

Integrated Design Project

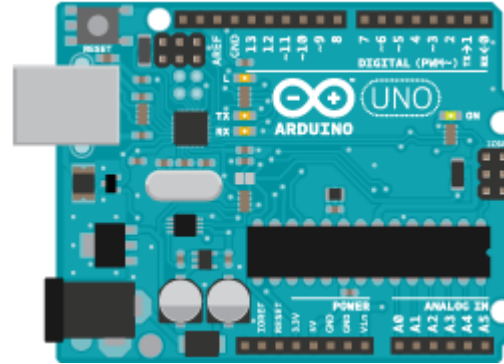
Mechanical Introduction

IDP: Rapid Prototyping Approach

Rapid Prototyped Robot



Microcontroller: Arduino (well Orange Pi...)



- C++ IDE
- Analogue, Digital I/O
- PWM

Mechanics: Chassis Development



Interface electronics

- Motor shield provided
- Prototyping shield/strip board
- Bank of standard electronics given
- Sensors: Ultrasound, IR, compass, accelerometer, microswitch + many more

- Laser cutting (MDF/Plywood)
- 3D printing (PLA)
- Metal parts (right angle section, tubing)
- Fastenings – bots/glue
- Wheels, castors other parts provided

IDP: Rapid Prototyping Approach

Mechanical Development

- **Cardboard** will be provided (which can be used in the laser cutting) to test develop a Chassis
- **2 sheets** of 300x600 MDF/Ply (2mm, 3mm or 6mm) can be obtained from the Dyson Centre Technicians for laser cutting.
- Once trained laser cutter keys can be obtained from the Dyson Centre technicians
- Two 3D printers will be on the 3D printer benches. Use these.
- Be mindful that there are other students using the Dyson centre facilities....
- If there is something you believe you can't do MDF/Ply and want to use metal come and talk to us!

IDP: Rapid Prototyping Approach

Student editions of CAD software can be downloaded for free:

- Creo (supported, CAD modles supplied)
- SolidWorks
- Fusion 360

Laser cutting/3D printing information can be found on the Dyson Centre website:

<https://www.dysoncentre.eng.cam.ac.uk/>

Choice of Materials/Methods

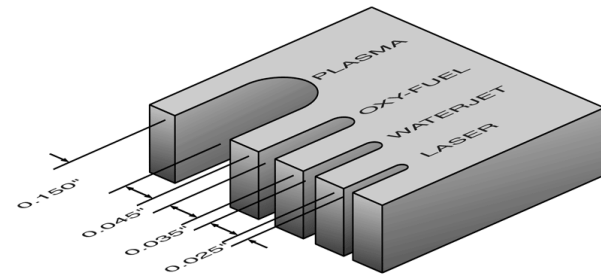
Chassis Design

- MDF/Ply (consider relative merits)
- Box Joints, consider how to support (right angle metal?)
- Remember about 'kurf' widths when cutting designing
- Consider where to mount wheels, and castor options



3D Printing

- Should be used appropriately.... It is not a solution to everything. Should only used when laser cutting/metal cutting is not an alternative.



Sheet Metal

- Can be drilled/cut/bend.

Fastening Methods

- Bolts (can be taken apart/reconstructed)
- Glue (where appropriate, consider what is appropriate)
- You can make brackets to mount parts

Mechanism Design

- Support rods other parts – considering using bearings (we have both roller bearings/PFTE bearing inserts)
- Motor should be mounted appropriately
- Servos come with sensor horns (these can be drilled out/bolted as appropriate)

- Designs need to be reliable.
- Take care when manufacturing
- Remember you can test-iterate design and test again!
- You may need to get other team members involved with design/manufacture

Sensor Placement

- **Sensor placement is key** – needs to be considered from all points of view (electrical/software/mechanical)
- Consider how and where they should be mounted.

Design Acceptance

- 3D Assembly
- Indications of materials you would use
- Drawings which are suitable for you to work from for assembly
 - Dimensions where appropriate

Examples of what is expected will be given on Wednesday.