Design & Technology
6th Form A Level

Our Ethos:

Independent, creative problem solving with a strong emphasis on technical solutions

Three possible A Level DT pathways:

Design Engineering
Product Design
Fashion & Textiles

A Level DT: Design Engineering:

Electronics
Mechanisms
Robotics

This pathway is ideal for students who:

- are keen on Maths and Physics,
- have a strong academic track record in these subjects (GCSE 7+)
- Are considering Engineering as a degree

This robot design was varied differently from the previous one, it uses servos for the movement, bearings to counter balance and microcontroller to control the servos.

The initi
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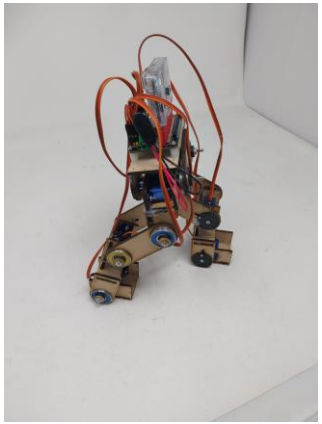
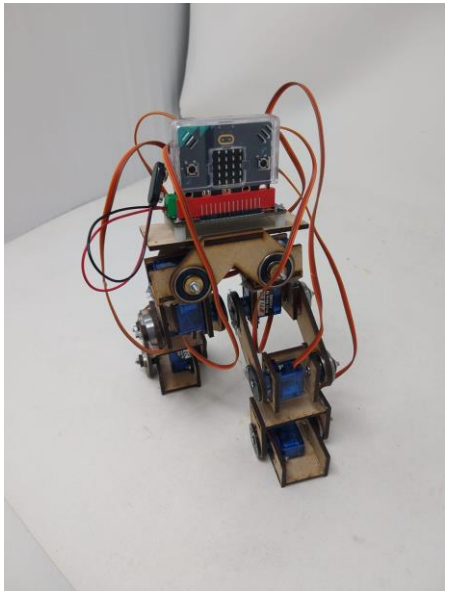
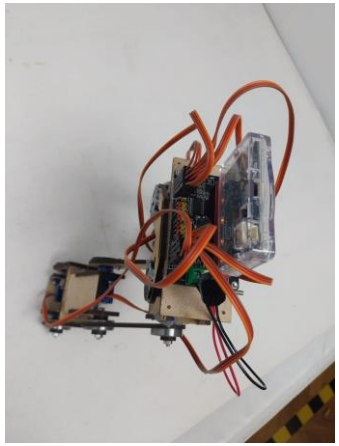
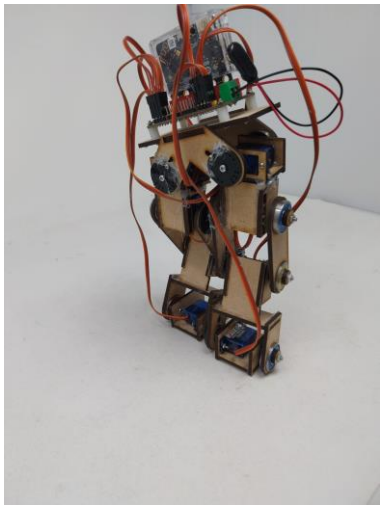
Design Engineering

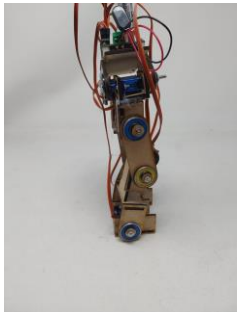
The plastic gear servos had to be replaced with metal gear servos for extra power which could increase the range of motion, therefore the stability.

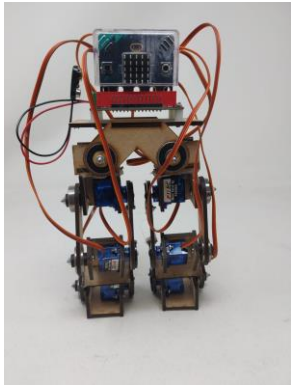










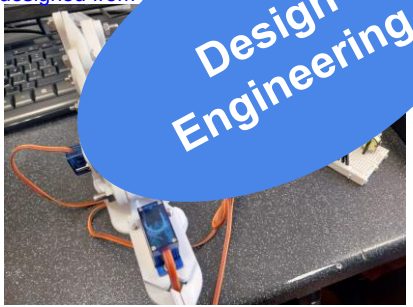


Each joint is counterbalanced with bearings to increase the balance so that the robot could have more mobility.

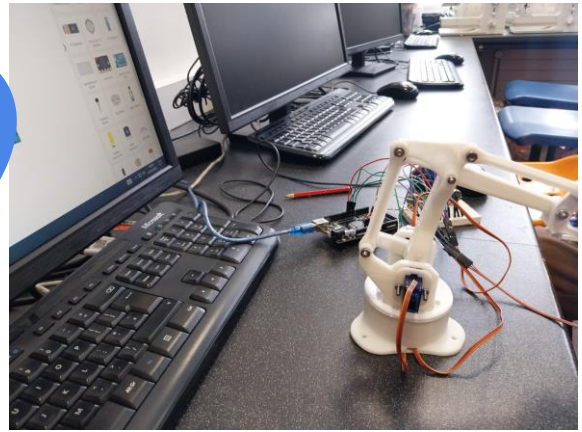
The robot needed 2 power sources as it had 8 servos. A servo stepper board is used to connect all of the different servos to the microcontroller.

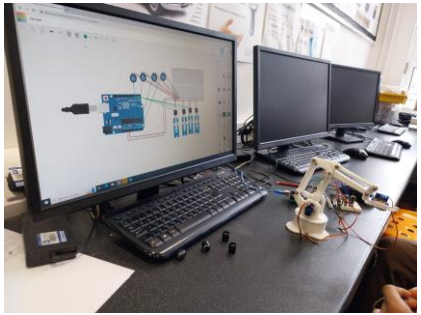
This robot was 3D printed from PLA

All electronics, circu
designed from s

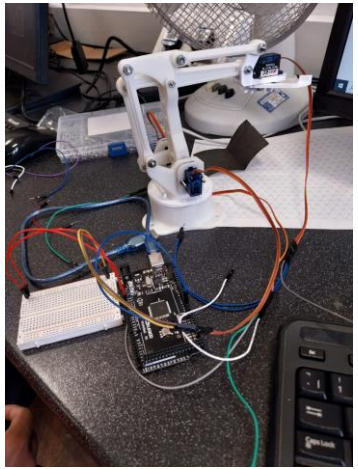


Design Engineering





This arm uses 4 metal gear servos to create 4 different point of direction control and the gripper opening and closing

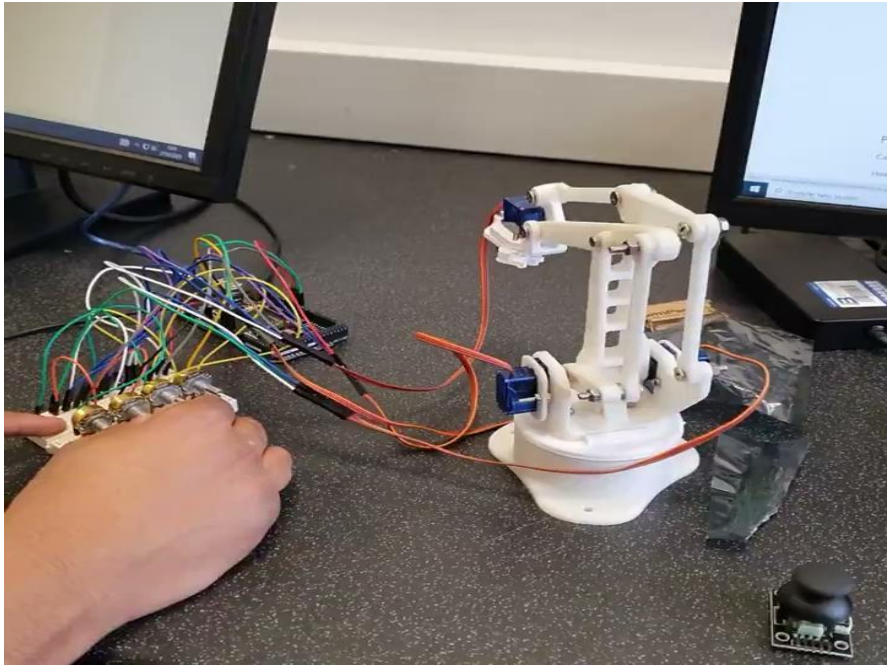


Designed was modified by adding a 3mm wooden dowel as an axis which was crucial to the design functioning

The arm was initially controlled by potentiometers, but this was not intuitive, so i decided to try and incorporate joysticks instead.

I designed a circuit from scratch using 4 potentiometers and breadboard. I coded a program in C++ to control each servo individually.

It uses an arduino mega as the microcontroller board.



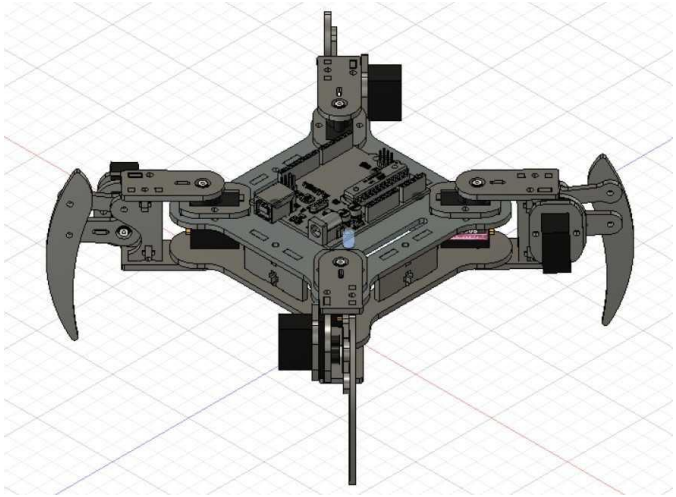
Design Engineering

```
#include <Servo.h>
#define SERVO_PIN 9
#define GROUND_JOY_PIN A3          //joystick ground pin will connect to Arduino analog pin A3
#define   VOUT_JOY_PIN A2          //joystick +5 V pin will connect to Arduino analog  pin A2
#define XOUT_PIN A1                //X axis reading from joystick will   go into analog pin A1
Servo myservo ;

void setup()
{
 Serial.begin(9600);
   pinMode(VOUT_JOY_PIN, OUTPUT) ;   //pin A2 shall be used as output
 pinMode(GROUND_JOY_PIN,   OUTPUT) ;  //pin A3 shall be used as output
 digitalWrite(VOUT_JOY_PIN, HIGH)   ; //set pin A3 to high (+5V)
 digitalWrite(GROUND_JOY_PIN,LOW) ; //set pin A1   to low (ground)
 myservo.attach(9);
}

void loop()
{
 delay(200);
 int joystickXVal = analogRead(XOUT_PIN) ;  //read joystick   input on pin A1
 Serial.print(joystickXVal);                //print the value   from A1
 Serial.println(" = input from joystick");  //print "output from joystick"   next to the value
 Serial.print((joystickXVal-520)/10);       //print a from   A1 calculated, scaled value
 Serial.println(" = output to servo");      //print   "=output to servo" next to the value
 Serial.println() ;
 myservo.write((joystickXVal-520)/10);      //write the calculated value to the servo
}
```

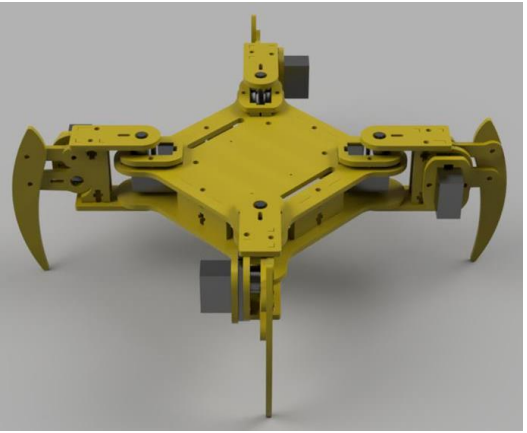
Program for joystick control of the arm - designed from scratch and had to integrate joystick and arm code together.



3D CAD model
360)

Design Engineering

3D model created in Fusion



Created a 3D model of a quadrupe
2D file I
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understa
works

Design Engineering

Assembled it
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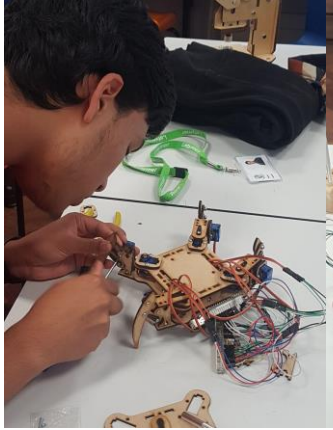
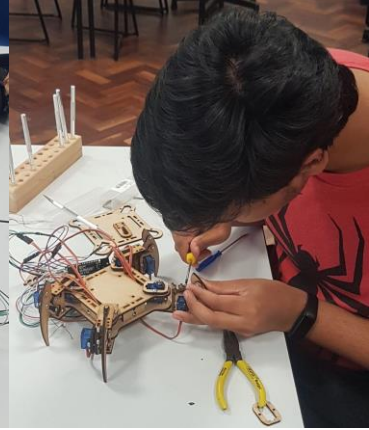
uts, out of
ser cut MDF,
with an Arduino Uno and some 9g servos

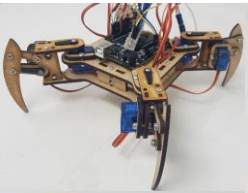


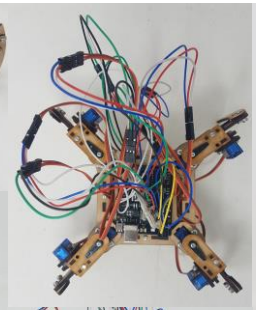


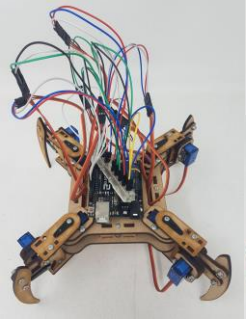
me assembling quadruped :)

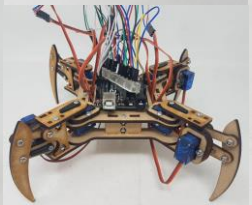
Wiring was very messy, and it didn't have a power source incorporated so i had to power it by hand

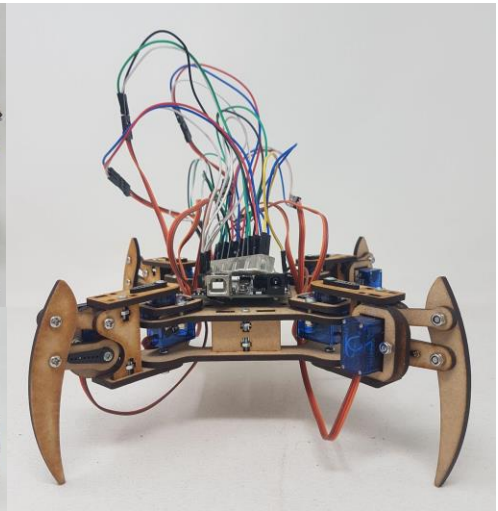
Some pics of the initial model



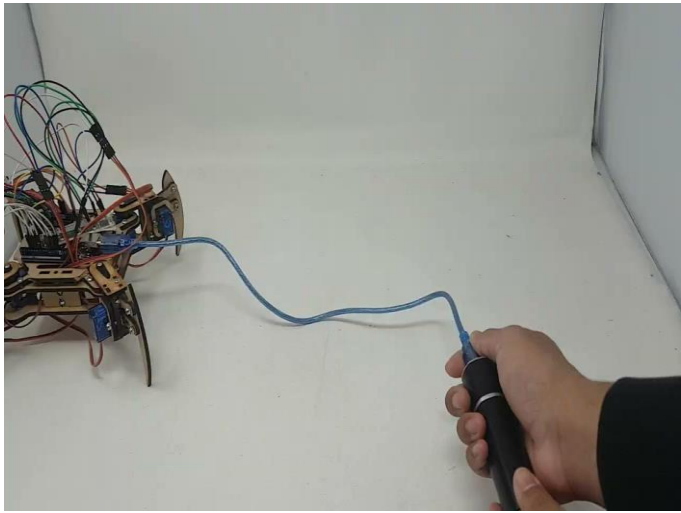




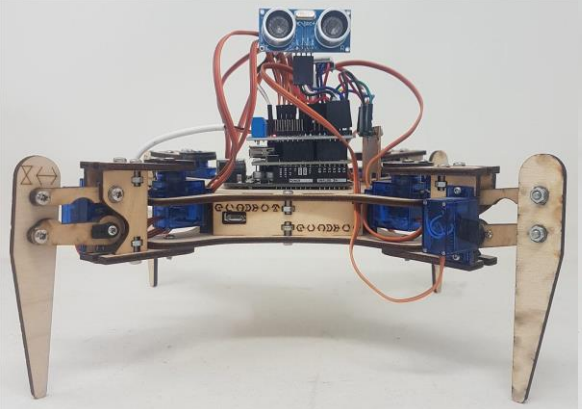


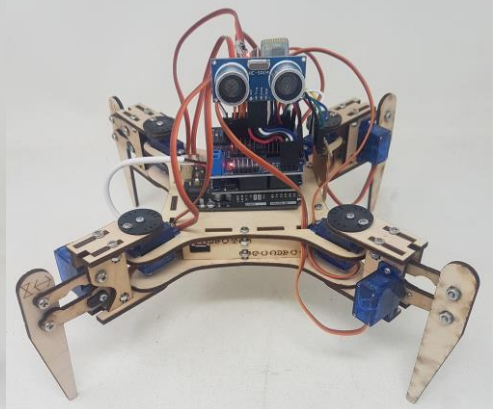


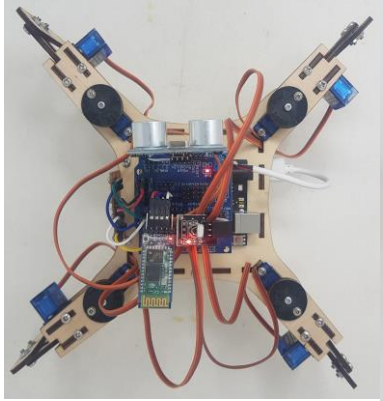
Initial code very basic, just a simple quadruped gait I found online executed via forward kinematics running on loop

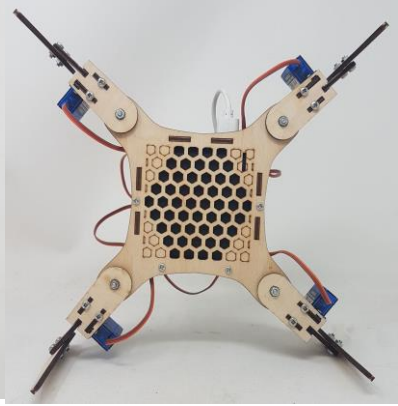


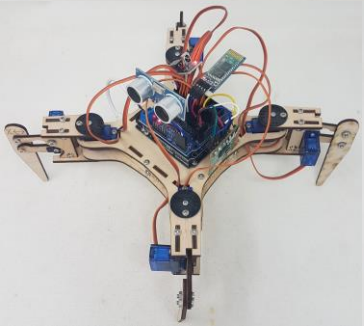
First working video

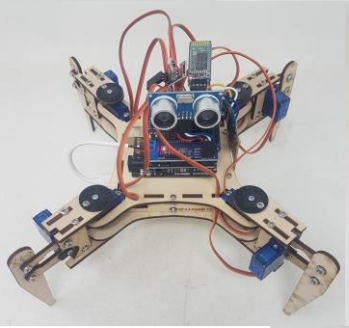


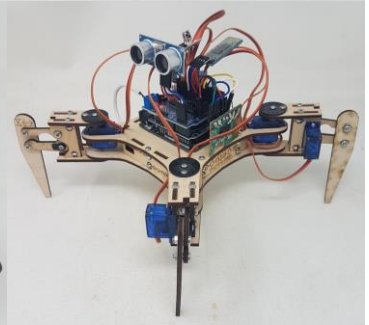










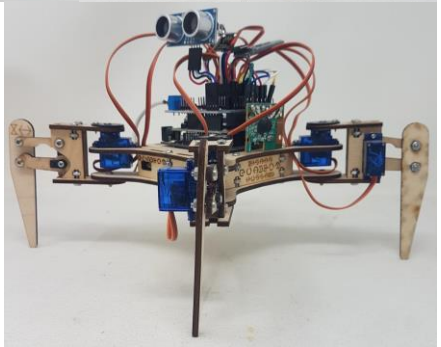


Used a power bank instead of batteries, as the batteries tended to come loose when the robot walked, and had much less capacity. I added some holes underneath for ventilation

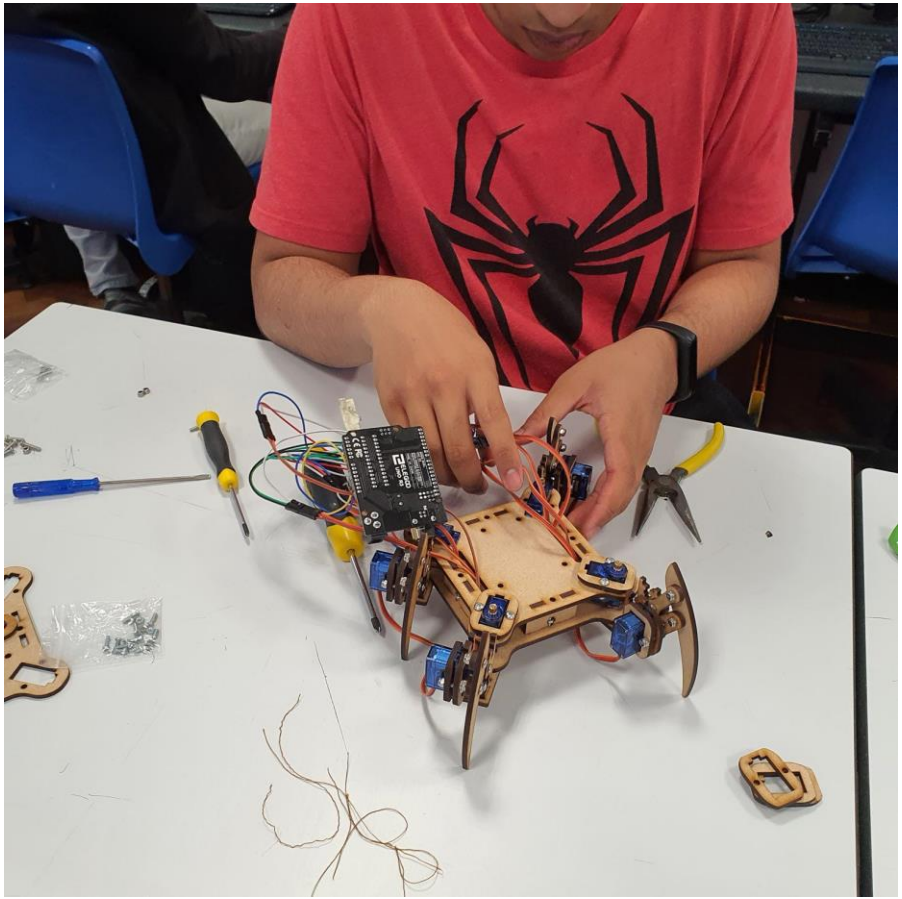
No major modifications made to code so far

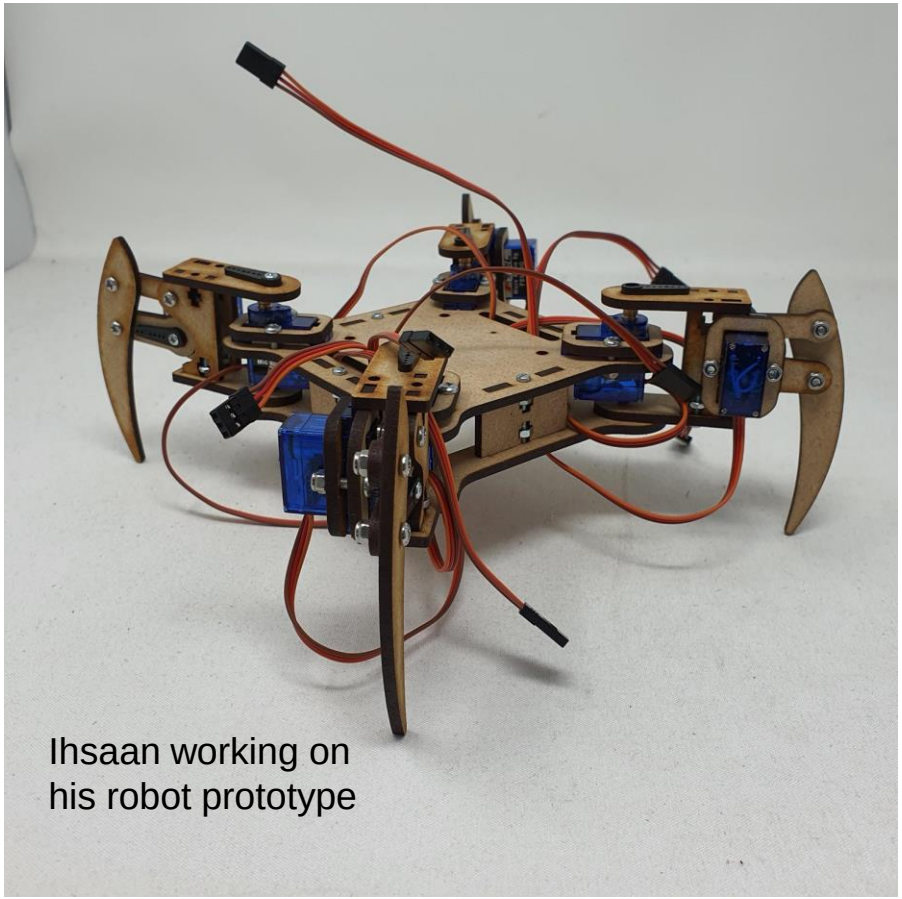
Pictures of robot V3 with the new leg design

I made the leg slightly off-centre as this encouraged friction

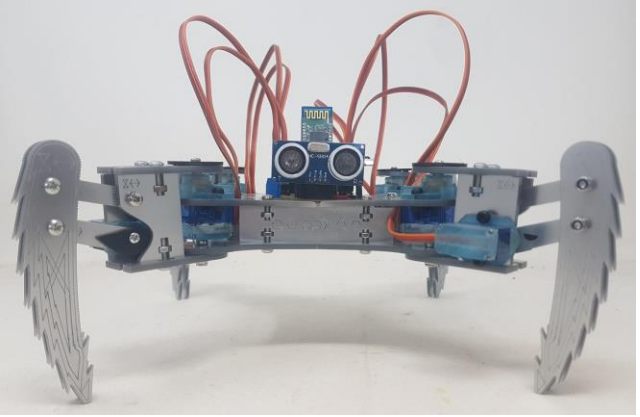


Design Engineering

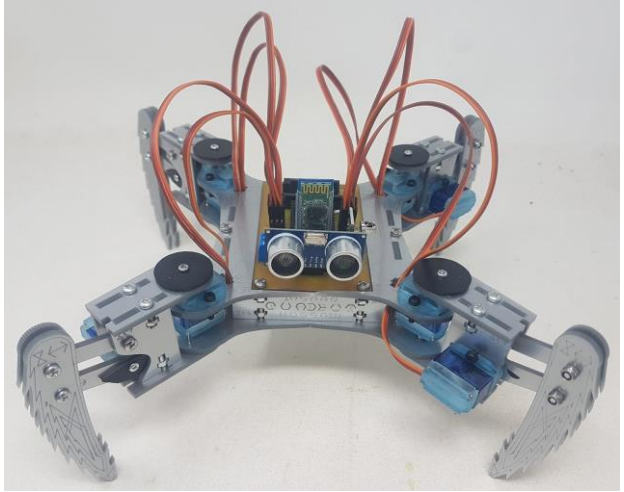




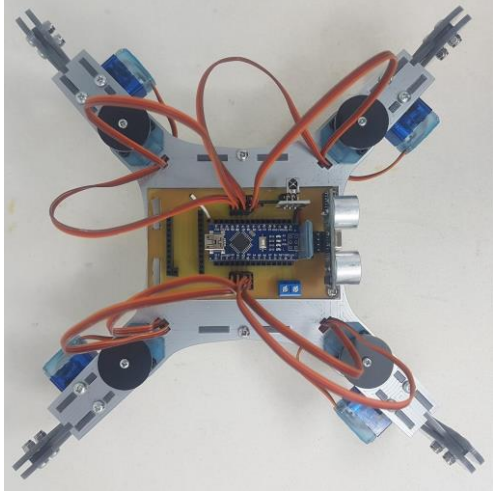
Ihsaan working on
his robot prototype



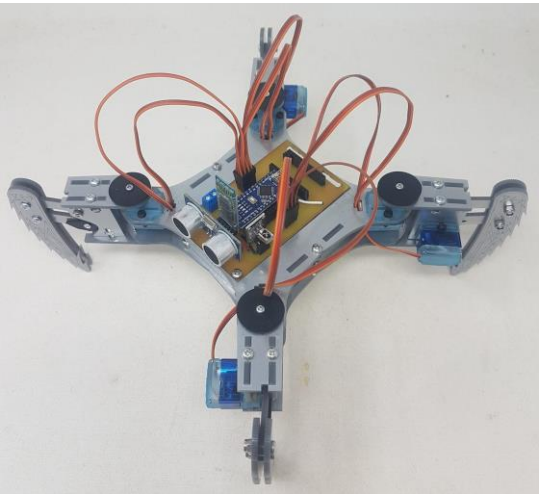
Silver acrylic body - no need for bearings due to lower friction coefficient of acrylic



Custom etched PCB to simplify the circuit connections and make it look nicer



Using an Arduino Nano as it's more compact



Custom resin-printed servo cases for more secure mounting and wire management

3D printed servo horns

Issue with servos due to insufficient tolerances of resin prints, free rotation of motors as opposed to controlled (pending resolution)

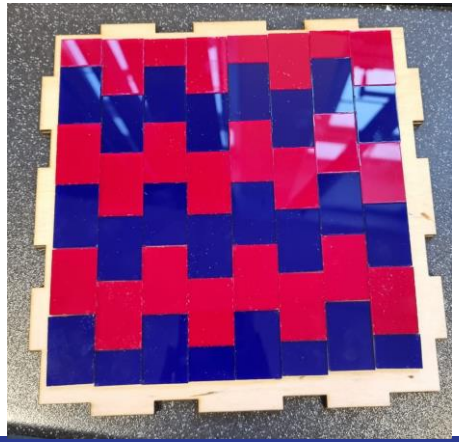
A Level DT: Product Design:

Furniture
Vehicles (Personal Transport)
Mini-Architecture (e.g. Bird house)

This pathway is ideal for students who:

- are interested in Ergonomics and Aesthetics
- are interested in Architecture

Product Design



Initial design ideas for bird house

Brief:

- Waterproof - water must run off the birdhouse
- Needs to fit a bird - must consider how it gets in and out
- Aesthetics
- Cozy
- Cat proof
- Humans need to be able to occasionally have access to the inside

My first sket
My design w
fungi, while
well as featu
out on the sid
entrance

Product Design

The first step of the design involved me figuring out how I was going to create this very organic form

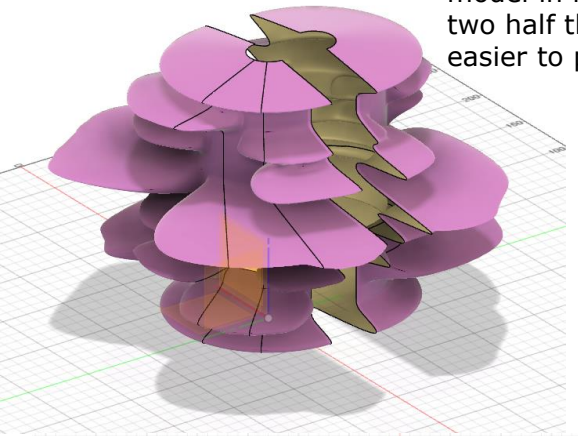
Initially I was inspired by bracket fungi that usually grows on trees, I thought this would be a cool starting point to base the aesthetics of my design on

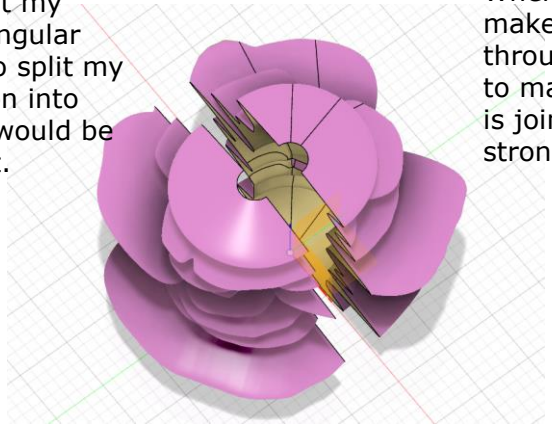
It would help the birdhouse blend into the surrounding nature

My first idea which i modelled in cardboard was to make a skeleton which i would then attach pieces onto to create the form

Preparing for printing

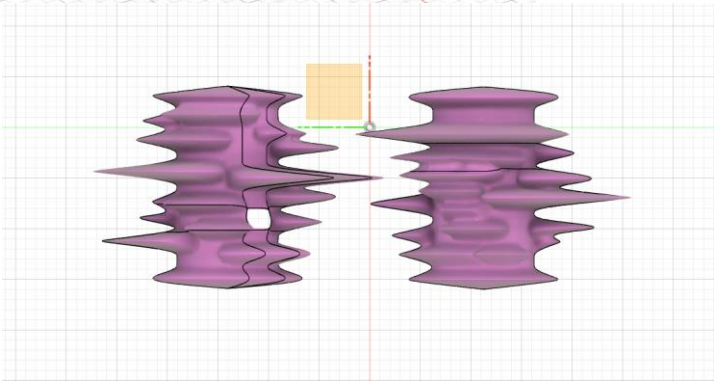
As I can't print my design as a singular piece, I had to split my model in fusion into two half that would be easier to print.



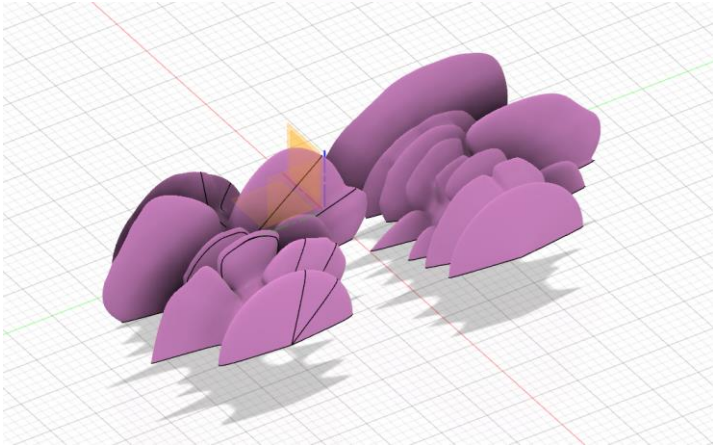


When splitting it, I tried to make sure the split ran through the largest ledges to make the area where it is joined back up the strongest

Product Design



By splitting them it gave both halves a flat side which they could lie on to give the least amount of overhangs



Product Design

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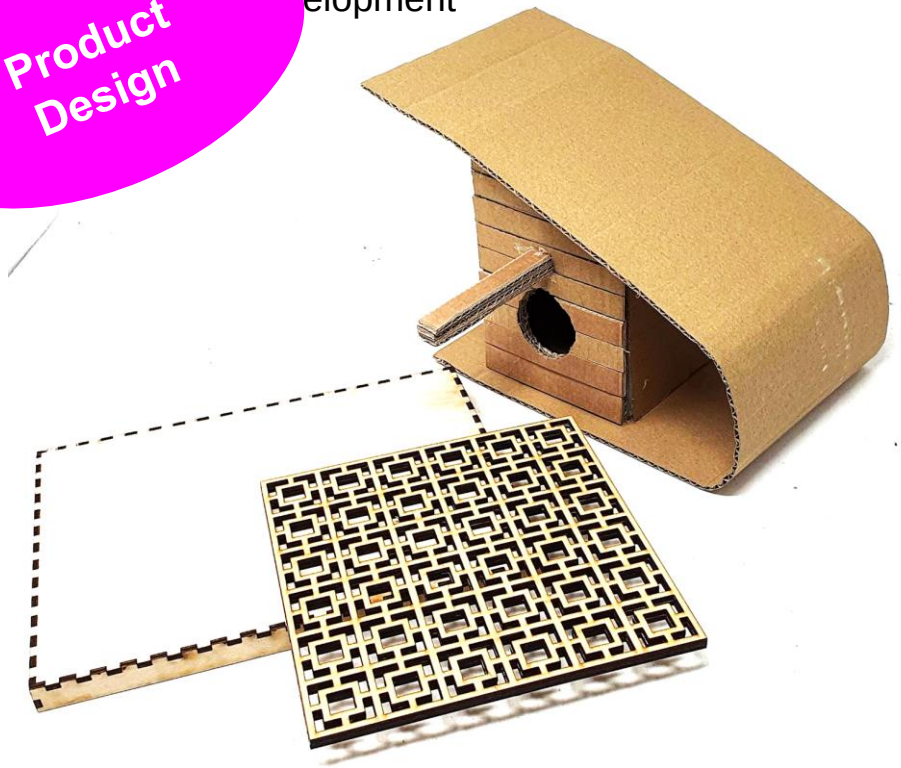
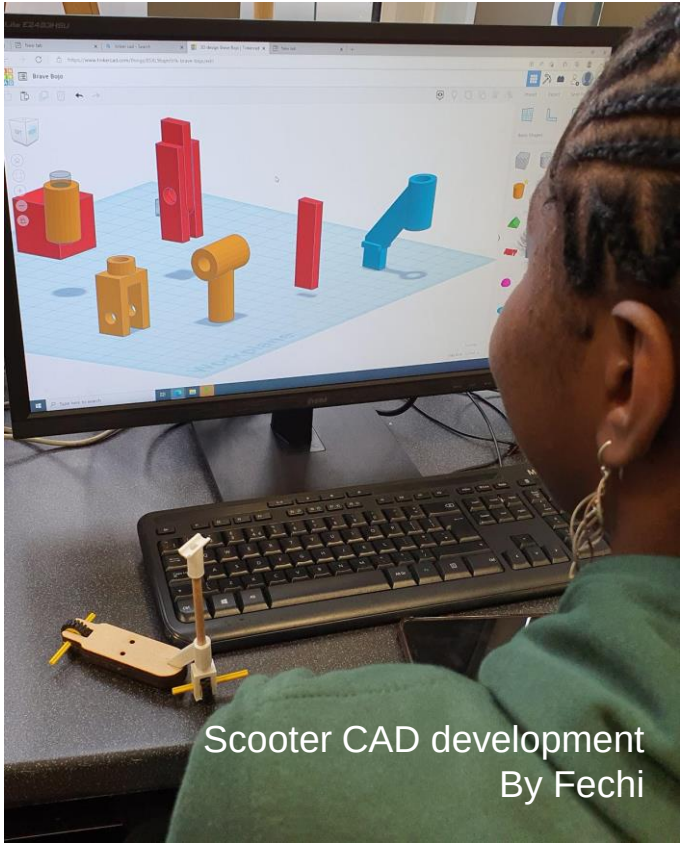




Scooter CAD development
By Fechi

4.6 Making my skateboard

Product Design

Firstly, I got five equal sheets of plywood and used the band-saw to cut them to a rough length for my skateboard

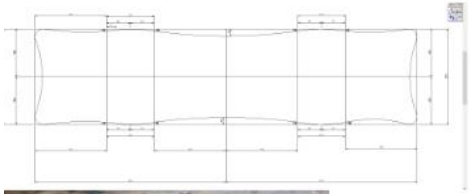
Next, I cut a separate block of wood to the angle at which the board ends will be bent to, and screwed this onto a larger board to help when clamping down the plywood

Using PVA glue and spreading it evenly onto each sheet, i stuck the five layers together

I then clamped all five sheets down to a large board. This was lifted from the ground so the clamps could all fit. The clamps ensured the board stayed in place and formed the correct shape. I left this for over a day to dry.

After a day, I unclamped the board it bent to the angle I intended. Next up was shaping the board.

I then made some templates for the shape of the board out of cardboard, I went with the bottom one as it provided more functionality and was more aesthetically pleasing than the top one.



I made the final shape design in 2D design and laser cut it out of MDF. This was going to be my template to cut the actual skateboard by

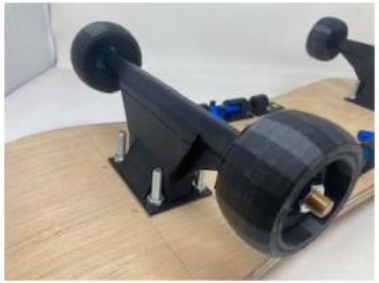
Product Design

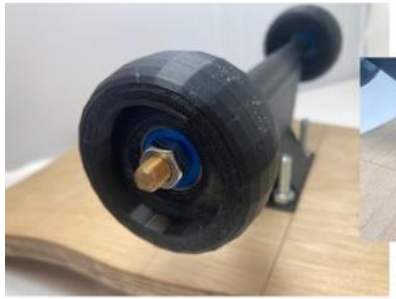
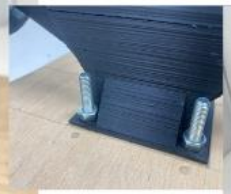
4.13 Final prototype pictures








A Level DT: Fashion & Textiles:

Current projects include:

Skirt

Garment reverse engineering

e-textiles

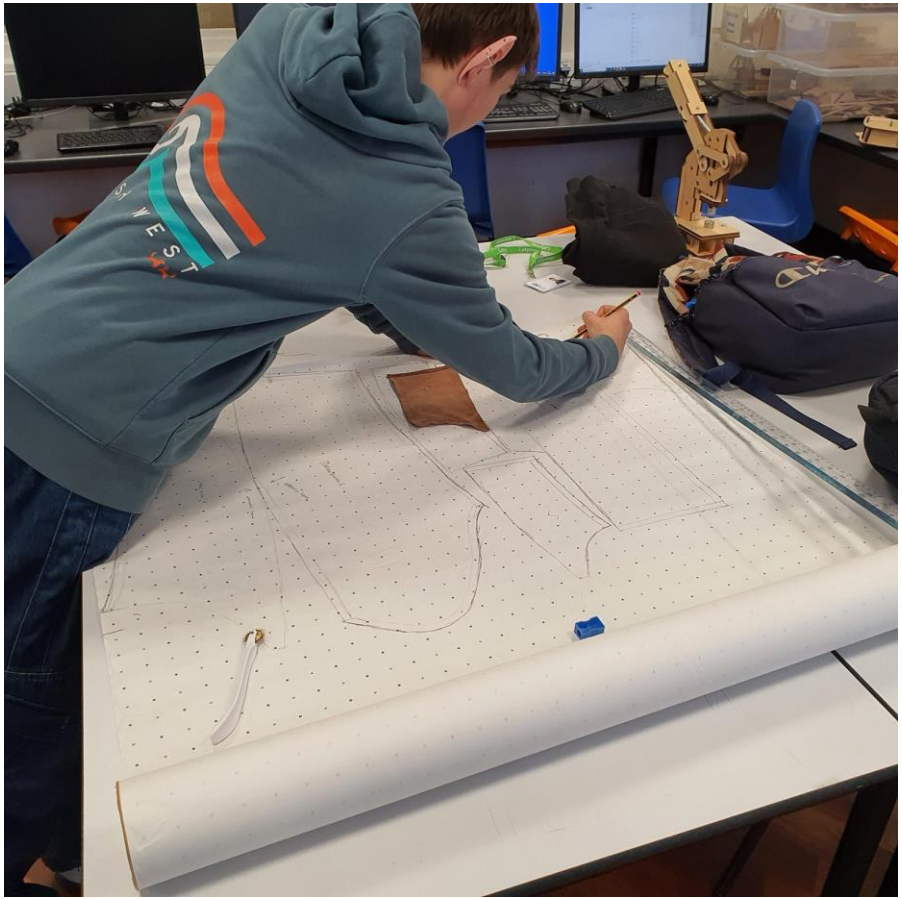
This pathway is ideal for students who:

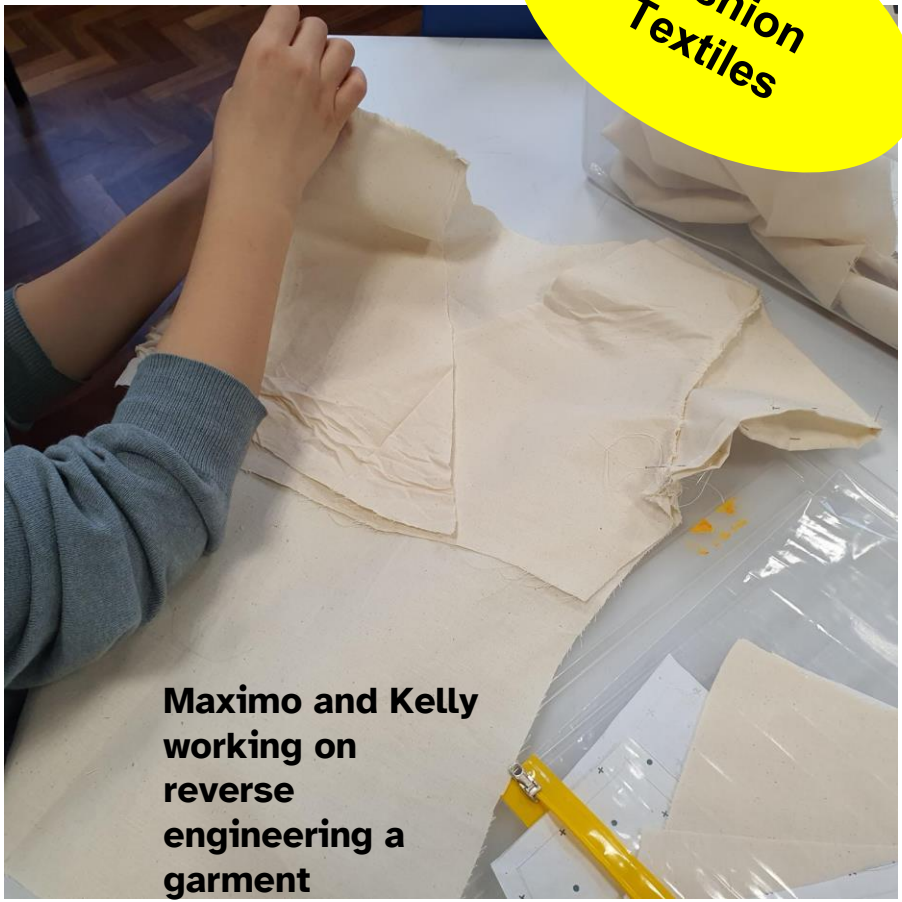
- Have experience of designing and making using fabrics
- Are interested in pursuing a Fashion/Textiles degree
- Are highly creative and experimental

Fashion Textiles

Multi-layer skirt
by Maximo

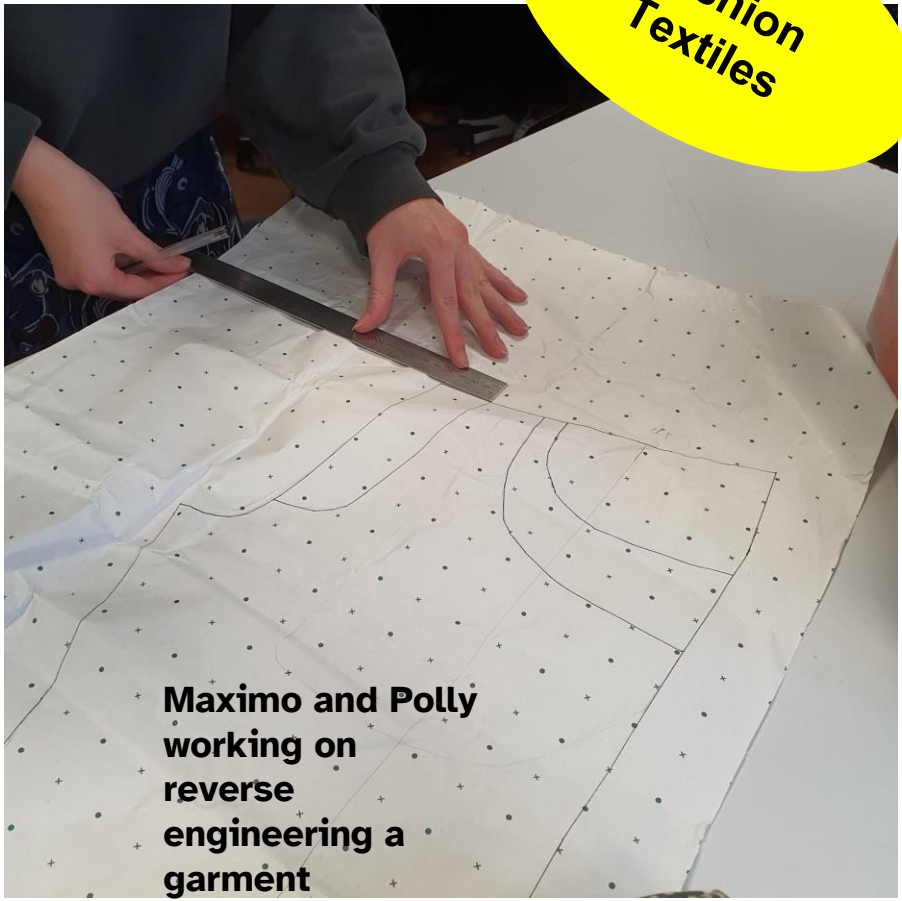
Fashion Textiles





Maximo and Kelly working on reverse engineering a garment

Fashion Textiles



Maximo and Polly working on reverse engineering a garment

Further designs

Fashion Textiles

Finished Calico Jacket

Fashion Textiles

A Level DT: Course Structure

	Term 1	Term 2	Term 3	Term 4	Term 5
Design Engineering	Intro to mechatronics	Advanced Mechatronics	Product Analysis leading to Iterative Design Project	NEA Development & Testing	Finalising NEA and exam preparation
Product Design	Workshop skills	User Focused Iterative Design	Personal Projects leading to NEA		
Fashion & Textiles	Skills Acquisition	Deconstructing garments	Personal Projects leading to NEA		

A Level DT: OCR Content & Assessment Structure

Content overview	Assessment overview	
This paper is set out through four sets of questions that predominantly cover technical principles within each endorsed title. Learners will be required to: • analyse existing products • demonstrate applied mathematical skills • demonstrate their technical knowledge of materials, product functionality, manufacturing processes and techniques • demonstrate their understanding of wider social, moral and environmental issues that impact on the design and manufacturing industries.	Principles of… 80 marks 1 hour 30 minutes Written paper	**26.7% of total A Level**
This component has a series of longer answer questions that require learners to demonstrate their problem solving and critical evaluation skills. Learners will be required to: • apply their knowledge, understanding and skills of designing and manufacturing prototypes and products • demonstrate their higher thinking skills to solve problems and evaluate situations and suitability of design solutions.	Problem Solving in… 70 marks 1 hour 45 minutes Written paper	**23.3% of total A Level**
The 'Iterative Design Project' requires learners to undertake a substantial design, make and evaluate project centred on the iterative processes of explore, create and evaluate. Learners identify a design opportunity or problem from a context of their own choice, and create a portfolio of evidence in real time through the project to demonstrate their competence.	Iterative Design Project 100 marks Approx. 65 hours Non-exam assessment	**50% of total A Level**

A Level DT: Course Pre-requisites

Enthusiasm for making
Want to do a **creative** A Level
Able to work **independently**

For Fashion Textiles:

Must have some experience of working with textiles

A Level DT: Pathways

Engineering degree
Product design degree
Fashion design degree
Architecture degree

A Level DT: Pathways

Design Engineering is an *excellent* pathway to take if you are considering engineering as a degree. It gives students an advantage when applying for engineering degree courses, and complements Maths and Physics very well