THE UNIVERSITY OF WARWICK

School of Engineering

WMG Innovative Solutions

CATAPULT High Value Manufacturing

Warwick Mobile Robotics

Urban Search & Rescue Robotics 2013/14

warwick SU

MOUSER ELECTRONICS

NORTHROP GRUMMAN

GTSS

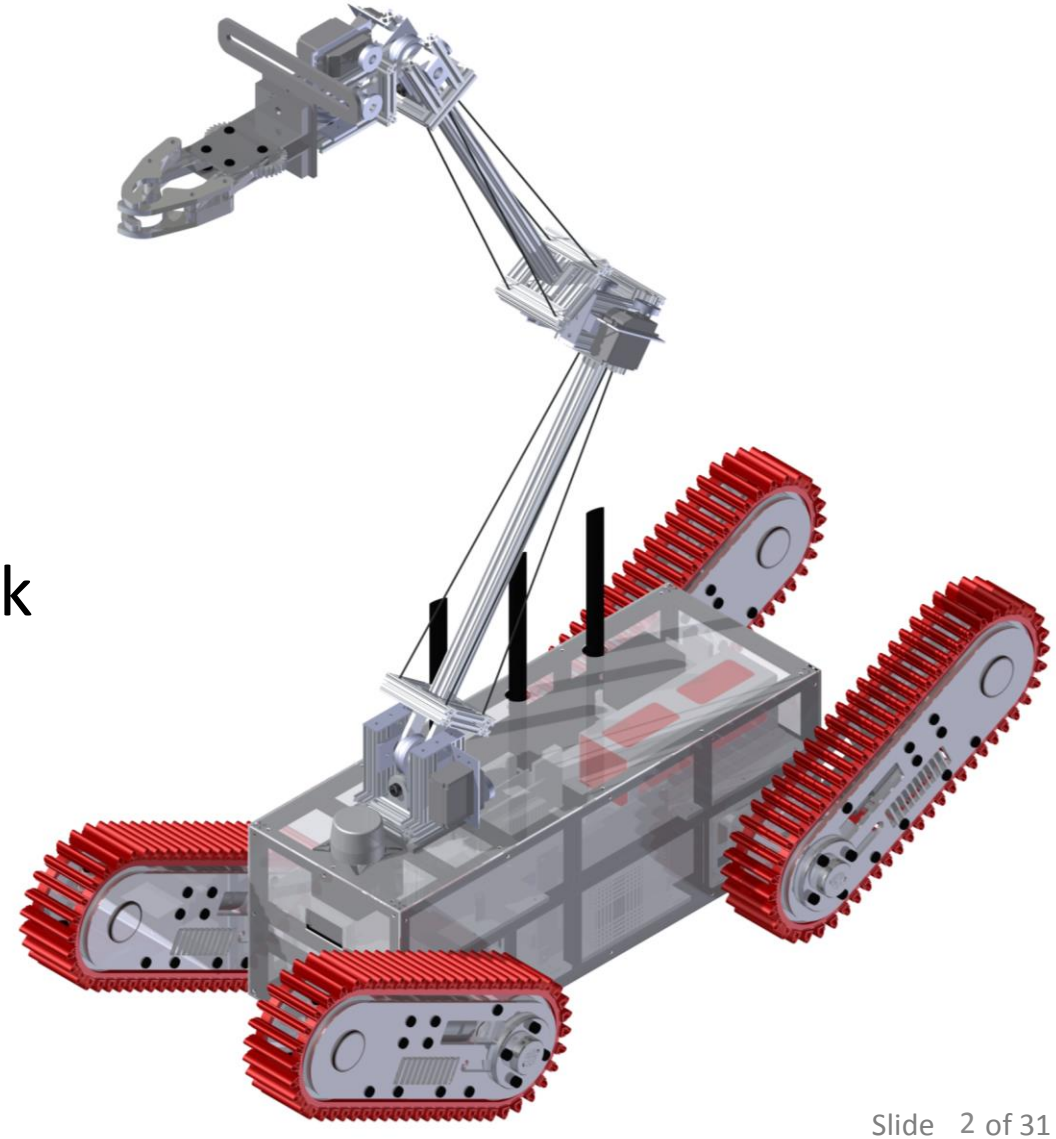
MakerBeam

HARWiN

AUTODESK

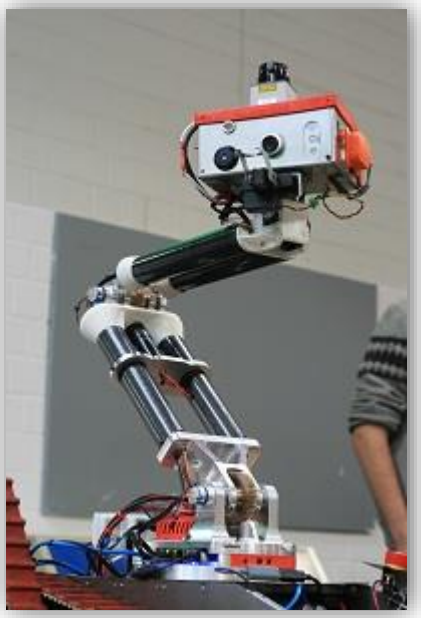
Introduction

- About WMR
- Aims and Objectives
- New Robot Design
- Testing
- RoboCup Competition
- Lessons & Future Work



What is WMR

- A group of student projects in mobile robotics



The WMR Team

Project Manager

Chris Chavasse
Electronics & Software

Systems Team

James Yardley
Power System

Jannah Aljafri
Battery Monitoring

Mechanical Team

Lauren Rutter
Chassis

Trevor Whales
Drivetrain

Andrew Parkin
Arm

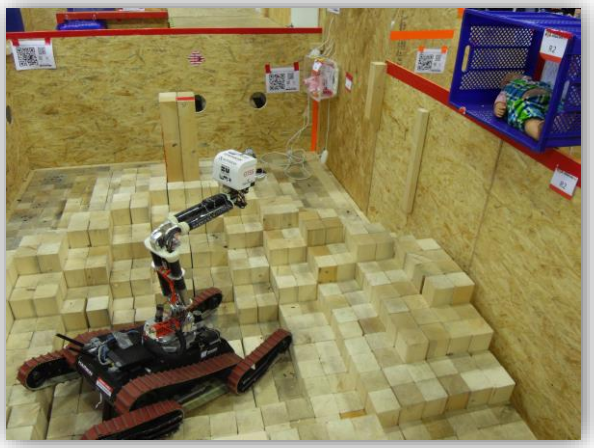
Vishal Dhanji
Head & Gripper

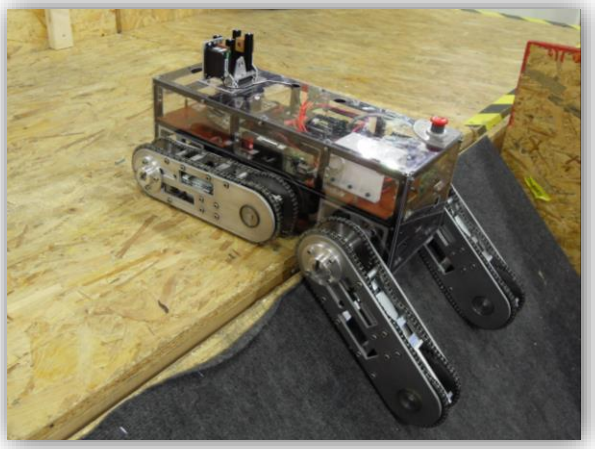
Aims & Objectives

1. Maintain the existing robot

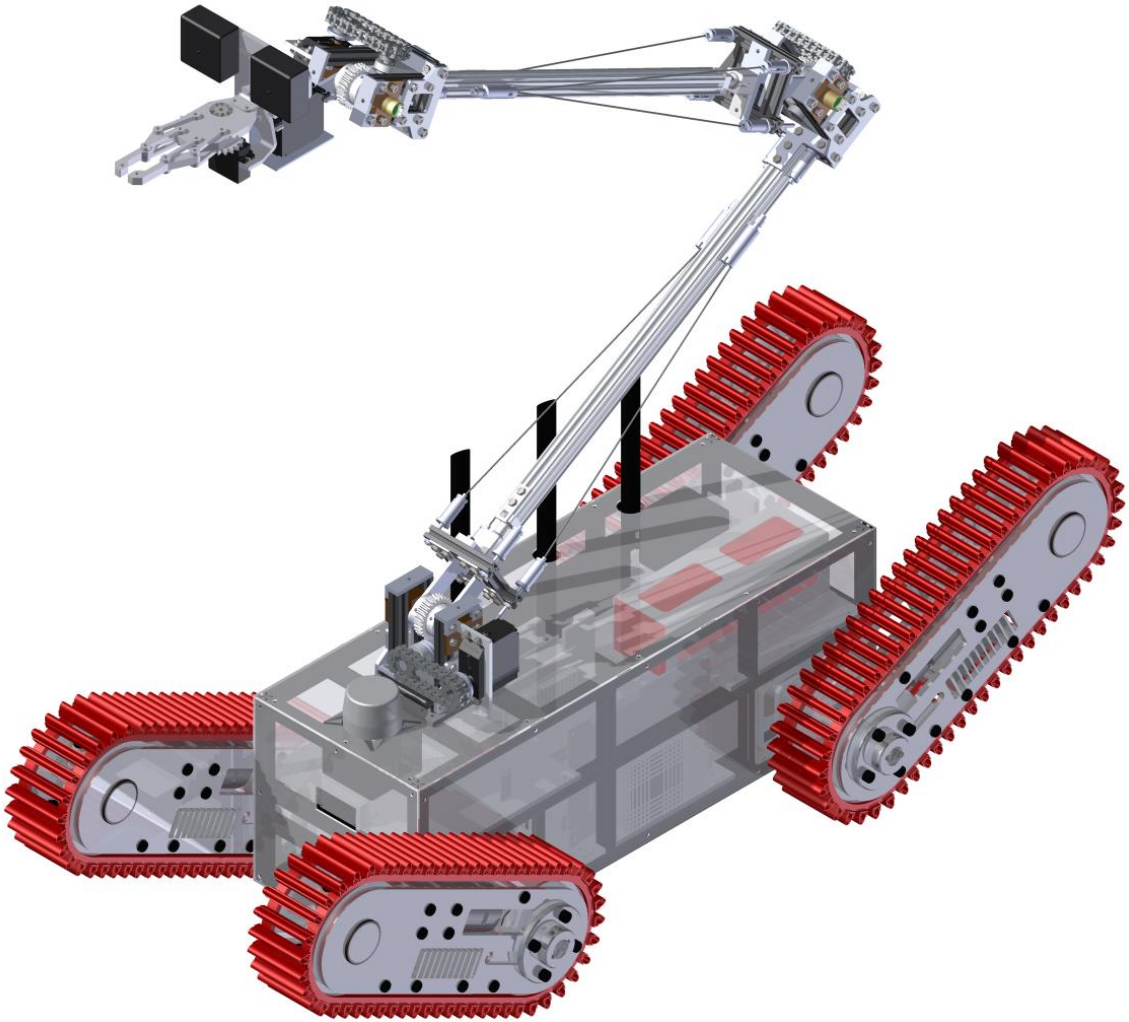
2. Develop a smaller modular USAR robot

3. Enter the RoboCup German Open 2014





New System

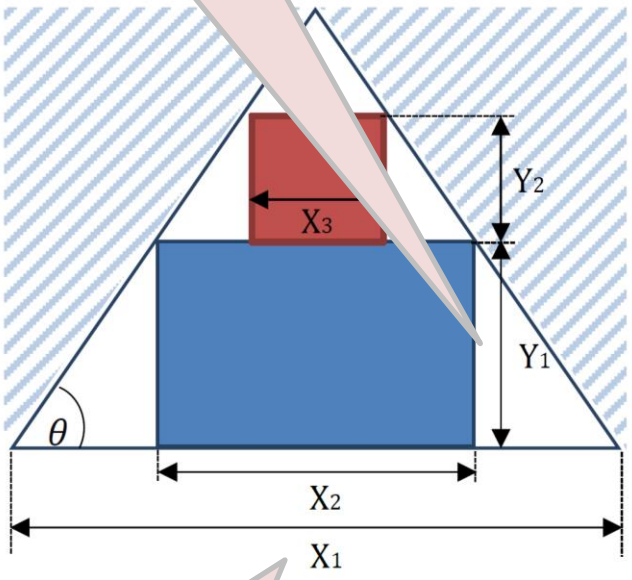


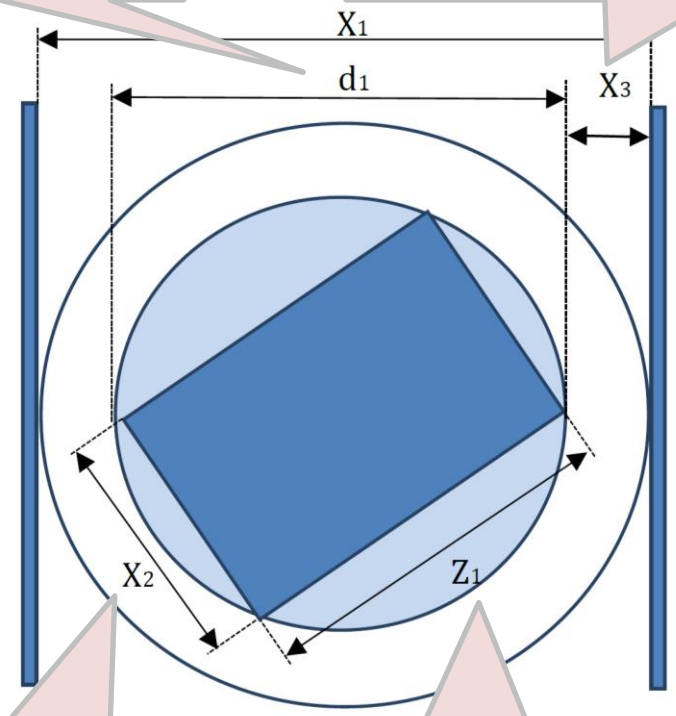
Robot Dimensions

Max. Robot Height

Turning Radius

Wall Clearance



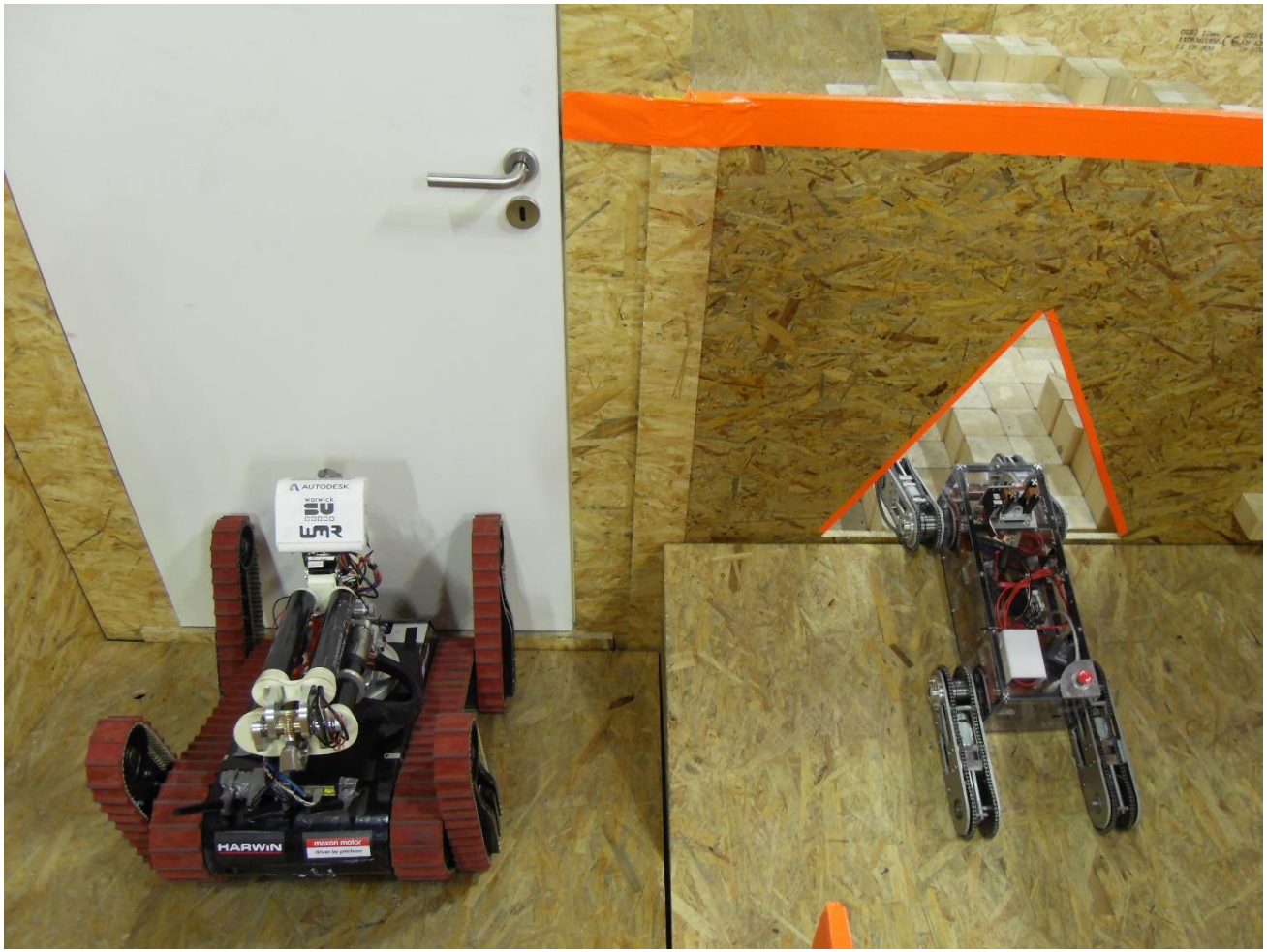


Hallway Width

Max. Robot Width

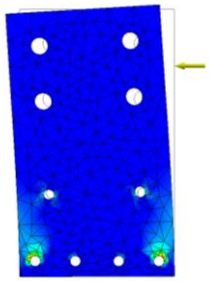
Max. Robot Length

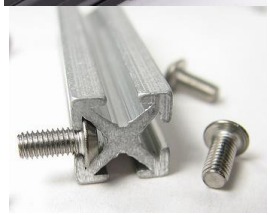
Robot Dimensions



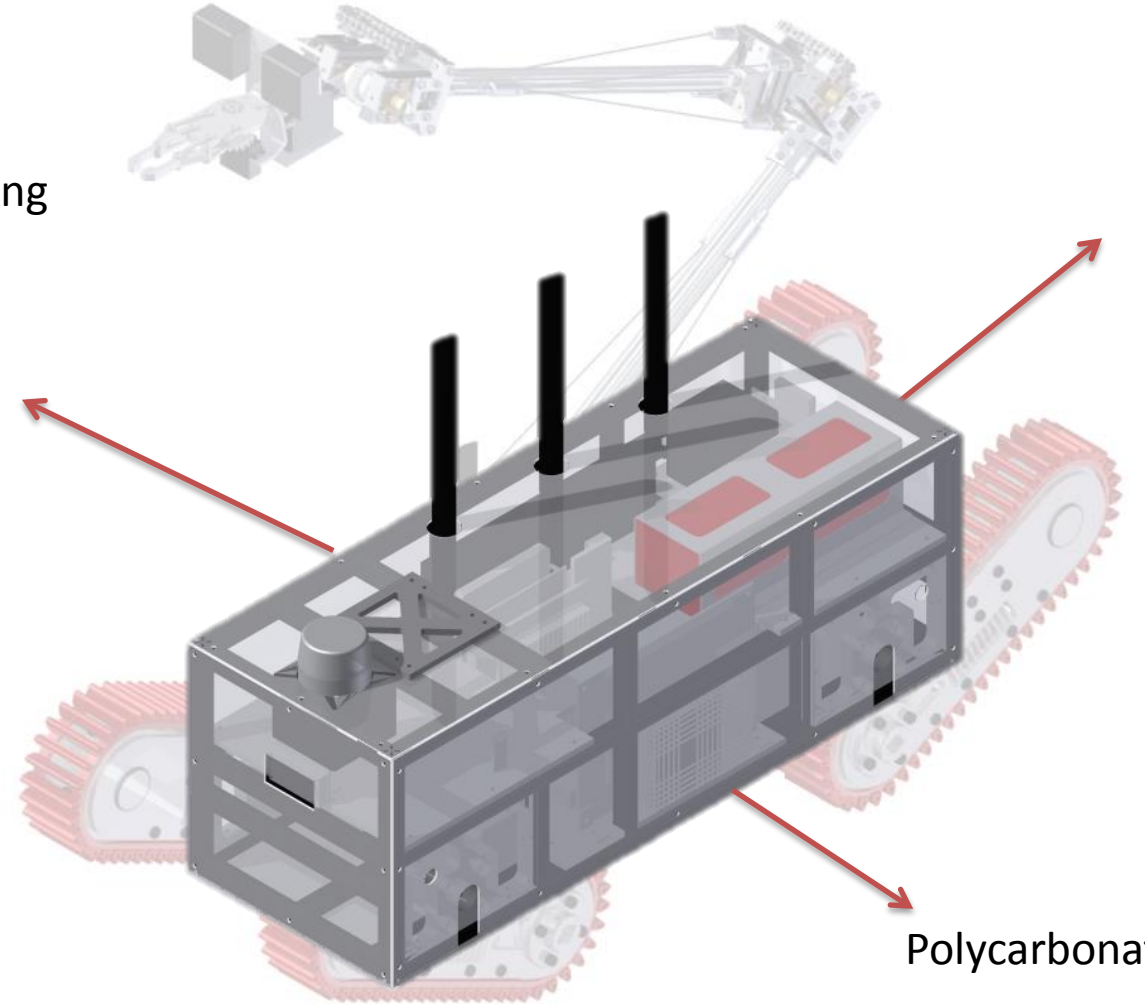
Chassis Design

Motor Mounting Plates



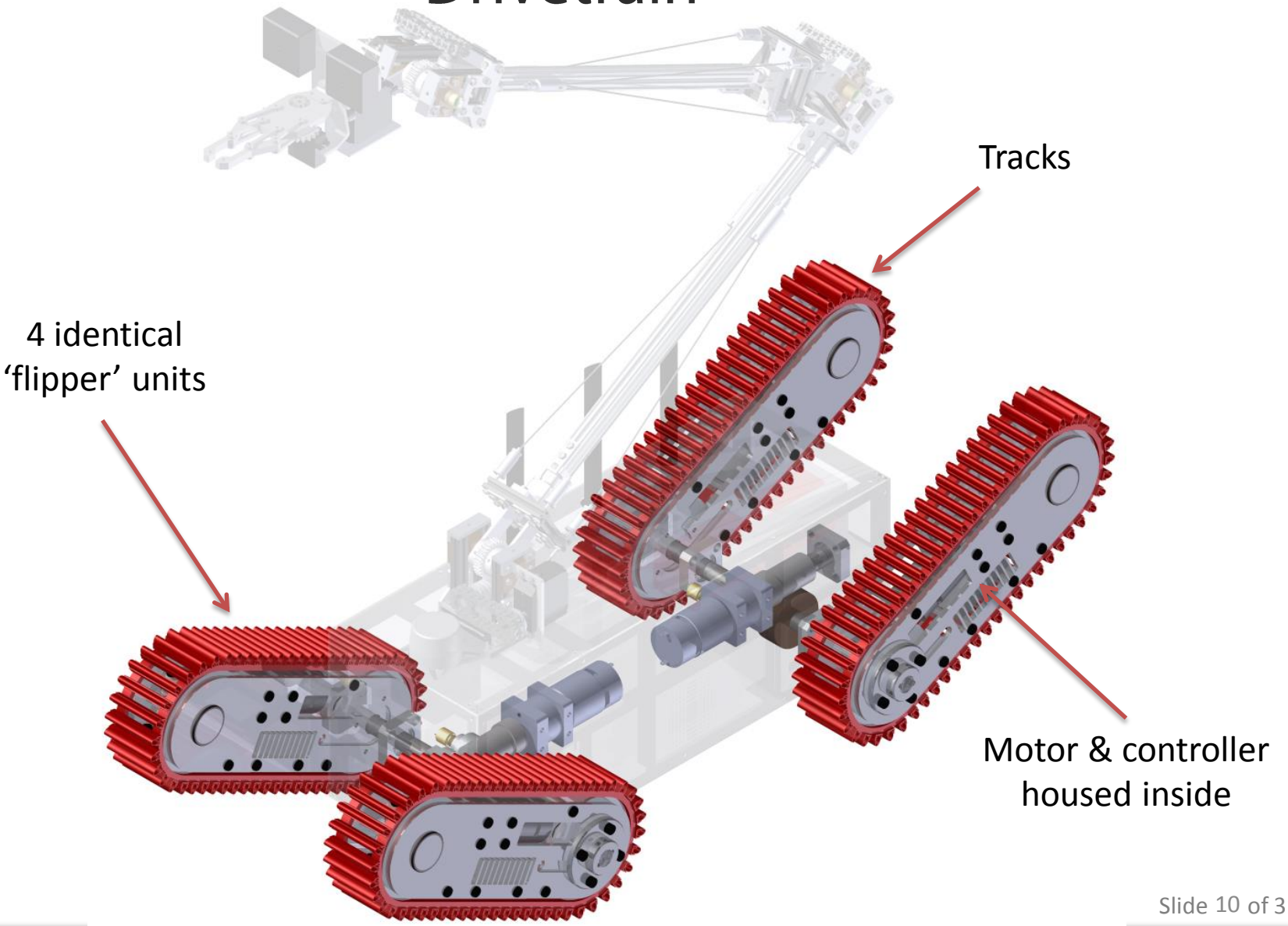


MakerBeam



Polycarbonate Shell

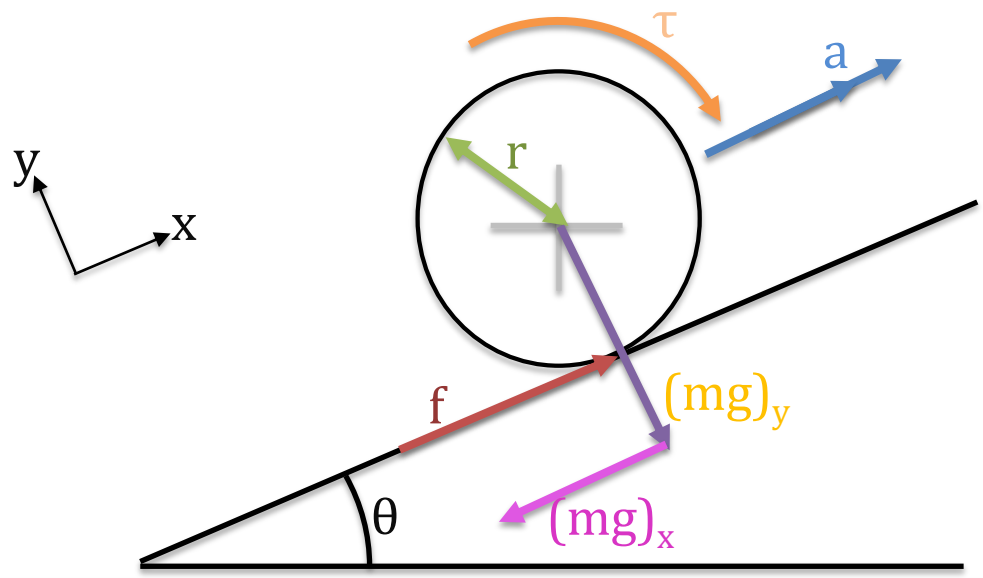
Drivetrain

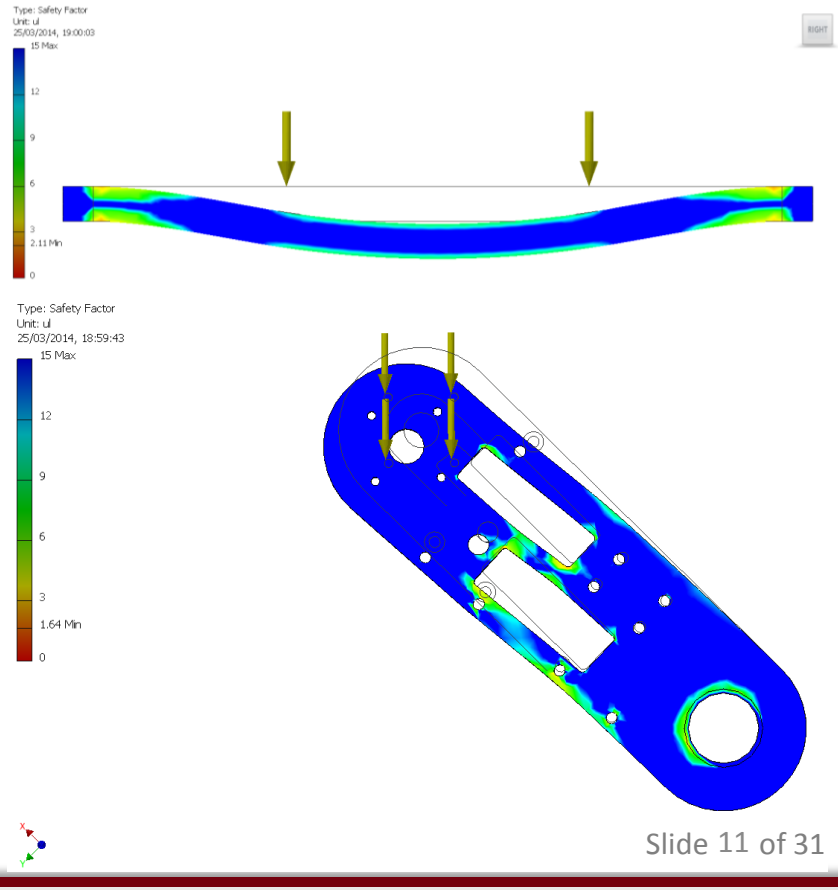

Tracks
4 identical
'flipper' units
Motor & controller
housed inside

Calculations & FEA

- Calculations carried out for motor torque

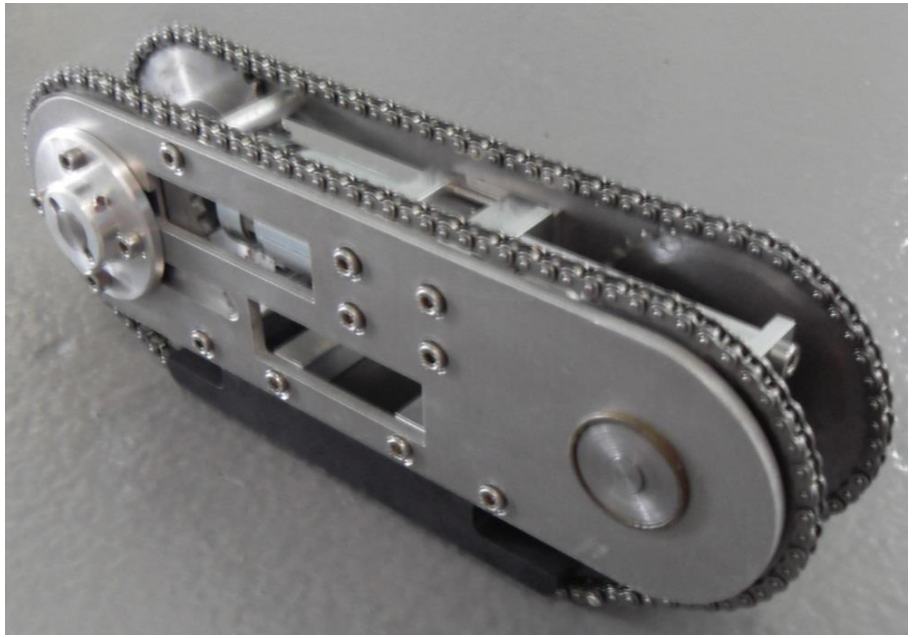
- FEA carried out on load bearing components





Finished Drivetrain

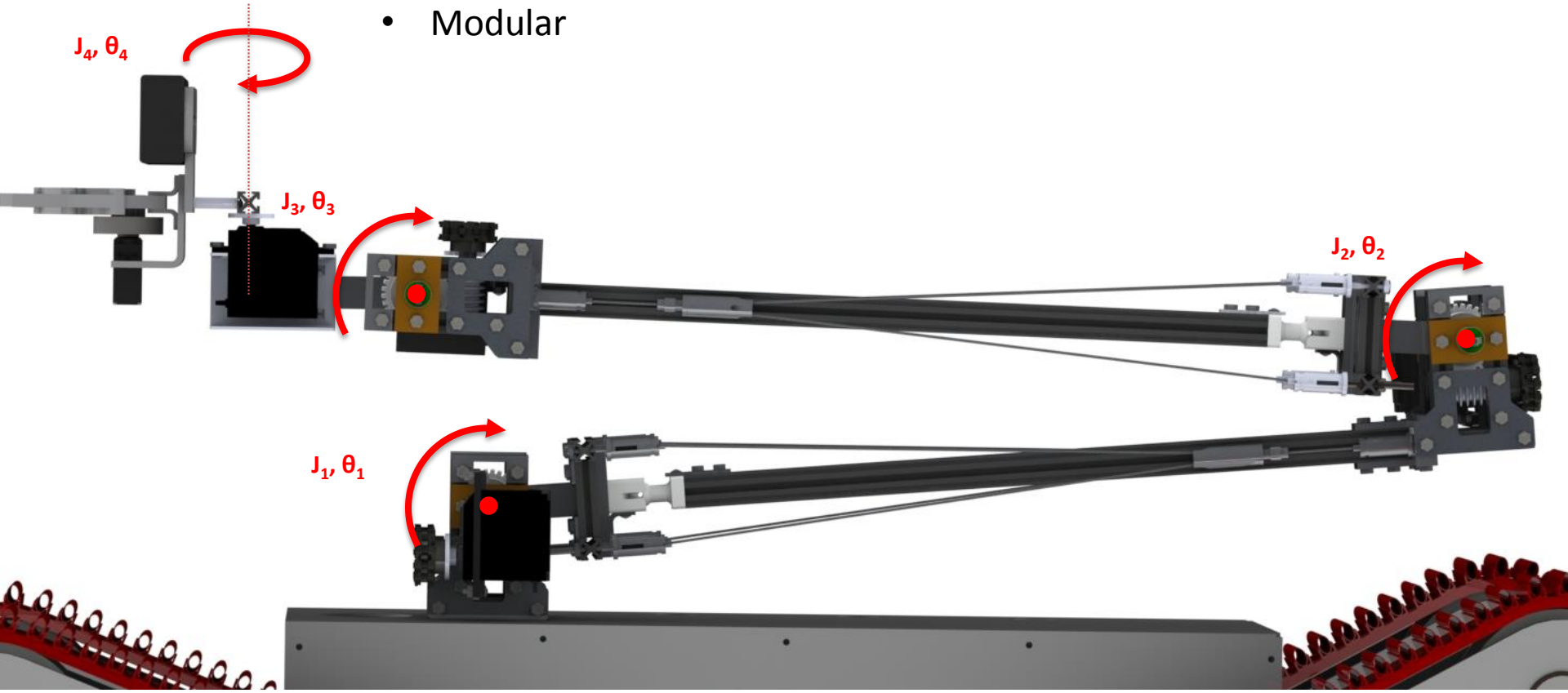
- Drivetrain designed and manufactured
  - Treads are not yet manufactured



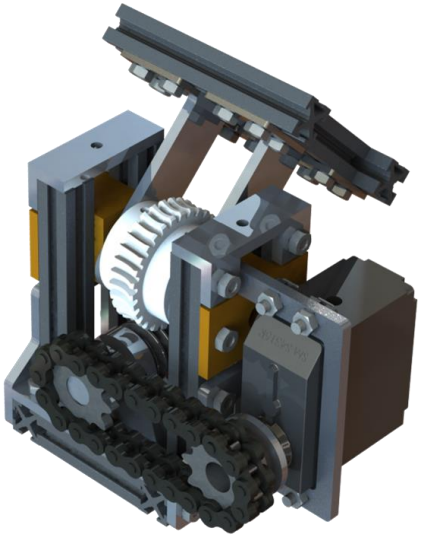
Mechanical Arm Design

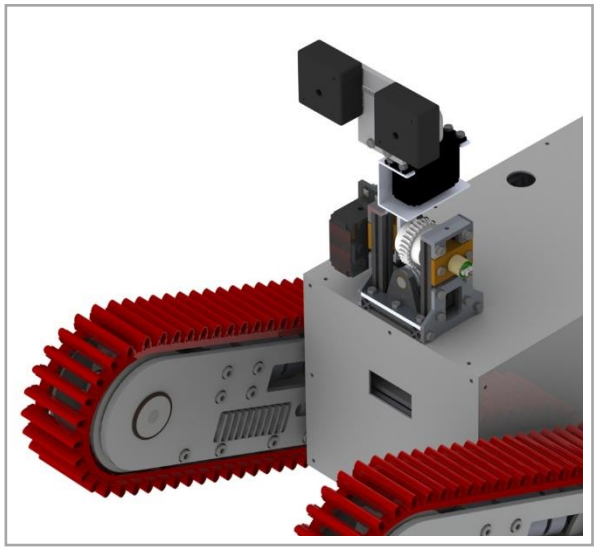
4 DoF Arm used to position& orientate sensors and gripper

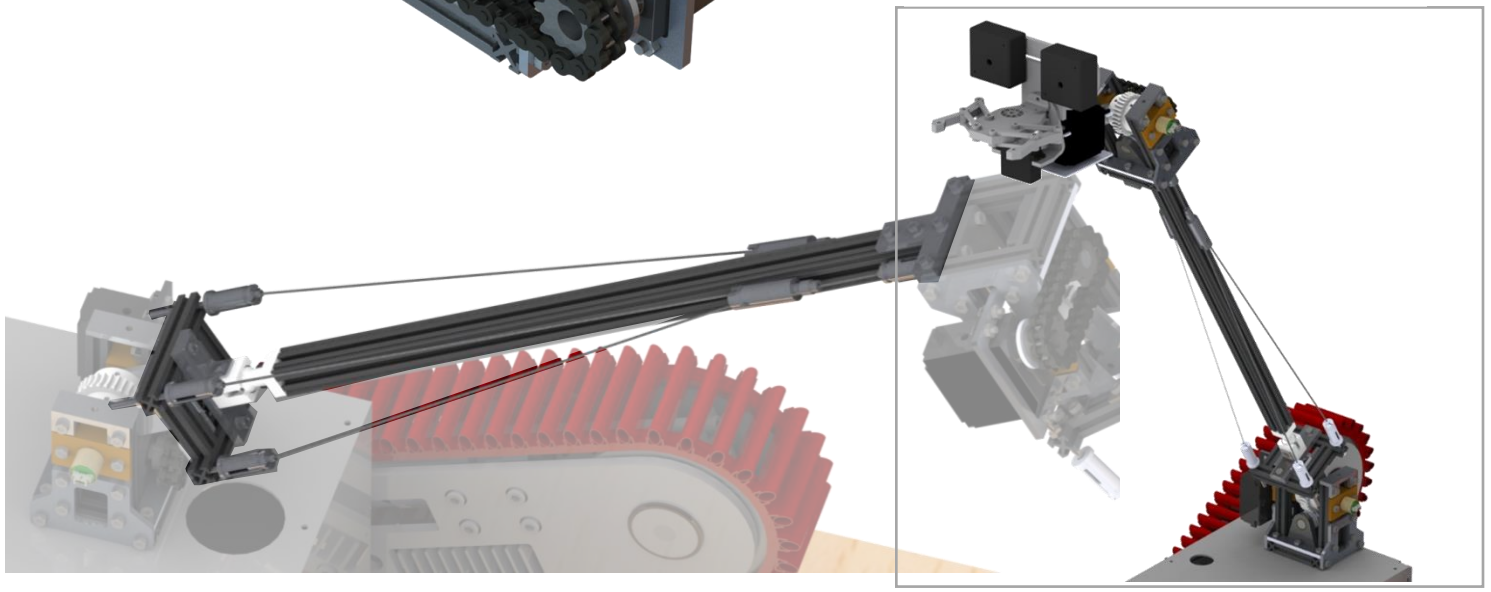
- Lightweight,
- Low cost
- Modular



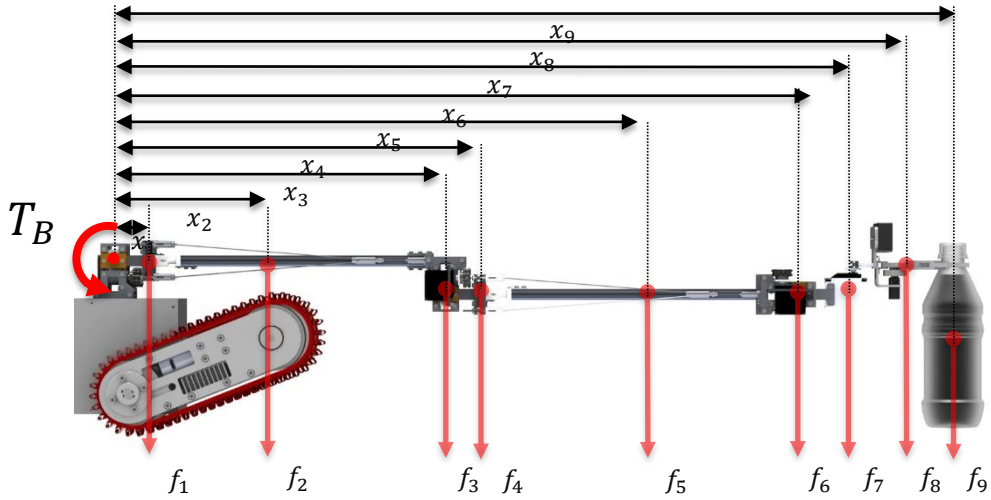
Modular design





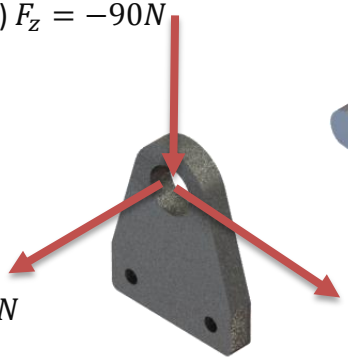


Force Analysis & FEA



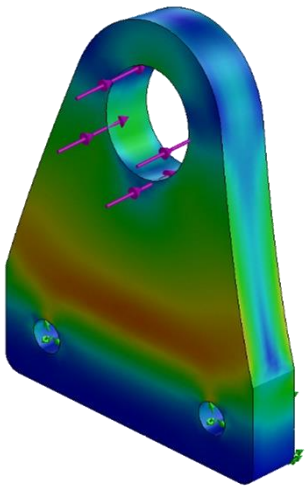
$$T_B = \sum_{1}^{n} (F_i \times x_i)$$

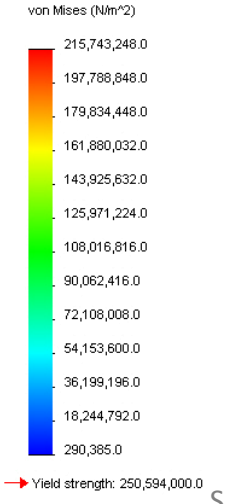
b.) $F_z = -90N$



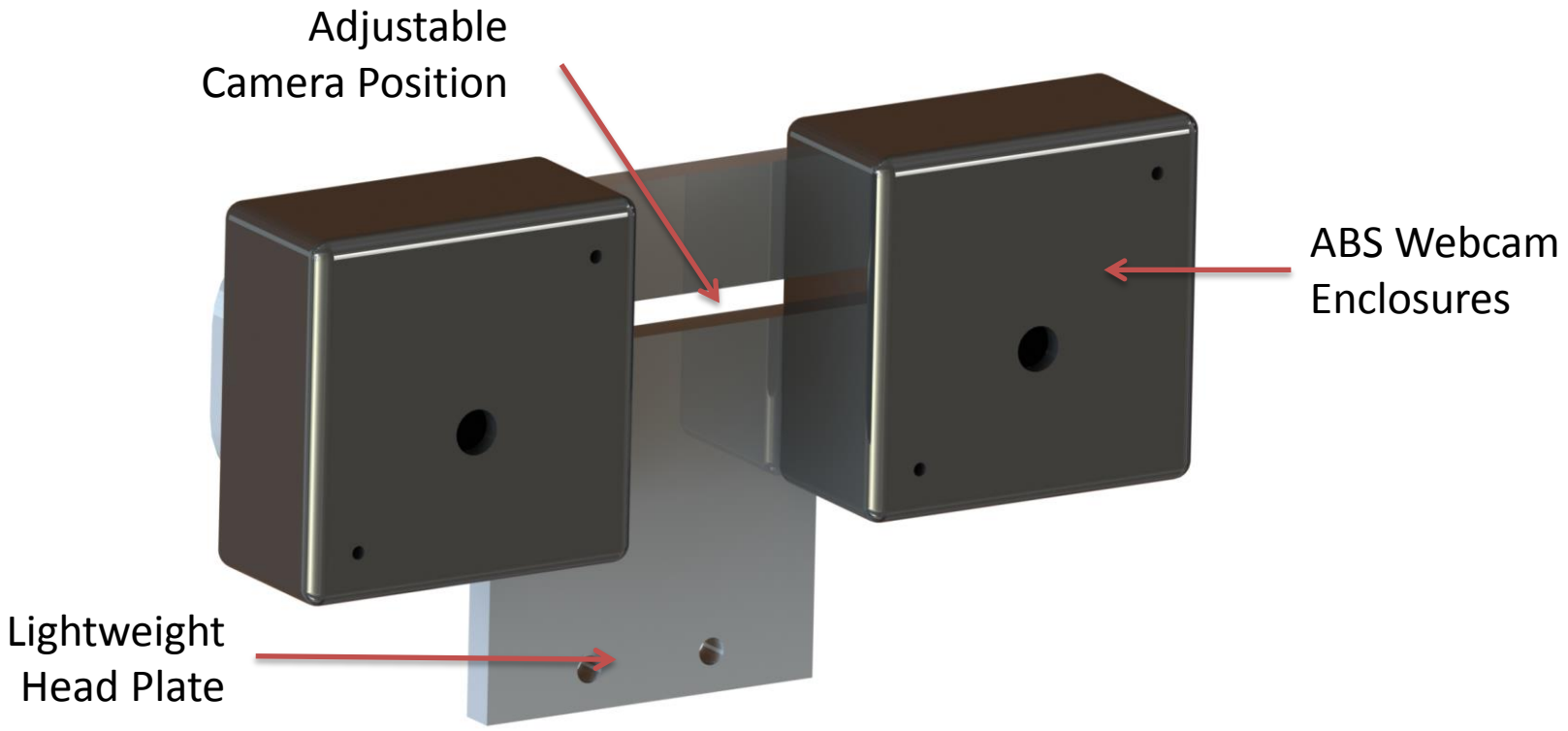
a.) $F_x = 1300N$

c.) $F_y = 290N$

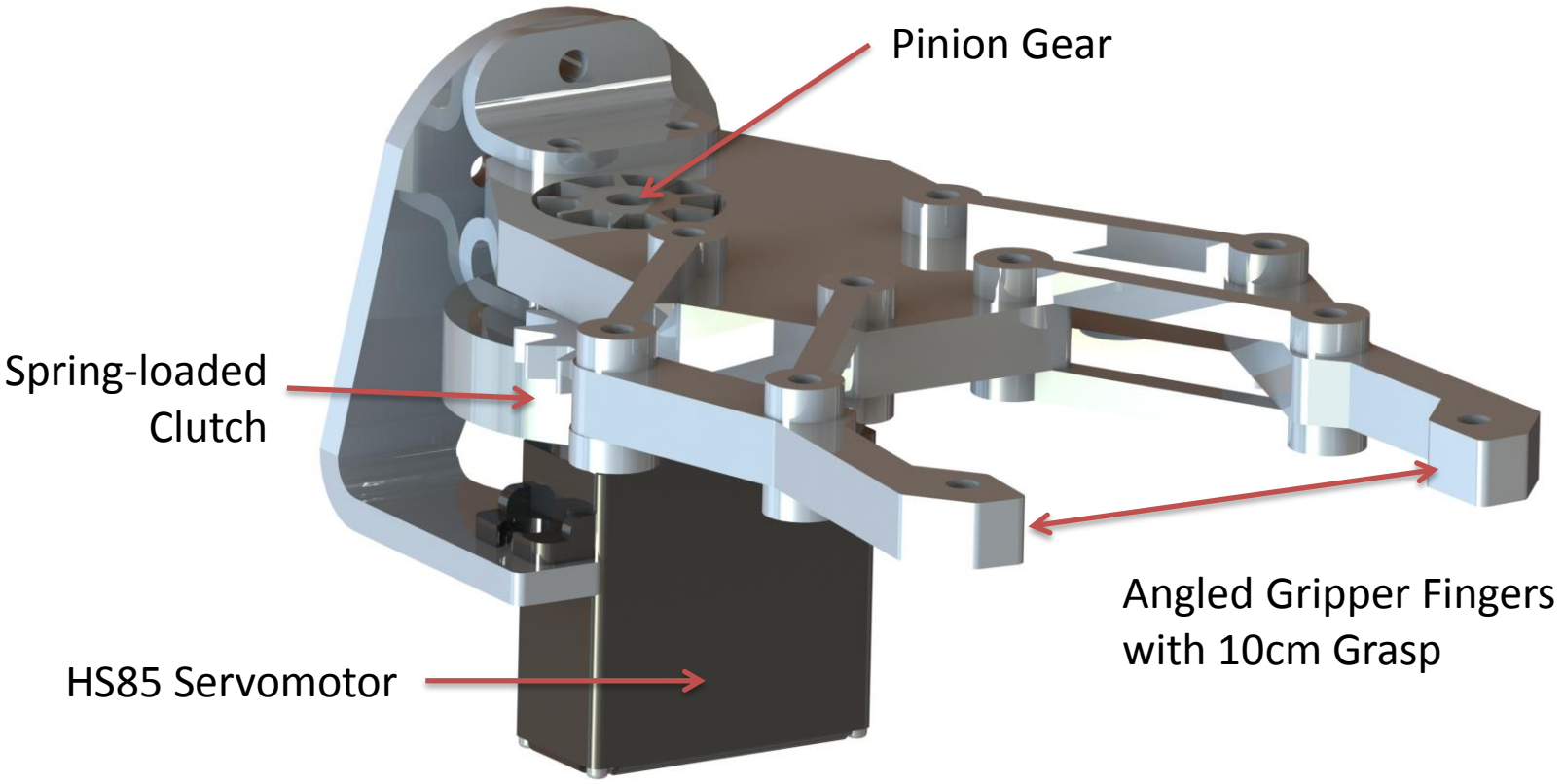




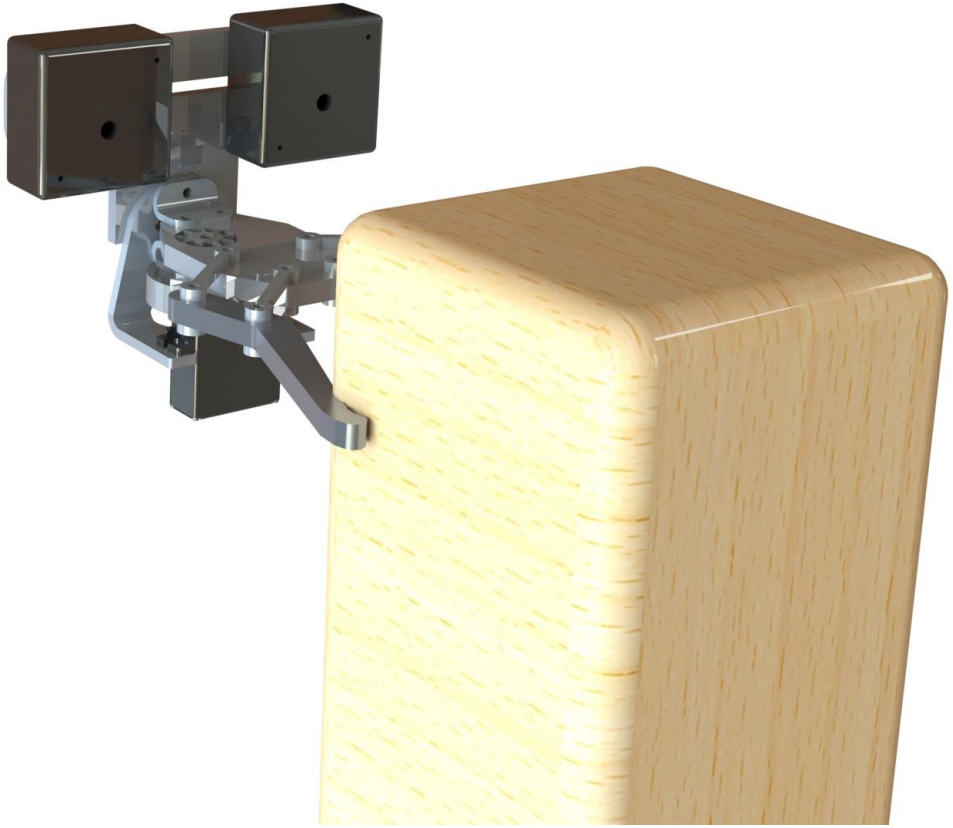
Head Design


Adjustable
Camera Position
ABS Webcam
Enclosures
Lightweight
Head Plate

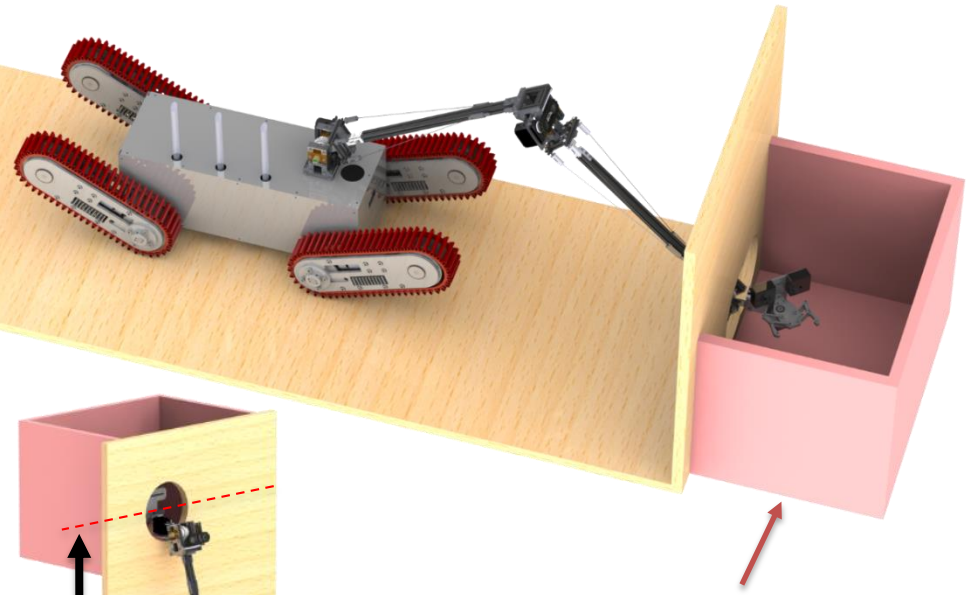
Manipulator Design

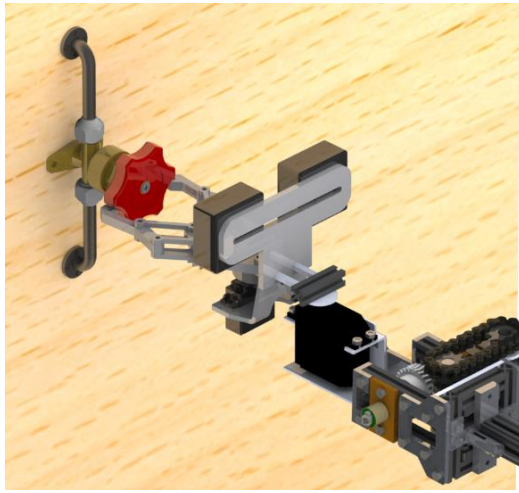


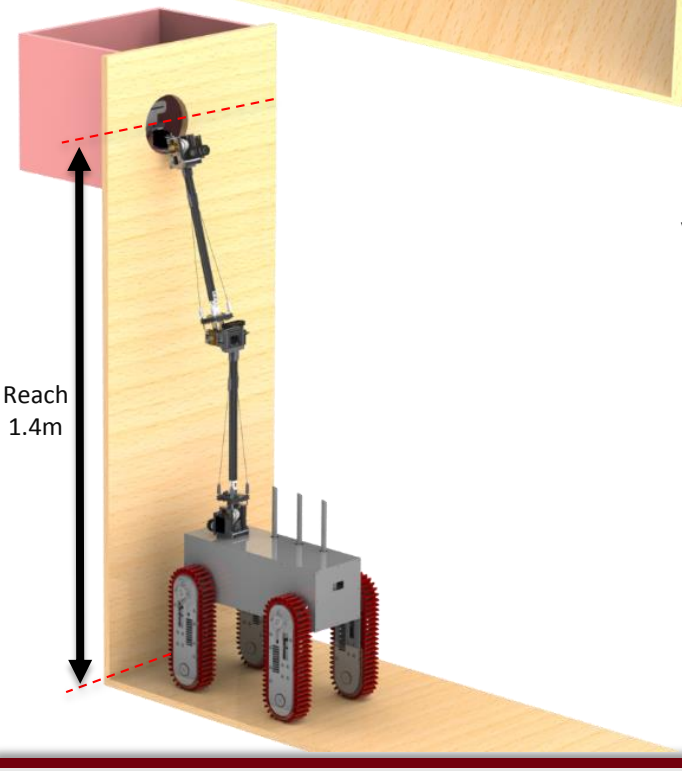
Testing



Virtual Testing



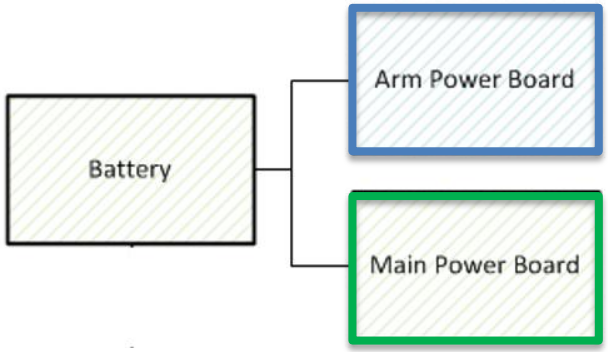


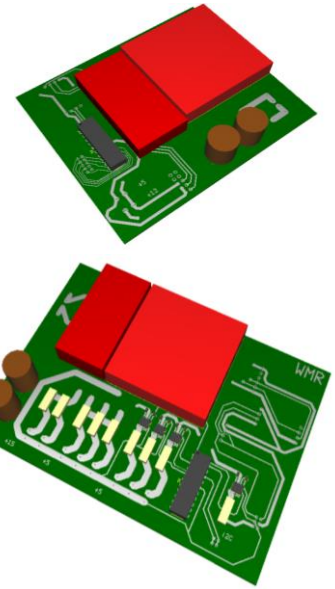


Power Distribution

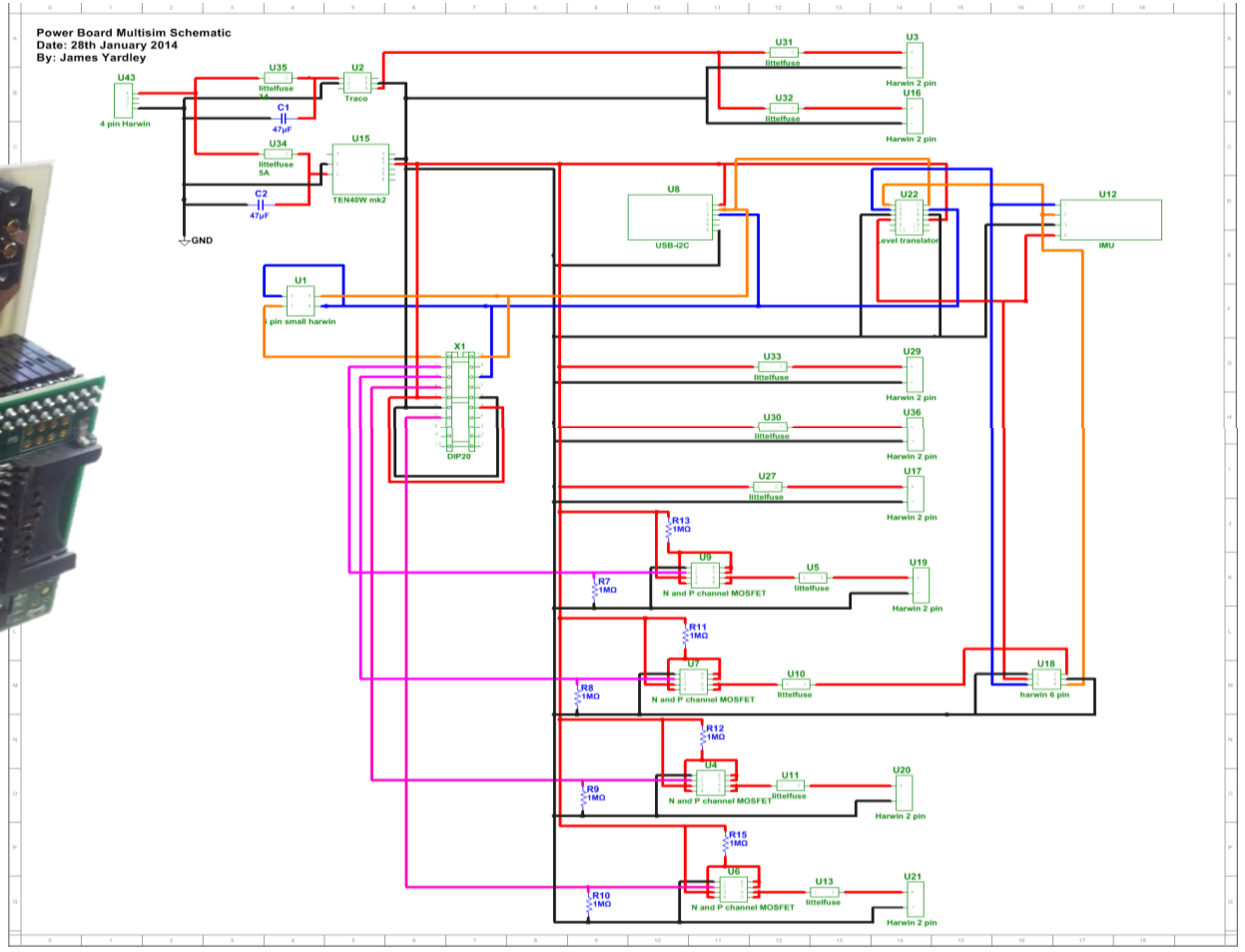
Power Distribution

- Dual power boards to allow for modularity of the arm.

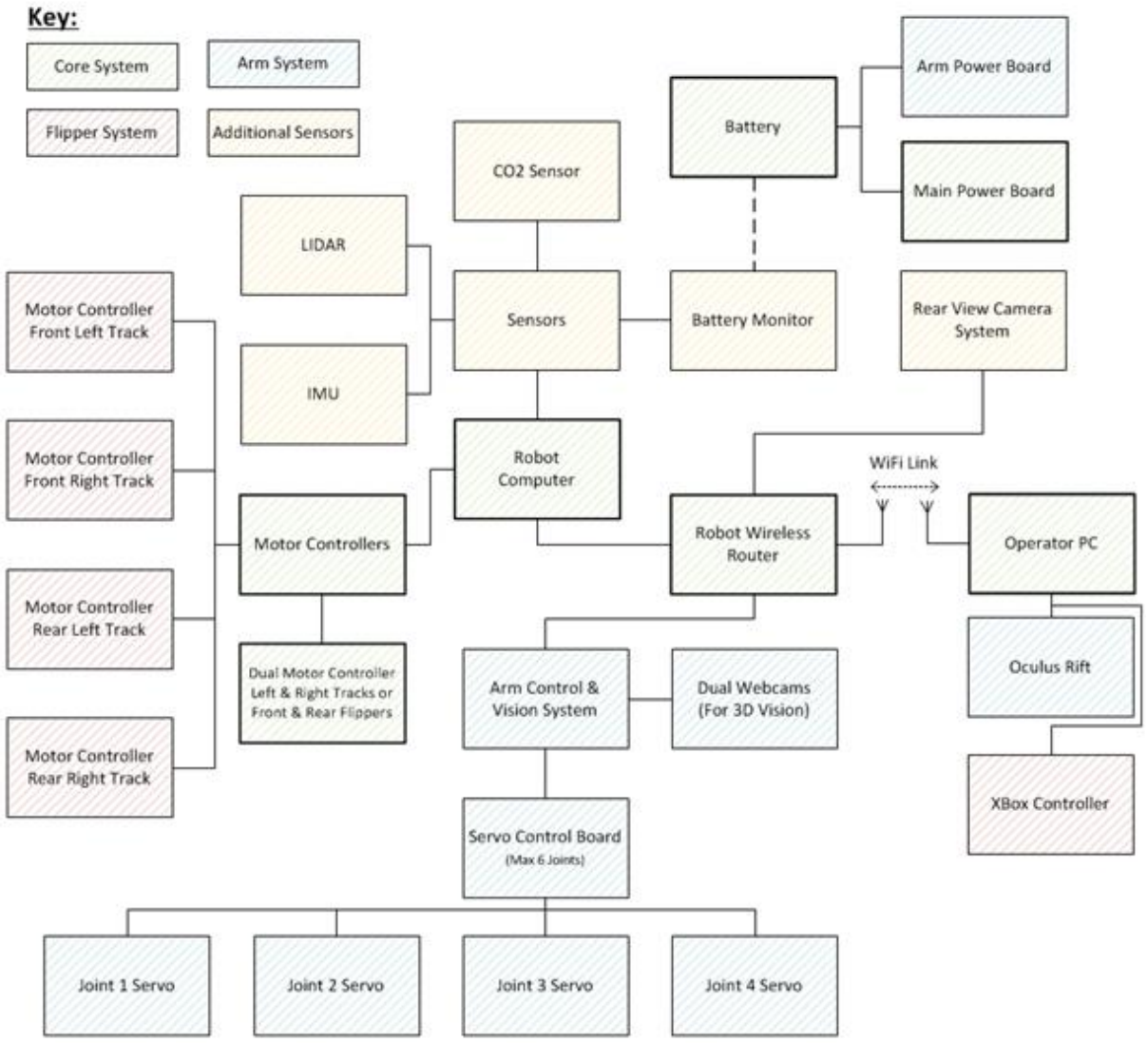




Power Board Design

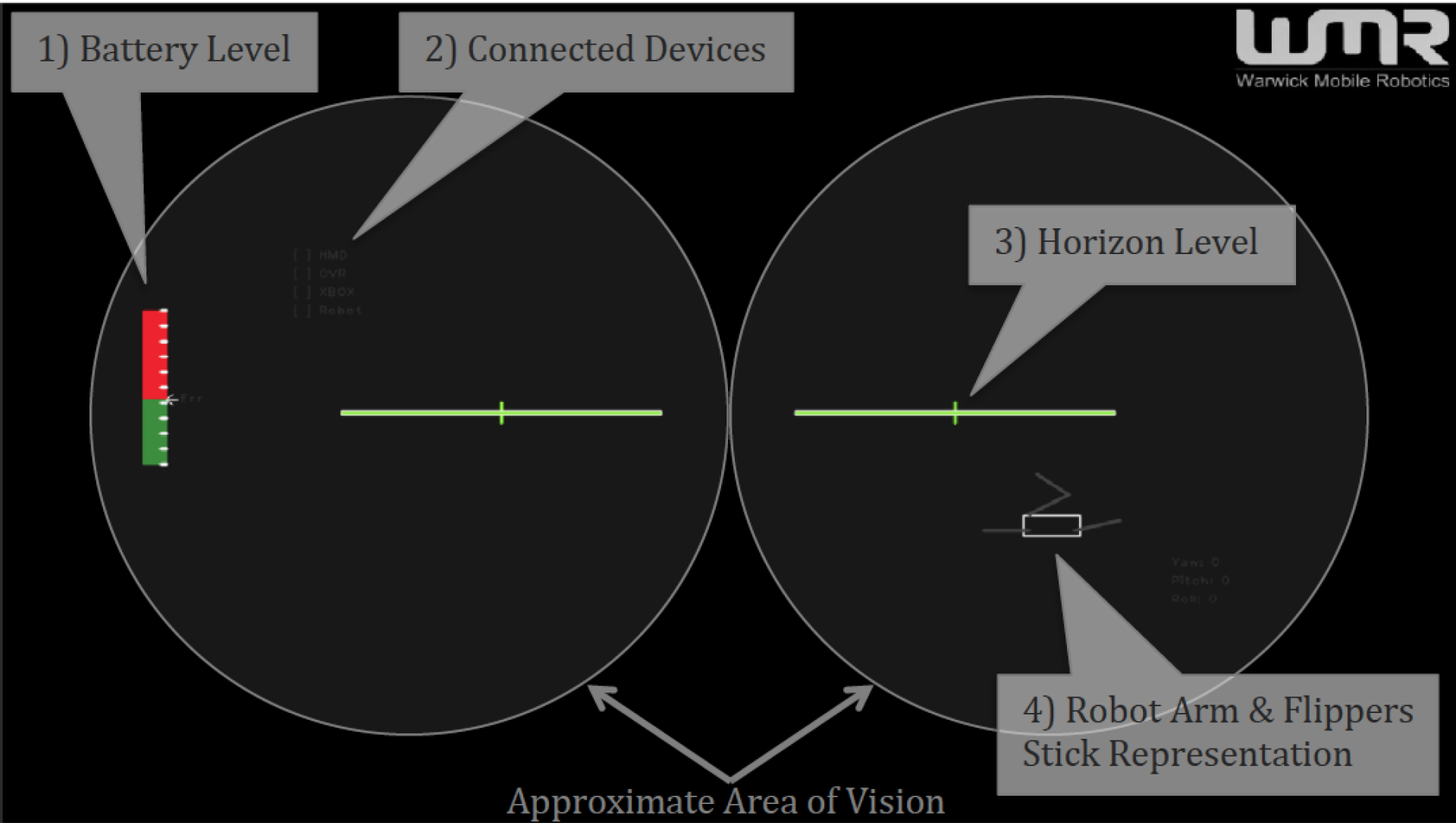


Electronic Architecture

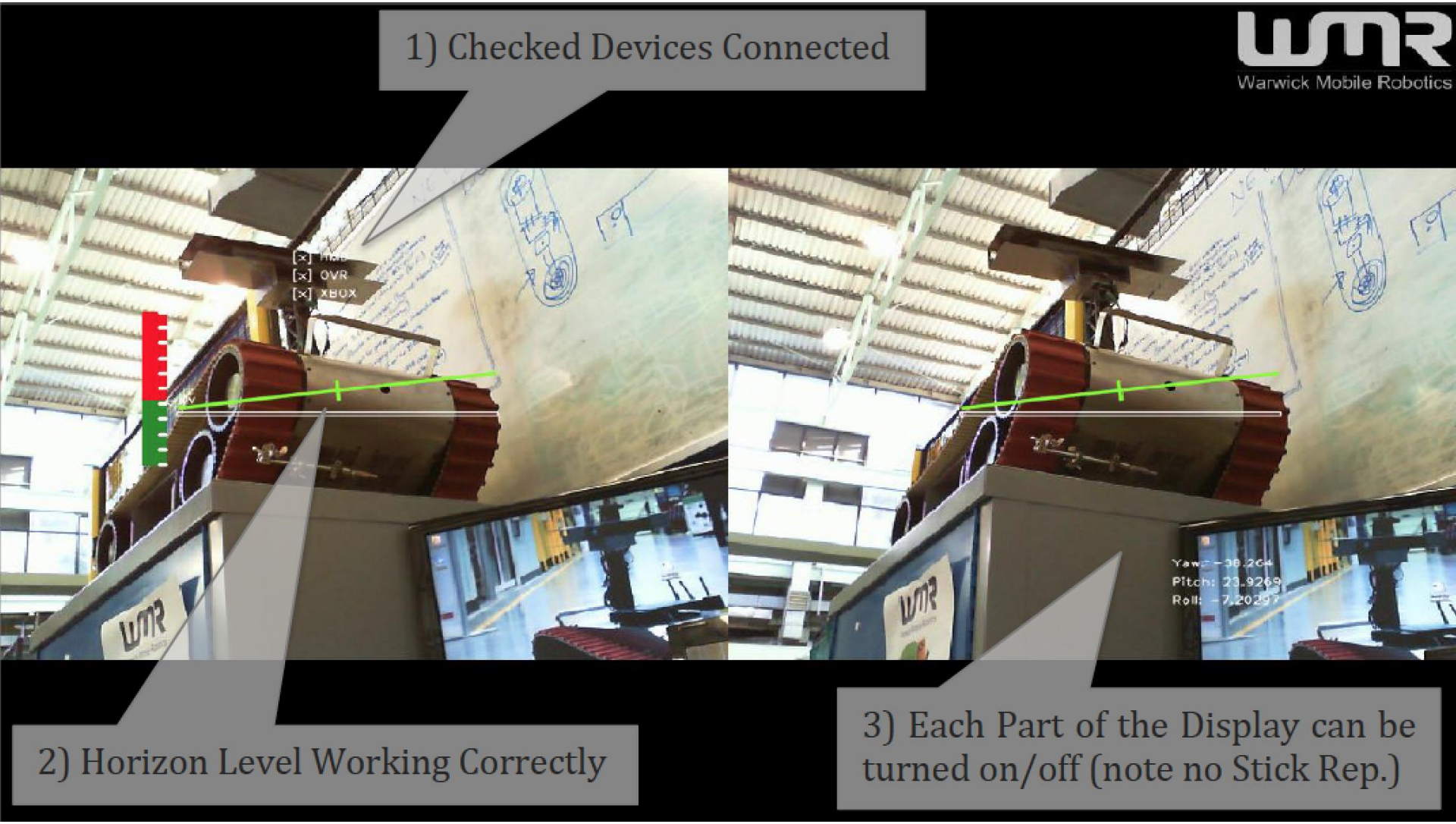


Mapping

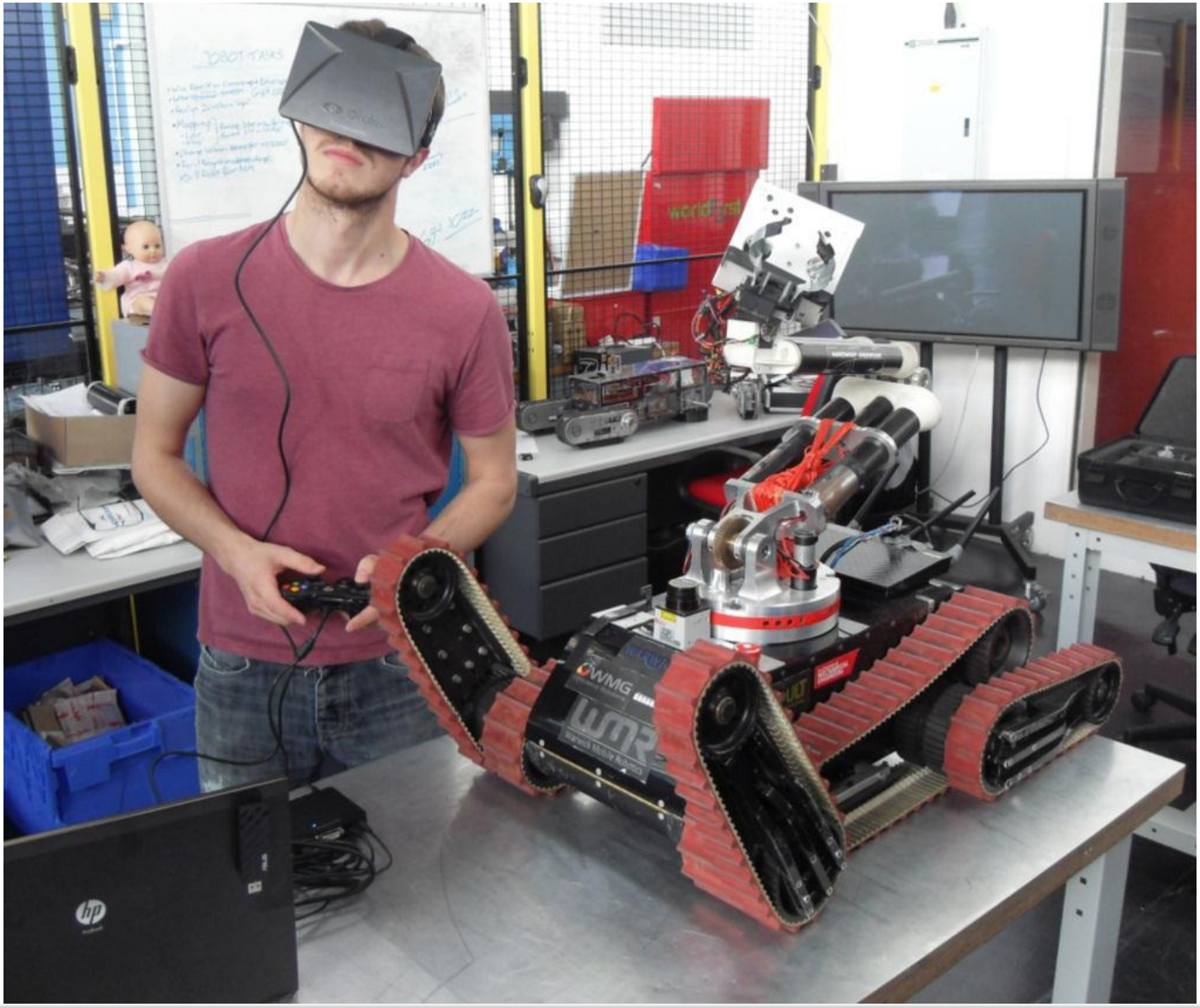
3D Vision Headset



3D Vision Headset

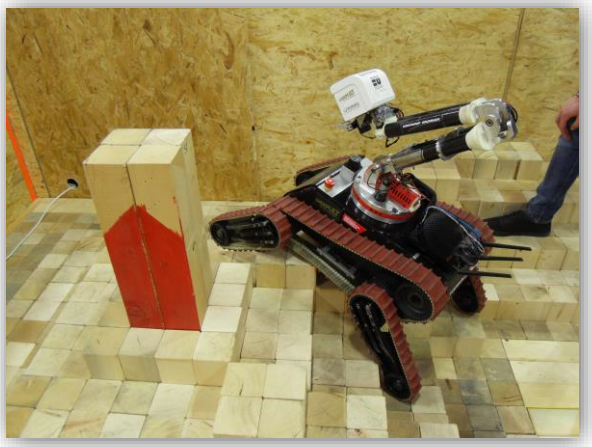


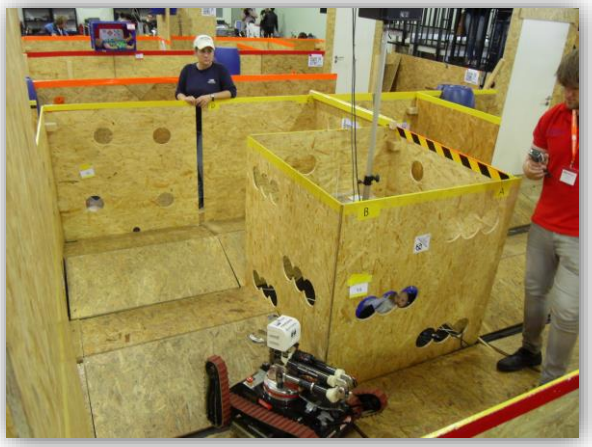
Head Tracking



RoboCup Competition

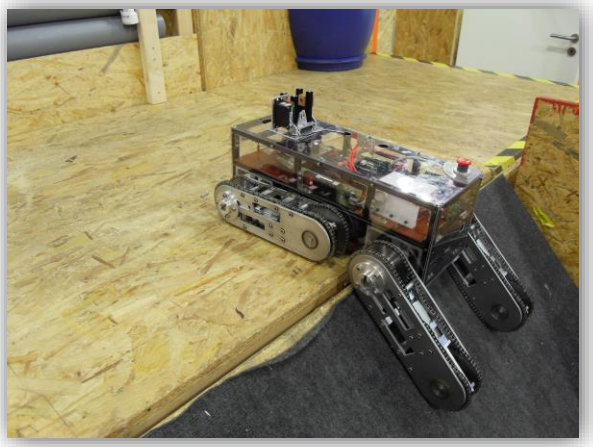
- 4th Overall
- 2nd in Mobility
- 2nd highest points in a single round
  - Most points scored by a single robot





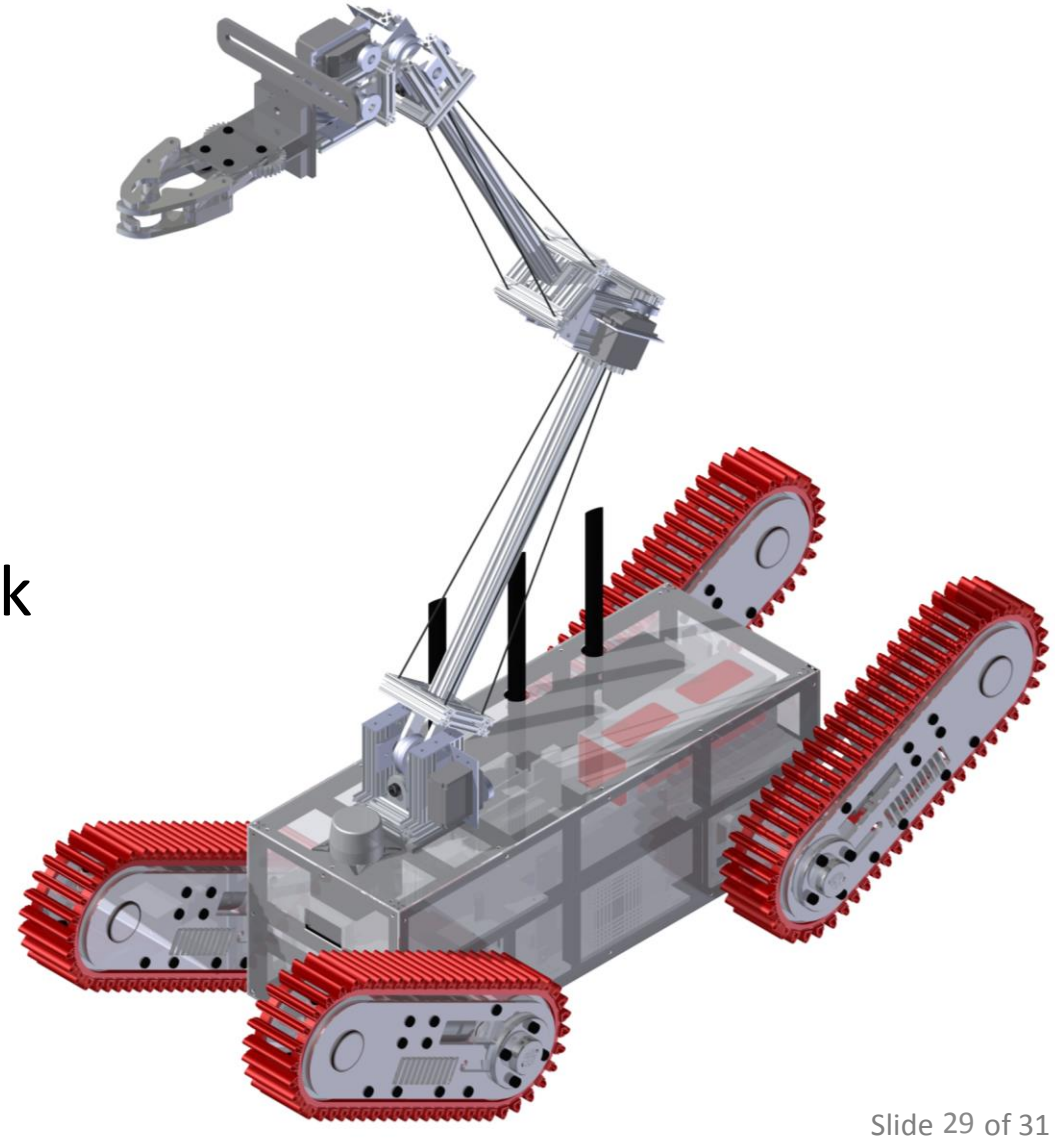
Conclusion & Recommendations

- Modularity allows adaptability
- Good research platform
- Low cost design <£5,000
- Lightweight <25kg
  - Areas for optimisation
- Manipulation
- Mapping
- 3D vision and head tracking



Summary

- About WMR
- Aims and Objectives
- Robot Design
- Testing
- RoboCup Competition
- Lessons & Future Work



Warwick Mobile Robotics

Thank you for your attention