

IMechE external pipe climber project – Group B

Team members & roles:

Mateusz Skoczylas – Electronic control system design, torque calculation, CAD, final assembly & technical poster

Eoin Collins – Team leadership, CAD, propulsion mechanism design & final document proof checking

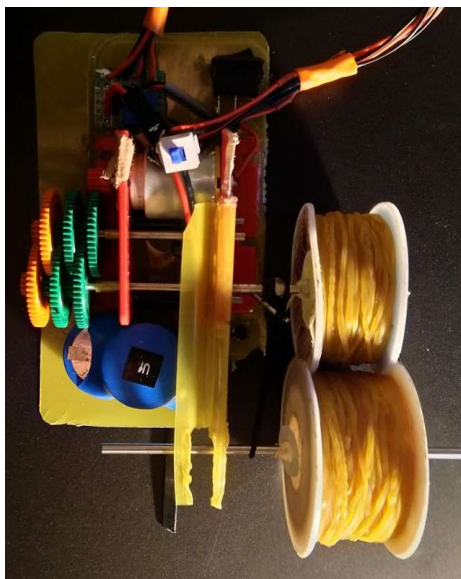
Kseniya Gomzjakova – Battery management

Introduction

The team had set out to create an external pipe climber with the approach of using thorough planning for effective execution of the task. Various concepts were discussed, and a multitude of calculations were made before the first prototype was built. The team also considered adjustability to be the priority.

The prototype discussed here is the first version. Based on testing, the next prototype will include:

- A more rigid 3D printed chassis to reduce the amount of flex at the axle.
- A more effective spring-loaded mechanical adjustment mechanism as opposed to the use of elastic treasury tags – reducing friction and increase clamping force.
- Higher reduction ratio (for more torque at output shaft) to be able to lift the supplied load fully.

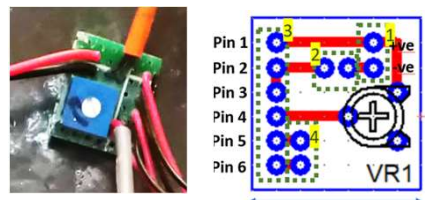


First prototype of the external pipe climber

Electronic control system

The electronic control system was designed from the ground up, with the emphasis on adjustability. This circuit offers:

- The ability to control the descent speed through a potentiometer to prevent damage.
- Configurable polarity reversal based on the position of the limit switch.



Electronic circuit

Propulsion mechanism

Just like the electronic systems, the propulsion mechanism also allows for adjustability.

- The systems conforms to the non-uniform diameter of the pipe using elastic material that secures the two axles. This provides sufficient clamping force at all times.
- The easily configurable gear ratio allows for torque multiplication. The torque achieved through changes in gearing is calculated in advance.



Propulsion wheels & elastic material

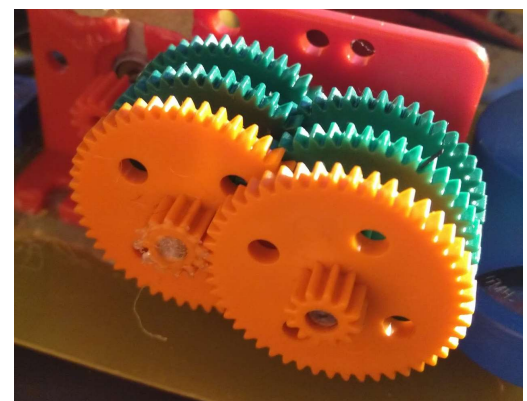
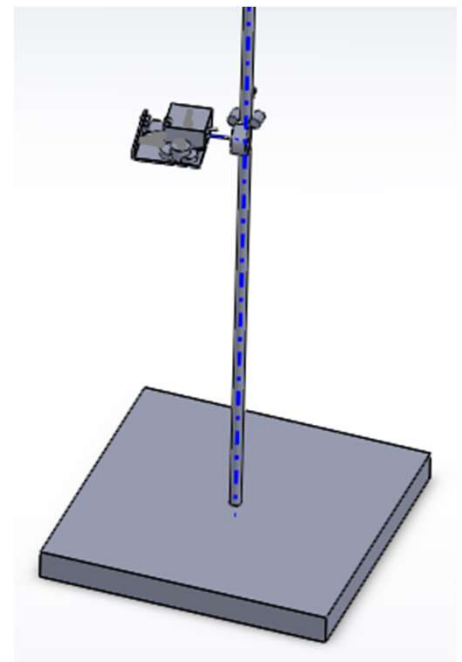
Battery

Through ensuring that ImechE battery safety requirements are met and determining the motor power draw in the worst case scenario, the minimum battery capacity & battery type was determined.

The calculations & considerations made in advance allowed for;

- The battery to be minimal in size and weight while still being able to supply power for sufficient time
- The battery to be rechargeable through the use of Ni-Mh changing technology and electrical connectors (as opposed to direct soldering to PCB)

CAD model



Gear-set