week 8 (Tuesday, 21 March 2017)
- 0% - Eurobot (UK) Final – Week 8+ (Thursday, 6 April 2017) ****Note: During Easter****
- 50% - UoS Eurobot Final – Week 11 (Tuesday, 9 May 2017)
- 30% - Design Report – Week 12 (Friday, 19 May 2017)

Conceptual Design Report (10%) – Week 2 (Friday, 10 February 2017)
Each group must provide an initial conceptual design report by Week 2. This report should be around 5-6 pages in length and contain the following:

- Name of the team and a list of team members together with their roles on the project.
- General description (20%) – Outline of the robot(s) – dimensions, concept sketches, CAD.
- Strategy map (25%) – Illustrate the chosen route, with distances, timings and points scored. (A3 colour – Landscape).
- Technical description (20%) – Power supply, drive system, control, actuators/sensors, etc.
- Organization (20%) – An A3 (Landscape) Gantt chart using MS Project – outline what will be done, when and by whom – break down to individual actions and work packages. (A3 colour).
- Design innovation (15%) – Highlight the innovative elements of your chosen design.

The report should be emailed to Dr Prior as a single PDF by **4pm, Friday, 10 February, 2016**.

Interim Design Review (0%) – Week 4 (Tuesday, 21 February 2017)
Each group will attend a design review meeting with a number of staff members during Week 4. At this meeting they are expected to present a short PowerPoint presentation, illustrating all progress to date including:

- The final design concept and why it was selected.
- Any design analysis performed to date on the design.
- Progress against the project plan outlined in the conceptual design report.
- A demonstration of the system on the Eurobot table scoring at least one point.

As part of the review, groups are free to bring with them any physical components already manufactured and/or any control systems developed up to that point. The presentation must last no longer than 5 minutes and will be followed by up to 5 minutes of Q&A.

This design review is a formative exercise, so no marks will be awarded. However, this does not mean that you should not take it seriously; this review is an excellent opportunity for your group to get valuable feedback on your design and the progress to plan.

Issues and problems identified during this review may save you time later and improve the quality of your design.

At the Design Review, please submit to **Tim Woolman (Faculty Experimental Officer)**:

1. An interim assembly drawing with a table identifying the parts, showing how parts are designed to fit together, perhaps with a designed clearance (section views may help).
2. At least one interim component drawing of an original design - suitable views in 3rd angle projection.

Poster (0%) (A3 Colour PDF - Portrait) – Week 8 (Tuesday, 21 March 2017)
All groups are required to produce an A3 colour (portrait) poster to bring along to the Eurobot (UK) final, as well as the UoS final. The poster should contain the name of the team, team members names, the Eurobot logo, the University logo as well as details of the robot: mass (g), cost (£), size (mm), points target, sensors used, actuators used, controller, power supply, etc. Add large colour images of the design and include snippets of coding elements in C#.

Eurobot (UK) Final (0%) – Week 8+ (Thursday, 6 April 2017) **Note: During Easter**
Although no grades will be awarded, this is an excellent opportunity for you to test your robot's performance against other teams in the Eurobot (UK) Final, which will be held at Middlesex University's Hendon campus in London. A coach will leave Southampton interchange at 08:00 hrs sharp and will return around 22:00 hrs. Bring lunch and drinks to sustain you during the long day.

UoS Eurobot Final (50%) – Week 11 (Tuesday, 9 May 2017)
Grades will be awarded based on the performance, as well as design innovation, quality of construction, etc in our internal University Final, which will be held in the Design Studio (177/3011).

- Design innovation – 20%
- Construction quality – 20%
- Low cost – 10%
- Performance in the UoS Final – 50%

Design Report (30%) – Week 12 (Friday, 19 May 2017)
Grades will be awarded for a written design report, with all members contributing equally.
The design report should be no more than 30 pages in length. The report should be handed in to the school office by **4pm 19th May 2017** and should contain:

- Excellent presentation (5%).
- Technical engineering drawings of your system, with correct dimensioning (10%).
- Details on the conceptual design study and selection of the final design (10%).
- Mechanical and electrical systems design process (including design analysis) (30%).
- A description of robot assembly and manufacturing processes (15%).
- A description of the programming and any testing performed (10%).
- A bill of materials and costing report (10%).
- Analysis of your team's performance, future improvements and recommendations (10%).
- Any other information that the group feels is relevant to the design and development of their robot.

This report should be treated as if it is a report to a chief engineer. The key thing to remember when writing it is to justify why you did what you did. A demonstration of an engineering approach to the design is therefore of paramount importance. Final drawings submitted as part of the Design Report should also include: Illustration(s) of system function - orthogonal or isometric assembly views showing different relative positions of the mechanism(s) (views combined or separated). Technical engineering drawings should appear in an Appendix and should be limited to a **maximum of ten**!

Eurobot World Final – Country TBA Late May 2017 (Week 12+ (Week 35))
The top three teams from the Eurobot (UK) Final will represent the UK at the World Finals. Transportation costs (coach, flight, train) will be met by the University, with subsistence and accommodation provided by the Eurobot organizers. Students are expected to provide sufficient funds for any other costs during the trip.

Figure 3 – Students having fun at the Eurobot Finals 2014, 2015 and 2016.

Our track record:

2014 – 1st, 2nd and 3rd in the UK Final.

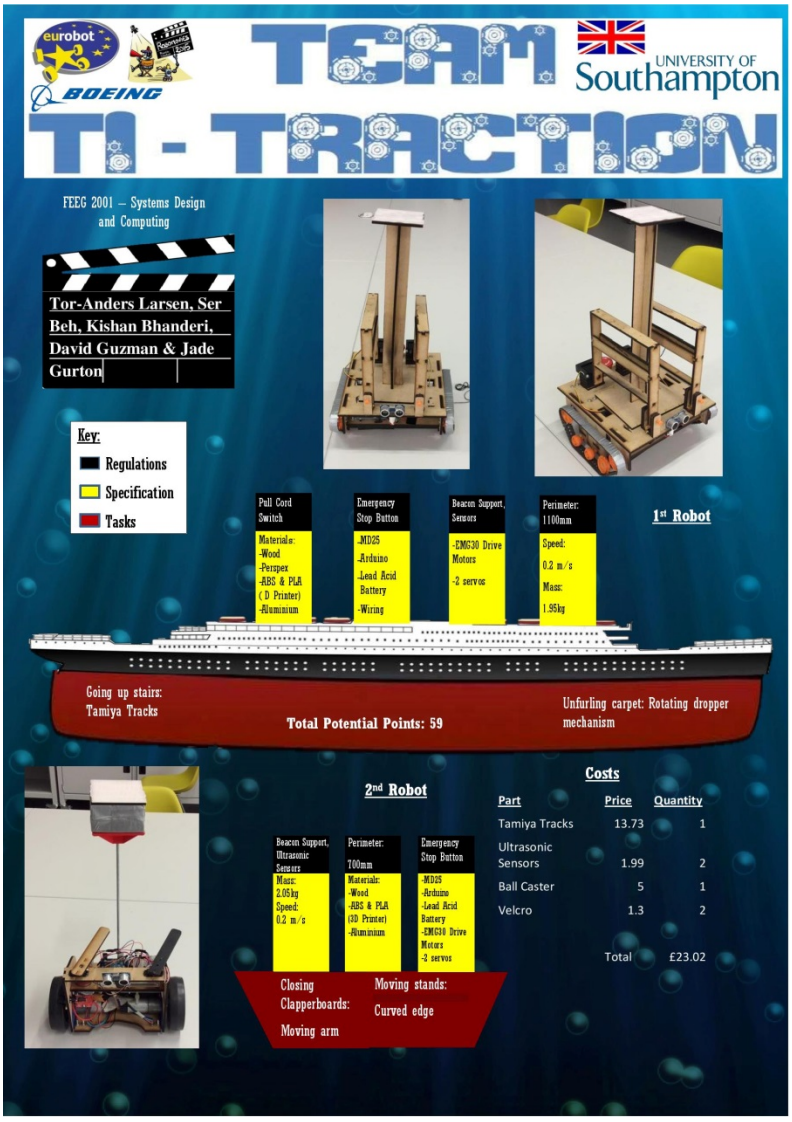
2015 – 1st and 2nd in the UK Final.

2016 - 1st and 2nd in the UK Final.

Essential/Recommended Textbooks:

Available from the John Smith's Bookshop (eBook):

An example Eurobot Poster:



Appendix A – Student Eurobot Teams

Team No.	Team Members	Team No.	Team Members
1	1. Caroline Layzell 2. Alice Loneragan 3. Kirsty Lynch 4. Joanna Forrester 5. Phillip Smith	12	1. Michael Leat 2. James Ledger 3. Dom Maddison 4. Khloe Komolafe 5. Bradlow M.
2	1. Rosemary Lim 2. Kimberly Daniels 3. Anvita Asthana 4. Krishna Venkatramani 5. Elena Gil Marin	13	1. Oliver Stocks 2. Oliver Heilman 3. Jan Gladowski 4. Peter Higgins 5. Basem Elshafei
3	1. Rishabh Arora 2. Ludovico Baldassarri 3. Iason Avlonitis 4. Laurence Costick 5. Ankur Sharma	14	1. Mridu Gupta 2. Kerry Aziz 3. Daniel Bennett 4. Kehinde Alli 5. Nikos Pappas
4	1. Pau Miquel Mir 2. Ian Hind 3. Michael Comport 4. Alberto Bosco 5. Mackenzie Brown	15	1. Andrew Everitt 2. Ollie Siederer 3. Matt Shilston 4. Elliot Simons 5. Patrick Rigby
5	1. Peter Griffiths 2. Finn Murphy 3. Gus Dixon 4. Aled Goddard 5. Jordan Jackson	16	1. Anup Naresh Patel 2. Michael Moawad 3. Man Lok Lee 4. Taran Panchal 5. Oliver Pattinson
6	1. Harry Moncrieff Macmilllan 2. Bart Jennings 3. Hugo Manning 4. Nick Turner 5. Tom Hughes	17	1. Mohammad Bin-Nasir 2. Ryan Firth 3. Andrew France 4. Robert Harrison 5. James Woolnough
7	1. Veton Derguti 2. Jeton Muliqi 3. James Cook 4. Ben Uwins 5. Floriane Colomb	18	1. Alexis Amic 2. Teodor Anton 3. Jack Bailey 4. Stanislas Bory 5. Arturo Escobar Flores
8	1. Diego Granero Marana 2. Adam Moneim 3. Kurt Looi 4. Rebecca Jayne-Coupe 5. Ashwin Mathur	19	1. Irfan Kaya 2. Mukund Korapati 3. Samuel Lloyd-Williams 4. Alexander Owen 5. Mo Thompson
9	1. Jack Harding 2. Shabnam Huseynli 3. Milan Dave 4. Scott Davis 5. Andy Yerassimou	20	1. Declan Owen 2. David Angell 3. Robert Jeeves 4. Tobias Preston 5. Mantas Gudaitis
10	1. Gregory Tidanian 2. Mohammed Ali Qureshi 3. Angelo Stavrinidis 4. Zbigniew Peplinski 5. Edward Flanagan	21	1. Cristina Blazquez 2. Andres Vina 3. Miguel Fuentes 4. Alberto Natale 5. Ruggero Gargiulo
11	1. Iakovos Kambis 2. Christoforos Miltiadous 3. Michalis Iakovou 4. Olgu Dolu 5. Andreas Kelepeniotis		