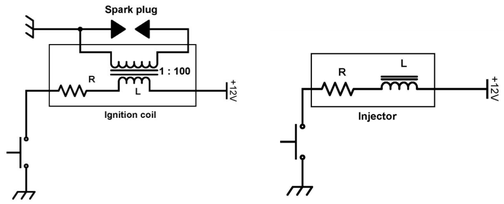
Biofuel Engine Control System

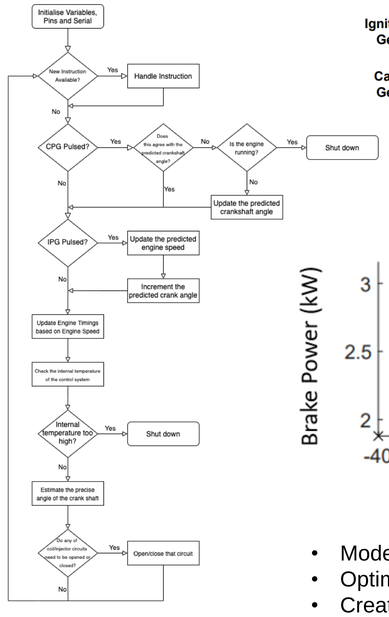
DMT Group 4C
Kyubin Lee: Project Manager
James Lum: Electronics Design
Chuan (Jerry) Wang: Housing Design
Louis Manestar: PCB & Software Design

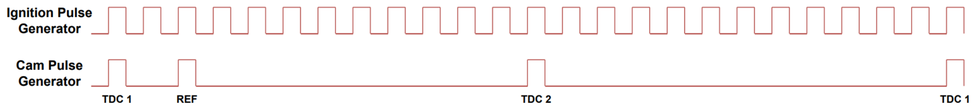
Goal: To design a control system that will allow a motorcycle engine to run on bioethanol (E85).

Control System objectives:
- Measure engine signals to determine speed and stroke.
- Determine optimal fuel/spark timings for brake power.
- Open/close injectors and create a spark at the right time.
- Communicate with the user.

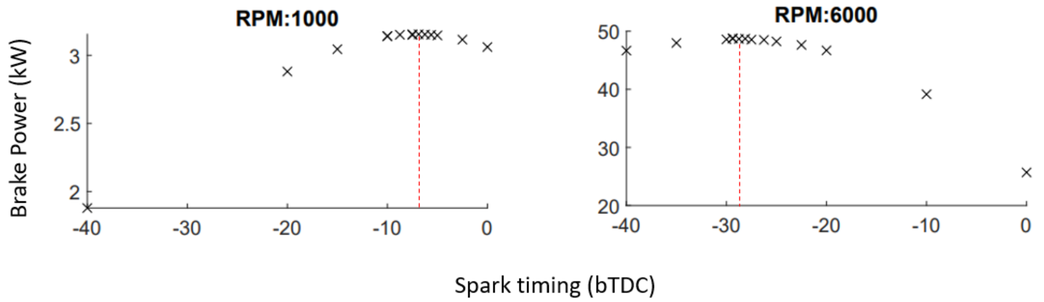


- Ignition Coil and Fuel Injectors can be modelled as simple RL circuits.
- Injector uses the inductor as an electromagnet to open and close valve.
- Ignition coil uses the rapid change in current across inductor to produce voltage spike.





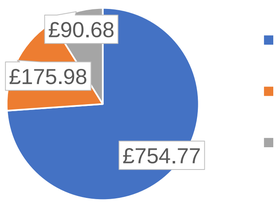
- Use Ignition Pulse Generator to determine engine speed.
- Use CAM Pulse Generator to determine what stroke each cylinder is undergoing.

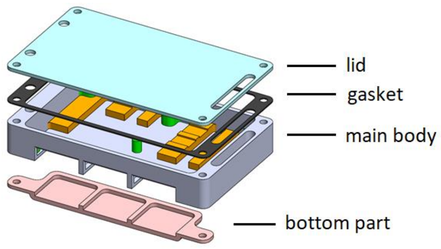


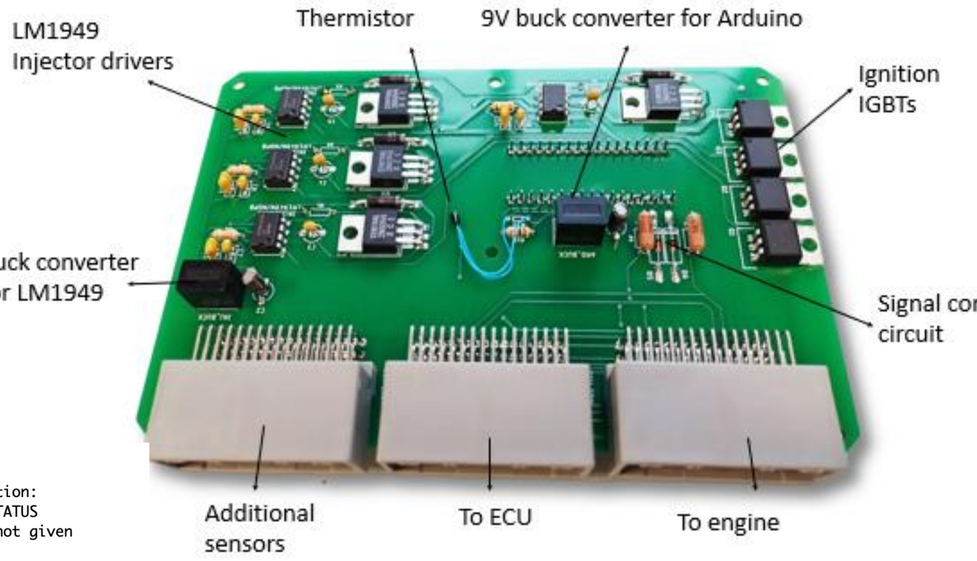
- Model engine on GT Power to determine the optimal spark and fuel timings.
- Optimise for brake-power over efficiency.
- Create fuel and spark map in control system for different engine speeds.

First Iteration

Overall Budget: £1023.70



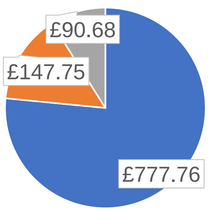


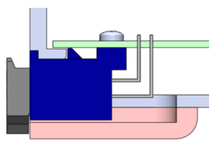


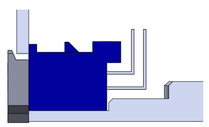

```
STATUS

new instruction:
    type: STATUS
    speed: not given

engine status:
    crank angle: 30 deg
    speed: 2480 RPM
    temp: 45 deg C
    is running: false

timings:
    target RPM: 1000
    spark: ~322 to ~352 deg
    fuel: ~10 to ~14 deg
    is valid: true
```

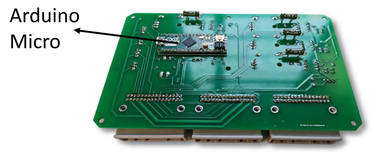
Second Iteration

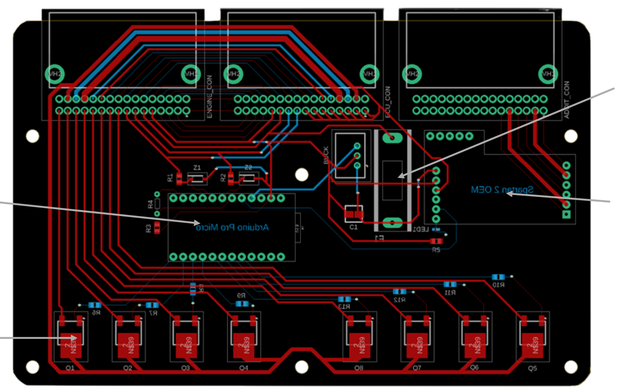
Overall Budget: £1016.19







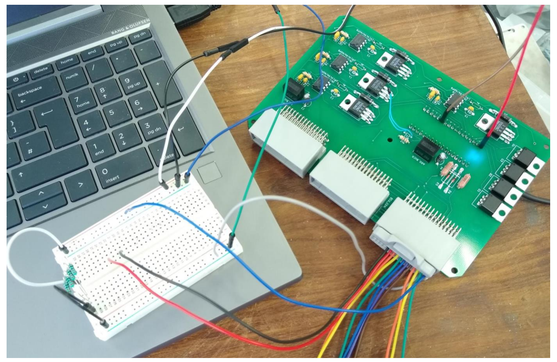




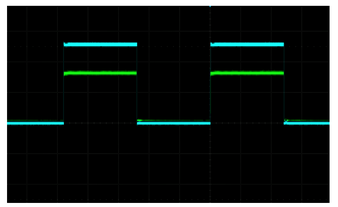
Imperial College London

Testing

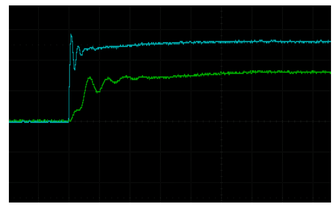
- PCB test to ensure that electronics operate as intended
- Other testing include:
  - Software test
  - Engine signal test
  - Housing tests



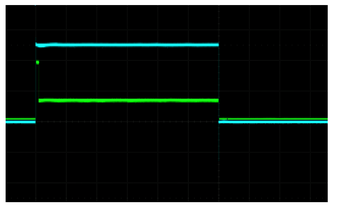
Test setup with PCB and breadboard



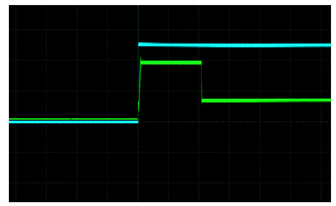
Ignition Switch



Ignition Ringing Behavior



Injector Peak and Hold Behavior



Injector Close-up (duration 2ms)