ANAYAT KHAN

MECHANICAL ENGINEERING AT UNIVERSITY COLLEGE LONDON

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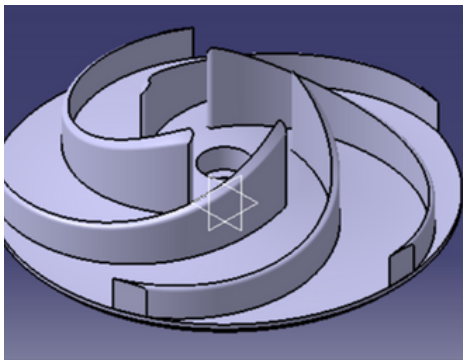
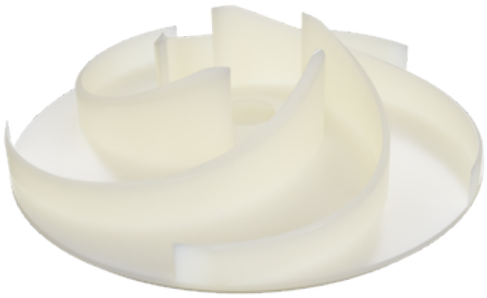
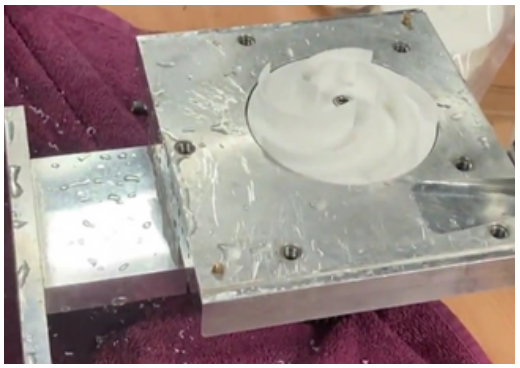
VENTRICULAR ASSISTANCE DEVICE (VAD)







What?

- Design and manufacture an **impeller** device that assists patients with heart failure by increasing blood flow to 16 kPa
- Test **requirements**: speed 2900 RPM, flowrate 4 L/min, Power 168W,

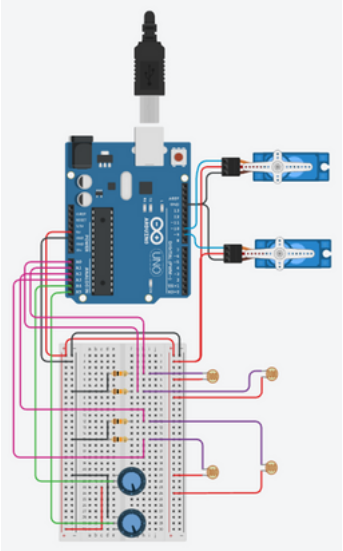
How?

- Designed on **CATIA V5**
- Flow angle mismatch calculations- prevent turbulent flow and losses
- Material selection using **CES Edupack**: Aluminium 7000
- Additive manufacturing by **3D printing** for testing

Results

- The impeller achieved an efficiency of 60% which was higher than expected
- Flowrate of 75 L/min and pressure gradient of 80 kPa
- Lightweight at 0.121 kg
- Impeller would be scaled down for use in patients

ARDUINO SOLAR TRACKER - PERSONAL PROJECT



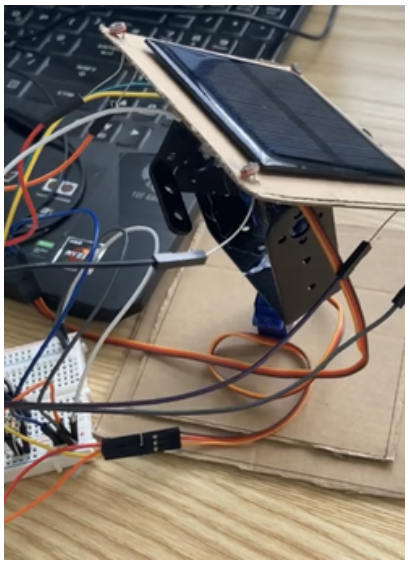
```
Text                                                    1 (Arduino Uno R3)
#include <Servo.h>


Servo horizontal; // horizontal servo
int servoh = 180;
int servohLimitHigh = 175;
int servohLimitLow = 5;
// 65 degrees MAX

Servo vertical; // vertical servo
int servov = 45;
int servovLimitHigh = 60;
int servovLimitLow = 1;

// LDR pin connections
// name = analogpin;
int ldrlt = A0; //LDR top left - BOTTOM LEFT <--- BDG
int ldrrt = A3; //LDR top rigt - BOTTOM RIGHT
int ldrld = A1; //LDR down left - TOP LEFT
int ldrrd = A3; //ldr down rigt - TOP RIGHT

void setup(){
horizontal.attach(9);
vertical.attach(10);
horizontal.write(180);
vertical.write(45);
delay(2500);
}
void loop() {
int lt = analogRead(ldrlt); // top left
int rt = analogRead(ldrrt); // top right
```



What?

- Create autonomous robot solar panel that tracks the position of the Sun
- Maximise renewable solar radiation absorption during the day

How?

- Circuit designed on **TinkerCAD**
- Connected components: servo motors, resistors, LDR using breadboard and **soldering**
- Used **Arduino** Uno R3 to programme the functionality of the instrumentation

Results

- Compared with static panel on **MATLAB** the tracker improved voltage output by 76%
- Relatively quick response time of 0.5 s

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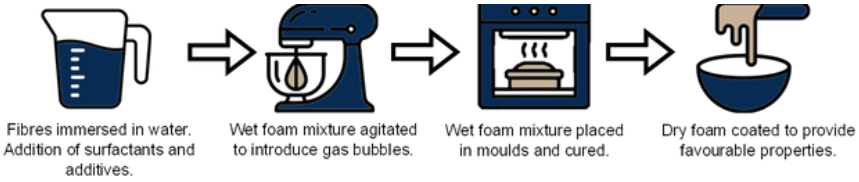
SUSTAINABLE FOAMS - MENG PROJECT



What?

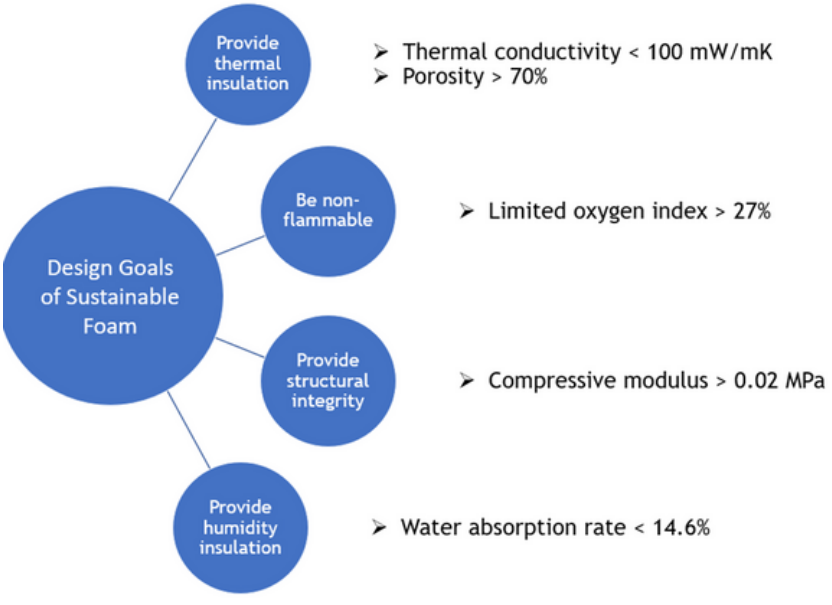
- Create a **sustainable** cellulose-based foam for **insulation** and **construction** applications
- Must be **non-toxic**, **carbon neutral**, **biodegradable** and prevent/slow fire spread in a building
- Compete with polyurethane foam properties: insulation, loading modulus, flammability and humidity absorption, end of **life cycle**

How?

- Perform mechanical foaming to form foam matrix
- **FTIR spectroscopy** to determine quality of cellulose foams
- **CT scanning** to model morphology of the porous network in **Avizo3D**
- **Compression testing** using Instron 5985 to find loading modulus and densification energy
- **Thermal conductivity testing** using MTPS sensor
- **Flammability testing** using LOI tests at iTA Labs

Results

- Thermal insulation achieved at **67.24 mW/mK**
- Higher loading modulus than competitive foams at **1.22 MPa**
- Greater resistance to flammability at **24% LO**I
- Humidity absorption of **13%**
- Higehr porosity of **86%**
- All these properties enable the foam to be used in building appilcations



Scaled up Final Foam Panel

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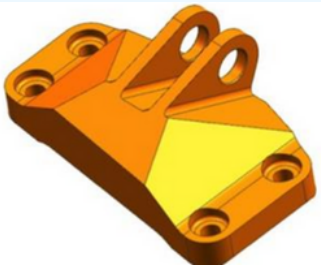
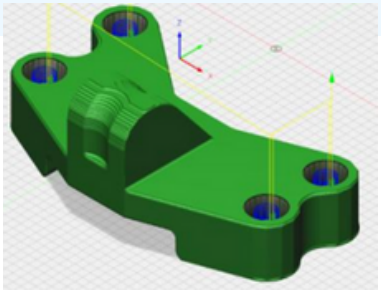
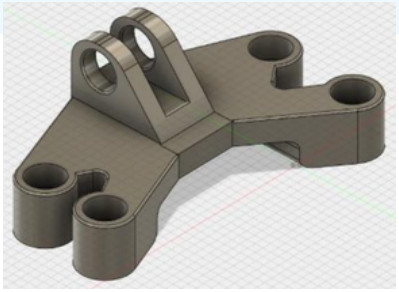
BATTERY BRACKET







What?

- Design a bracket to hold EV batteries
- Must be able to carry load and have a fast manufacturing time

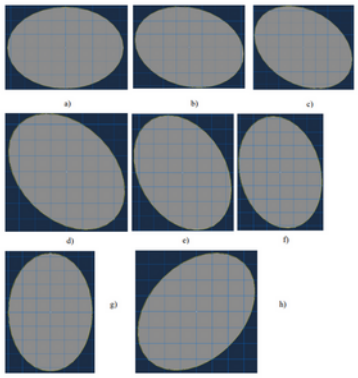
How?

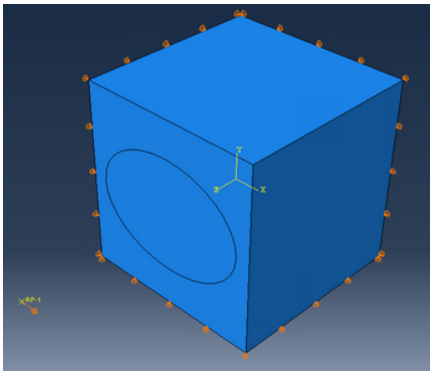
- Used **Fusion 360**
- **Generative design** function to input constraints and requirements
- **3 Axis CNC** miller and standard tools used for manufacturing

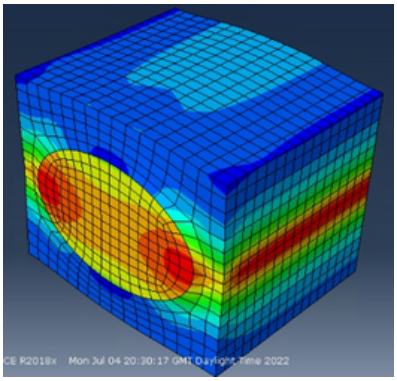
Results

- 11 step manufacturing process
- 7 tools used
- cycle time of 5 hours
- **Safety factor** of 1.8

GRAPHENE FIBRE ORIENTATION OPTIMISATION







What?

- Determine the **optimum fibre orientation** of graphene in an aluminium matrix
- Create a **computational model** that can be used for any material property
- Improve on existing model accuracy

How?

- **FEA** carried out on **ABAQUS**
- Individual models for angles 0-135 degrees
- **Periodic** boundary conditions applied using **Python** import
- Representative Volume Element (RVE) modelled

Results

- Optimum orientation found at 0 degrees (transverse load) and 90 degrees (longitudinal load)
- Transverse modulus of 185 GPa
- Longitudinal modulus of 442 GPa
- Successful model created for any material input