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EEEE1002

Applied Engineering Project

an
Introduction

Steve Greedy

H61AEE: Introduction

Very Important: Attendance

- The purpose of the module is to acquire practical engineering skills
- Impossible if you aren't in the lab
- Attendance is compulsory to pass
- Use you student ID to register in the lab for every half day session
  - AM: **IN** by 09:20 **OUT** after 12:00
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What is H61AEE: Applied Engineering Project?

- It is a lab based ‘hands on’ engineering design module.
- It is worth 40 credits, rule of thumb…
  - 1 Credit = 10 hours of effort ∴ 40 credits = 400 hours
  - You will spend approximately 220 hours in the lab
  - Therefore significant effort required outside the lab
  - Non-attendance at labs will attract a penalty
- It must be passed to progress to Year 2
- Then module can only be re-taken in attendance i.e. failing the module will delay your progression by one year

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- **Develop Skills Required by Employers**
  - Develops practical skills
  - Develops engineering ways of thinking
- **Develop the ability to work independently**
- **Develop the ability to work effectively as a team**

- **Support Throughout the Project:**
  - 4 x Academic staff running the module, 3 fulltime in the labs
  - 3 x Teaching Assistants full time in the labs
  - Technical staff as required
  - Lab Demonstrators as required
  - Each other

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In-Lab Support

Academic Staff:

ESLC:
Steve, Dan

Tower 401:
Adam, Richard

Tower 402:
Serhiy, Ahmed

Technical Staff:

Mark, Alex, Eddie, John

So, there is a lot of support in place. But…

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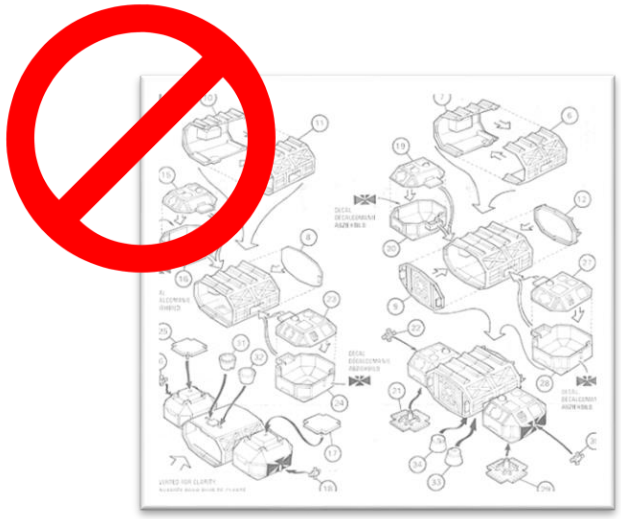
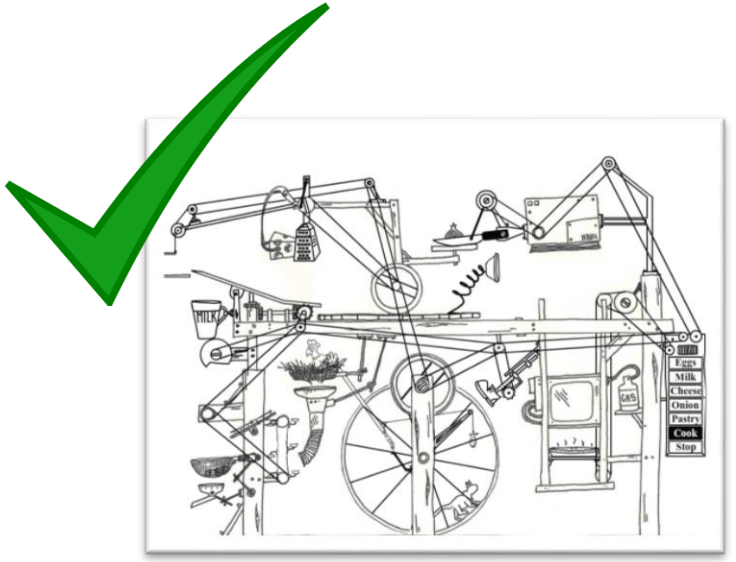
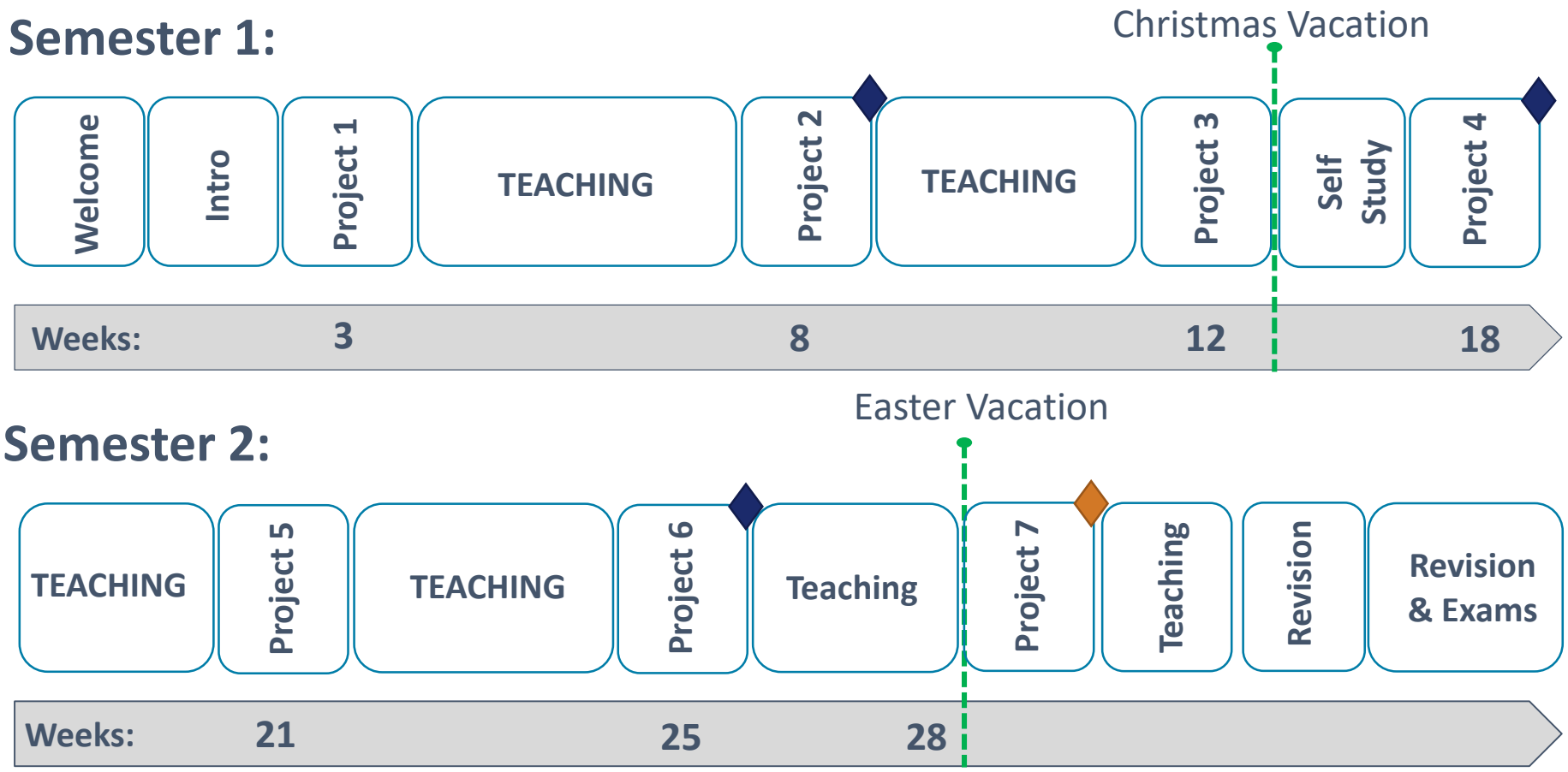
- This is not an ‘Instructional’ module
- No advance information (maybe a few hints…)
- We will help guide you in an Engineering approach
- We will not provide solutions





Introduction to Year 1



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Teaching Week	LAB BASED WEEKS	Thursday PM
2		Introduction to the Module
3	LAB WEEK – Vehicle Build & Test	-
4		Teamwork & Report Writing
5		PLECS (Power & Energy Coursework) *
6		CAD for 3D Printing *
7		LAB Week Intro
8	LAB WEEK – Individual Projects	-
9		Processing – GUI
10		LTspice *
11		LAB Week Intro (RF & IR)
12	LAB WEEK – Individual Projects	-
Christmas Vacation		
Assessment Week		
18	LAB WEEK – System Integration	-
19		Report Writing QA
20		LAB Week Intro – Pi Intro
21	LAB WEEK – Raspberry Pi	-
22		Open CV – Theory
23		OpenCV * Hands on session
24		LAB Week Intro
25	LAB WEEK – Computer Vision	-
26		Open QA
27		LAB Week Intro
28		-
Easter Vacation		
33	LAB WEEK - Computer Vision/Finale	

* Computer Laboratory Based

Introduction to Year 1

Ultimate Goal: Development of an autonomous vehicle utilising computer vision

http://www.sustained-quality.com/computer-visions-impact-automotive-industry/

SAE (Society of Automotive Engineers) Levels of automation:

SAE Level	Name	Narrative definition		Execution of steering and acceleration/ deceleration	Monitoring of driving environment
Human driver monitors the driving environment					
0	No Automation	The full-time performance by the human driver of all aspects of the dynamic driving task, even when "enhanced by warning or intervention systems"		Human driver	Human driver
1	Driver Assistance	The driving mode-specific execution by a driver assistance system of "either steering or acceleration/deceleration"	using information about the driving environment and with the expectation that the human driver performs all remaining aspects of the dynamic driving task	Human driver and system	
2	Partial Automation	The driving mode-specific execution by one or more driver assistance systems of *both steering and acceleration/deceleration*		System	
Automated driving system monitors the driving environment					
3	Conditional Automation	The driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task	with the expectation that the *human driver will respond appropriately to a request to intervene*	System	System
4	High Automation		*even if a human driver does not respond appropriately to a request to intervene*		
5	Full Automation		*under all roadway and environmental conditions* that can be managed by a human driver		

https://en.wikipedia.org/wiki/Self-driving_car

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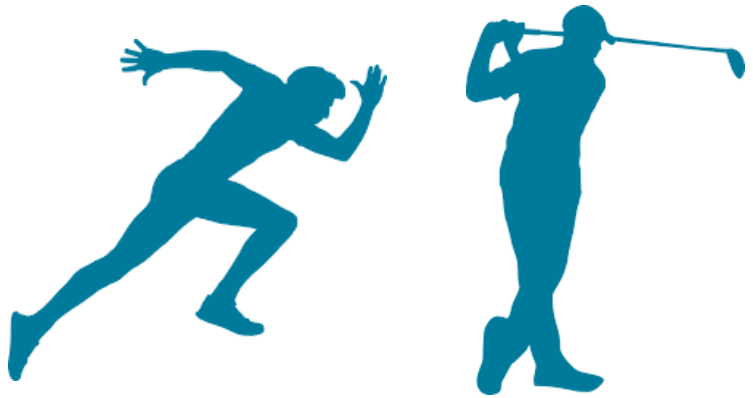
What to Expect (semester 1) - Session 1, teaching week 3:

- **Day 1**: Skills development - Build H Bridge
- **Day 2**: Skills development - Build H Bridge
- **Day 3:** Control Board Build & Software Development
- **Day 4**: Skills development - Test & Measurement
- **Day 5:** System integration & Challenge:



SPEED & ACCURACY

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https://www.youtube.com/watch?v=05XEaXyqIF4&feature=youtu.be

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What to Expect (semester 1) - Session 2 & 3:

- **Groups tasked with completing 4 individual sub-systems to add the following functionality to the vehicle:**
  - RF Remote control & telemetry
  - Line following
  - Inertial navigation
  - Autonomous parking
- Sub-systems developed on the minibot

- **What to Expect (semester 1) - Session 4:**
- **System Integration and end of Semester Challenge**

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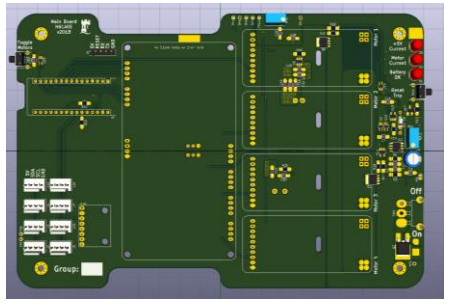
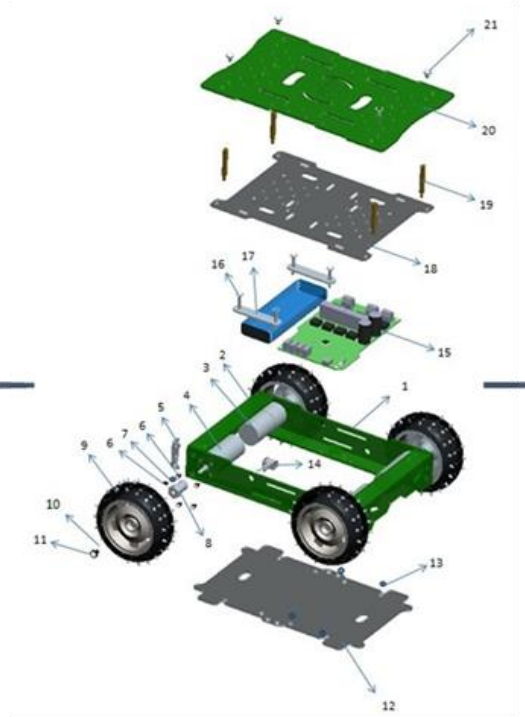
The Hardware





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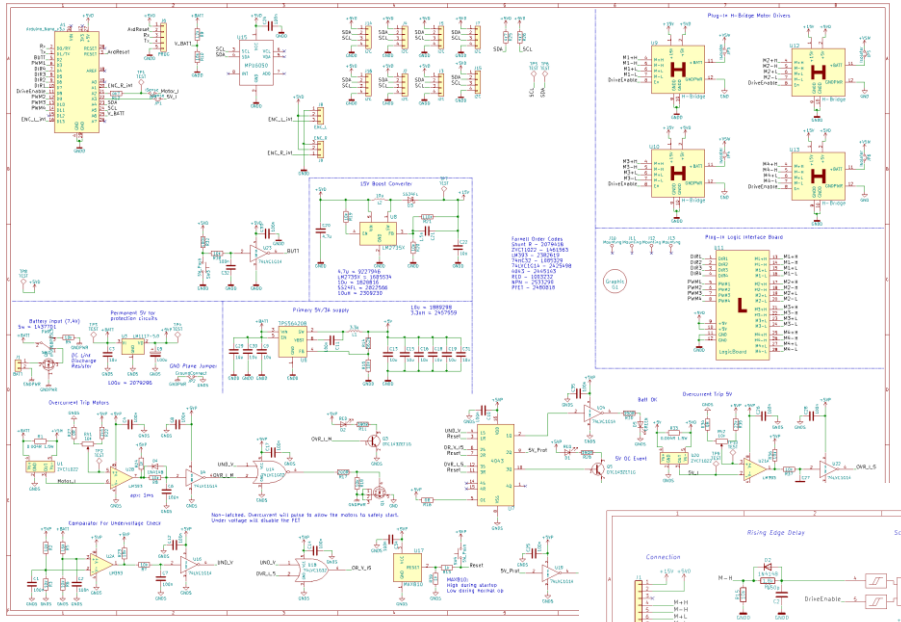

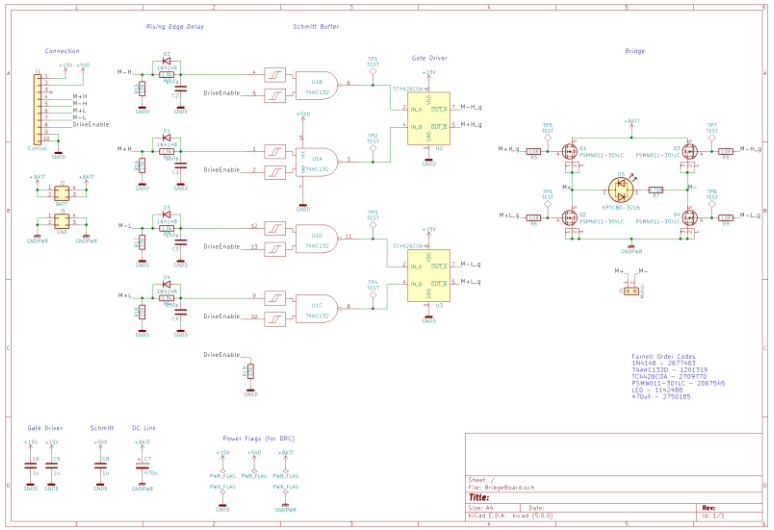

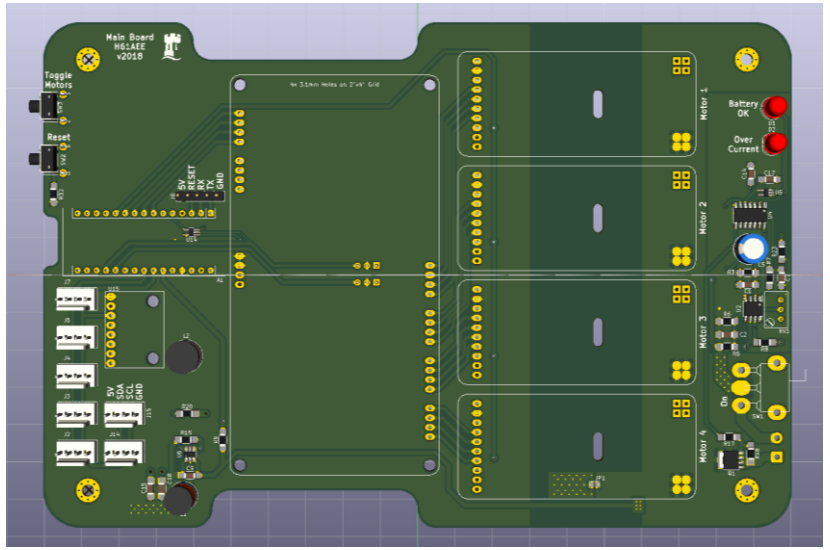

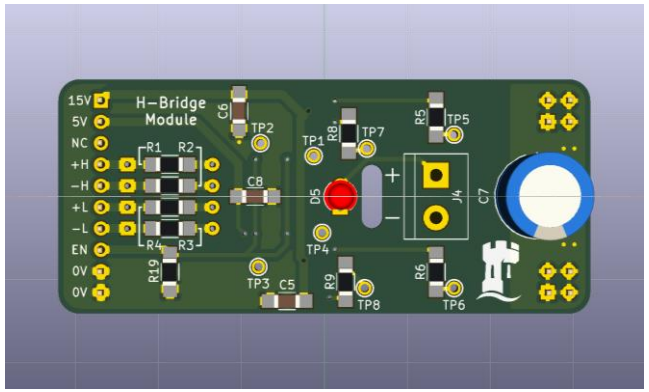

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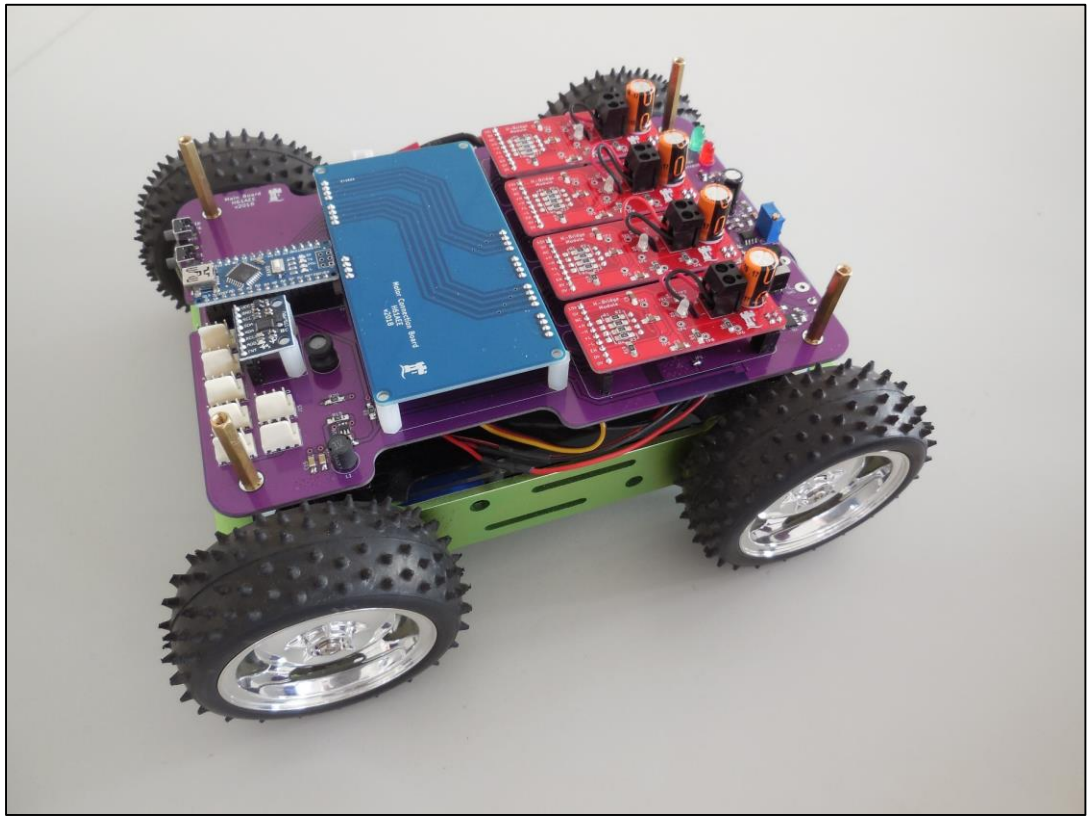

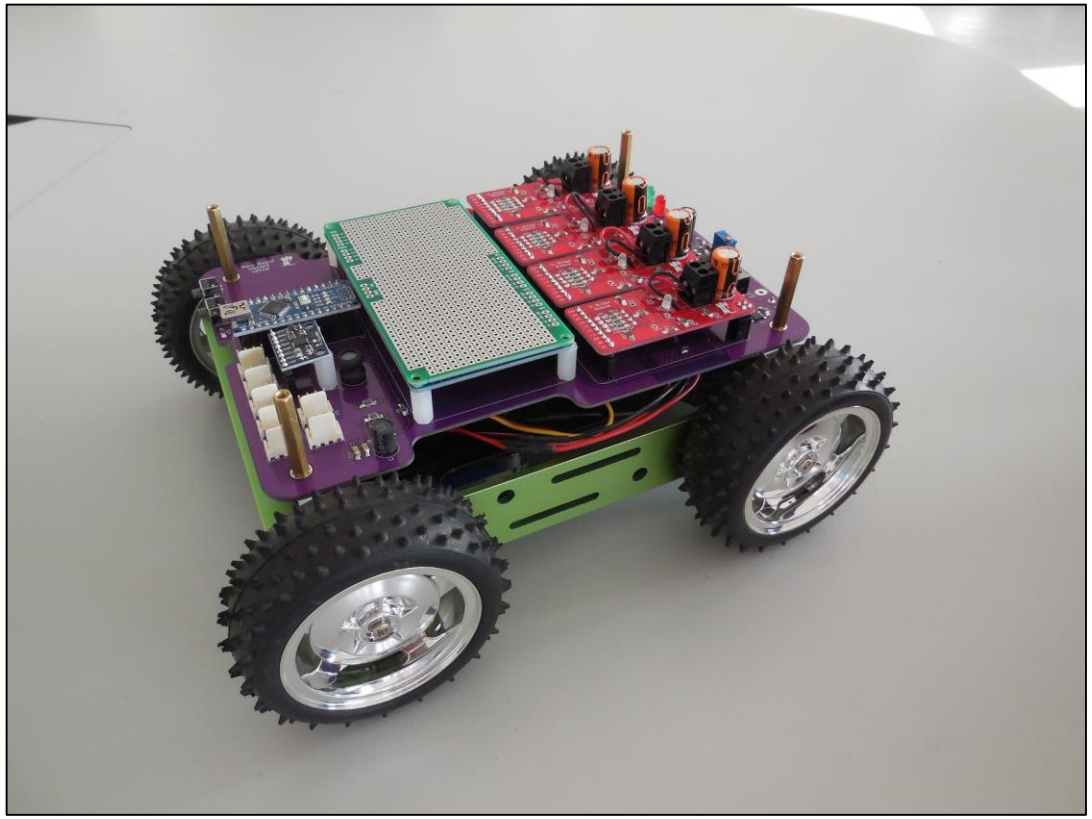

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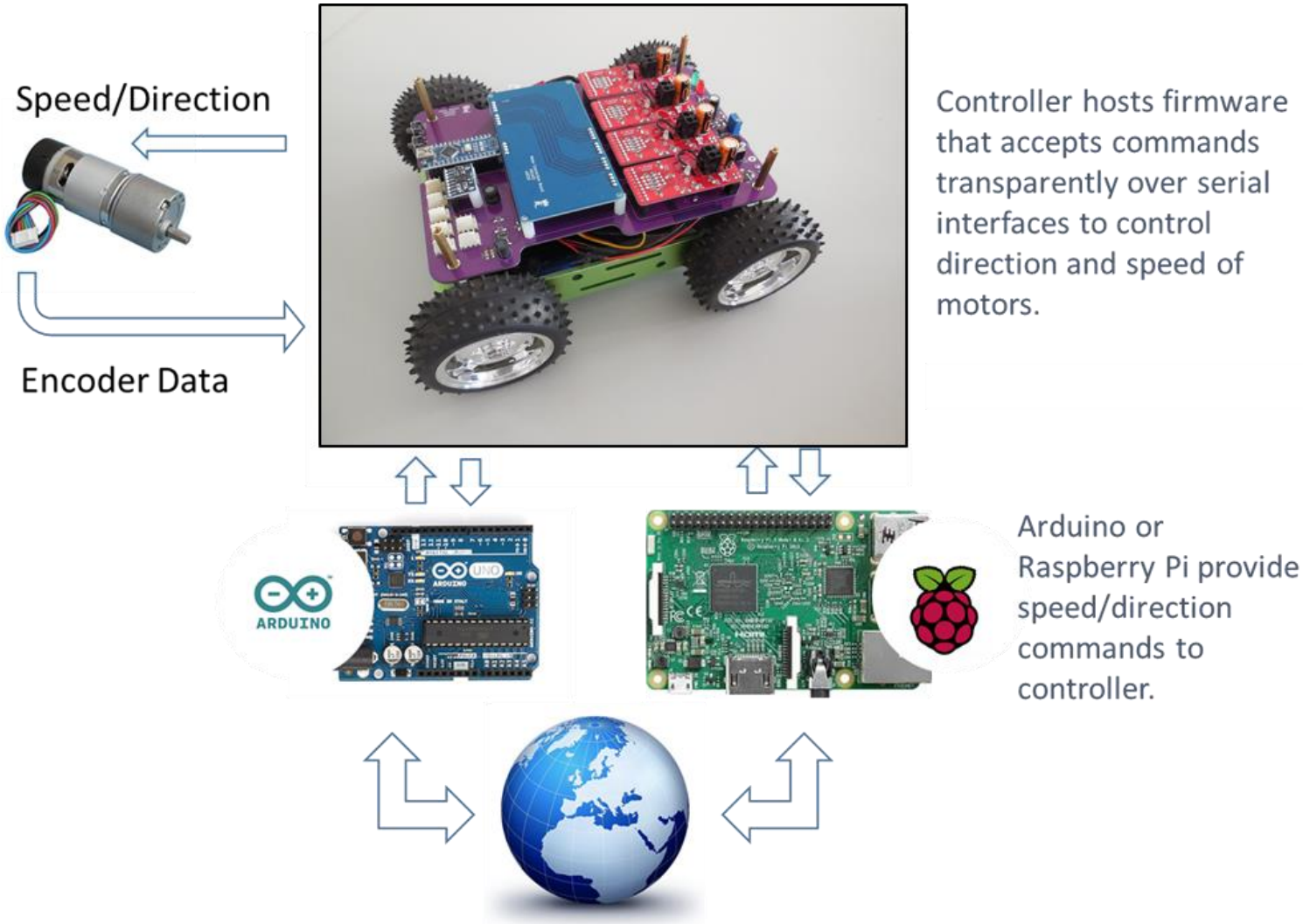
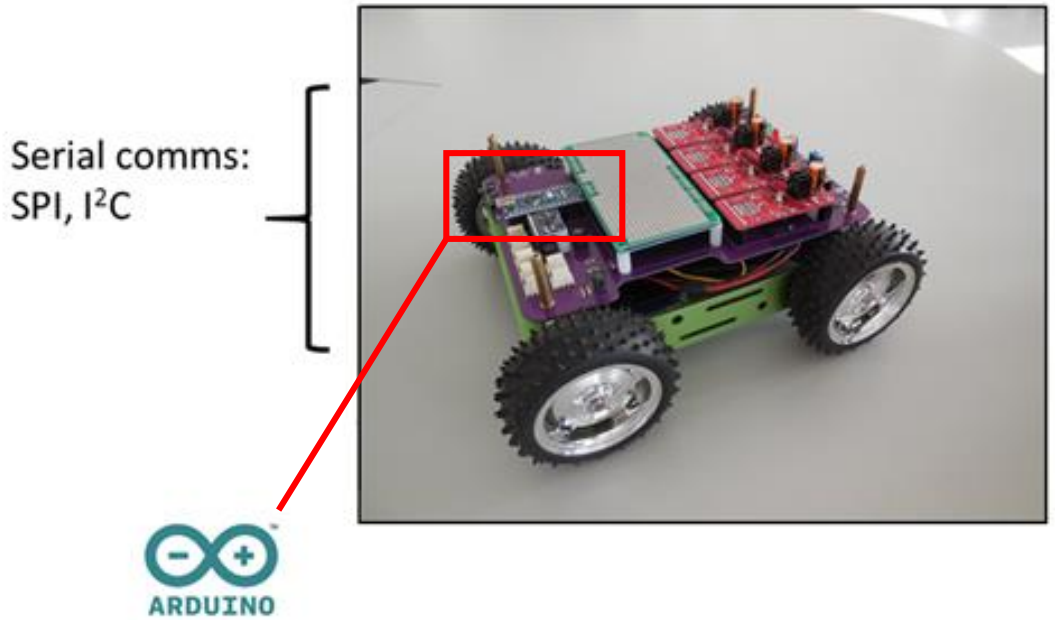


The Software (Semester 1): Arduino C



The control board's microcontroller will be programmed and used to control the vehicle in the first week. Afterwards it will need to be programmed to accept commands from an external microcontroller over a serial link. The external microcontroller will 'sense' the outside world and make decisions on movement.

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Assessment: Semester 1 (50% of Module)

- **Following Session 2**
  - 5% : Group poster presentation of proposed vehicle specification in the form of a 'Top Trump' card to be presented in class at end of second project week
  - 15%: Individual report on autonomous vehicles and proposed subsystem design

- **Following Christmas Vacation**
  - 10% : Prior to project session 4: Skills test and Viva Voce (oral) examination on skills test
  - 20% : Following project session 4: Individual report on complete subsystem design & performance

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Assessment: Semester 2 (50% of Module)

- **Following Session 6**
  - 25%: Assessed Individual report on computer vision based line following system
- **Session 7: Project Finale**
  - 10% : Final design and performance
  - 10% : Project management
  - 5% : Technical poster detailing final design & performance

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- **Project management, session 2 onwards….**
- **Beginning of the week's session:**
  - Prepare a 1 page plan:
    - Allocate tasks and describe roles
  - Maintain a project blog (MS SharePoint)
- **End of the week's session**
  - Write a 1 page reflective report

- **Guidance on what is expected and how to maintain the SharePoint site will be provided**

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A note on the Thursday lecture sessions:

- Thursdays prior to a lab week will always be directly related to the work required in the coming lab week
- Other Thursday sessions:
  - Effective team working (led by Industry and the IET)
  - Computer Aided Engineering (using KiCAD):
    - Schematic capture
    - PCB layout
  - 3D Printing (using AUTOCAD)
    - Technologies & Materials
    - CAD for design & print

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- **How to succeed….**
  - Engage
  - Make use of any support
  - Pay attention to and use moodle
  - Work effectively as a team
  - Talk to other groups
  - Above all – **have fun!**

- **Any questions?**

Reminder of Lab Locations

Location	Tower 401	Tower 402	ESCL
Teaching Team	Adam & Richard	Serhiy & Ahmed	Steve & Dan
Groups (Bench no.)	Groups 1 to 14	Groups 16 to 29	Groups 31 to 42

You will use the same lab/bench for all 7 weeks of the project

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Office 365: SharePoint Team Pages