

SWS3009 – Part B

Robotics / TeleOperation

Section 1: Introduction

Dr. Boyd Anderson

I am a Kiwi (New Zealander) and did my PhD at NUS. I liked it so much here that I decided I didn't want to leave!



My research interests are in *embedded systems*, *wearable sensors*, and *gait analysis* (analysing the way you walk or run). I am also working on *wearable sensors for sports* (such as fencing and sprinting).

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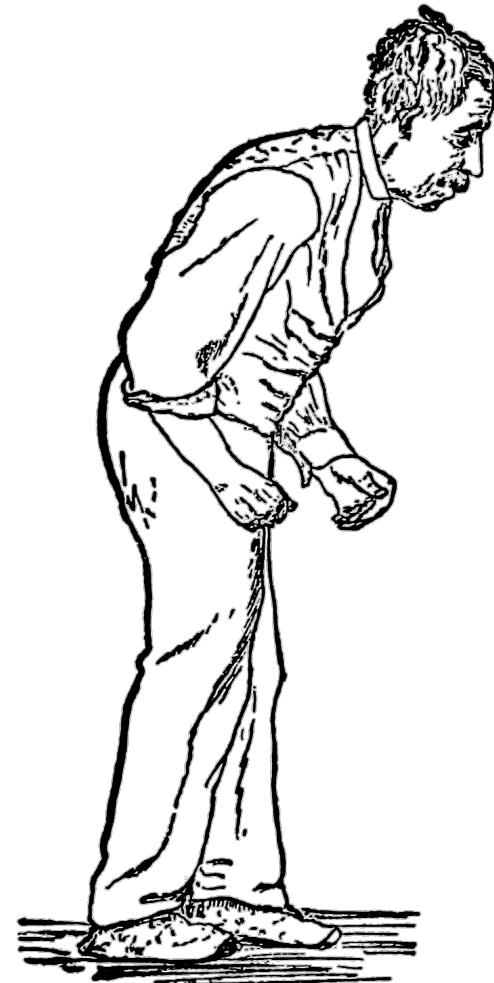
My office: **COM3-02-46**

Research Areas

Gait Analysis is the study and quantification of human locomotion.

Why are we interested in Gait Analysis?

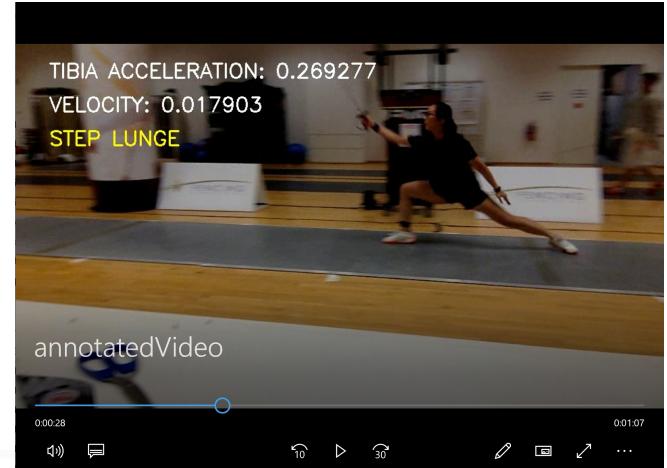
The way you walk says a lot about you



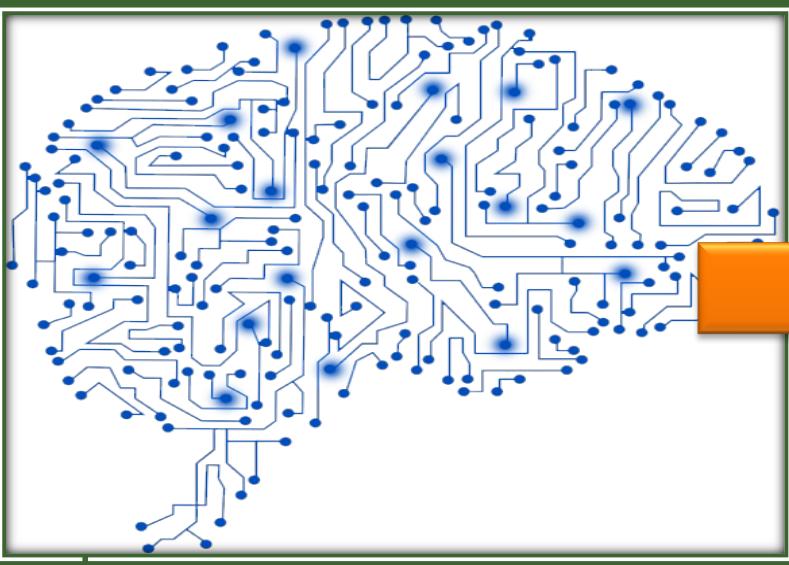
Fencing Profile Analysis System

Sensors in Sports
Technology.

Fencing specific
movements can be used
to improve training and
minimise injury.



Course Overview



Data
Intelligence

2 Students

Mobility
Platform

2 Students

Course Objectives

- An appreciation of embedded system platforms
- Understand the process of incremental, modular system design
- Ability to implement a solution that impact the **physical world**
- **Have an intensive but fun journey**

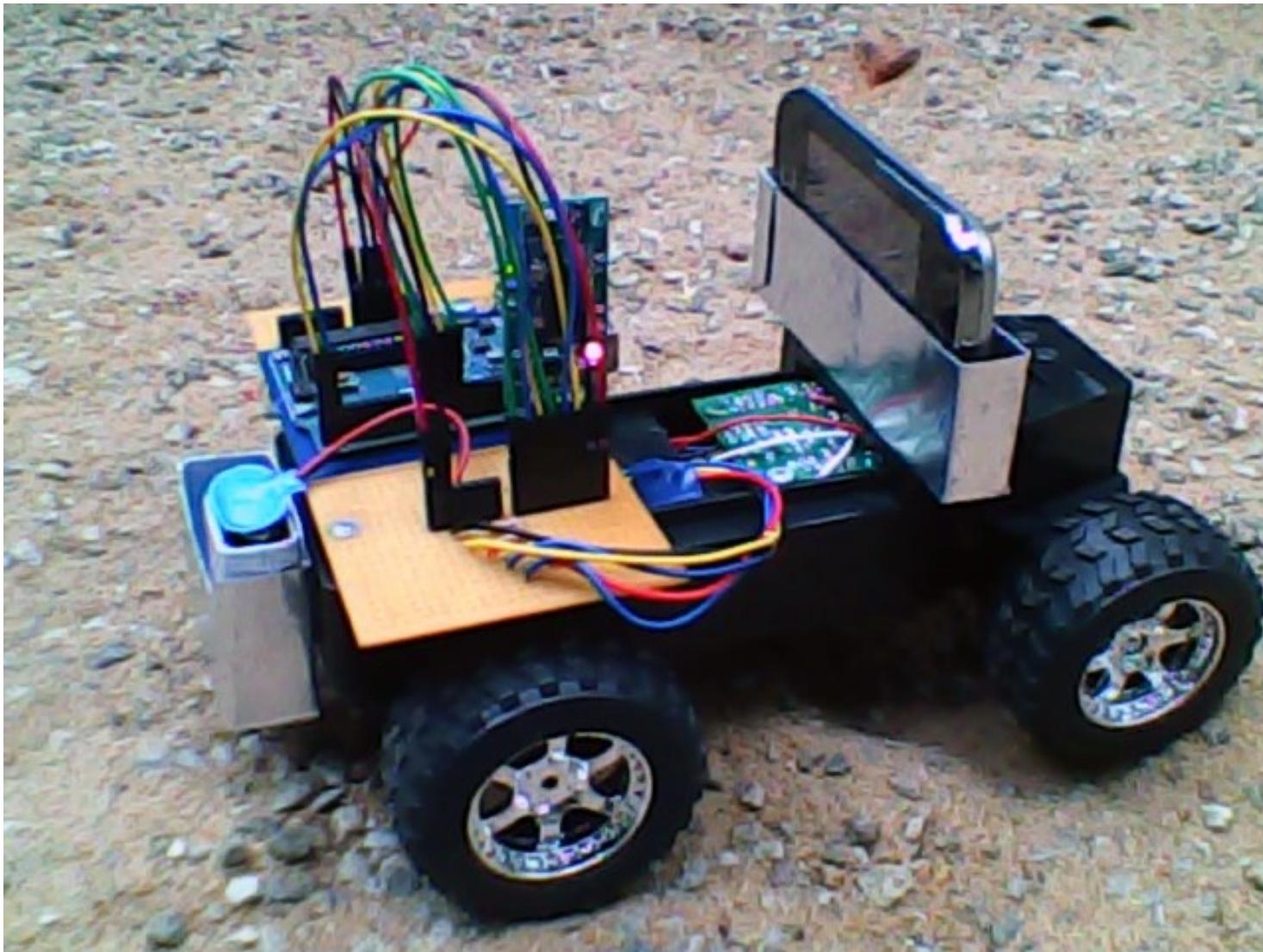
Outline

- **Robotics/TeleOperation**
- **Platform Overview**
- **Project Overview**

Requirement – Tele-Operation



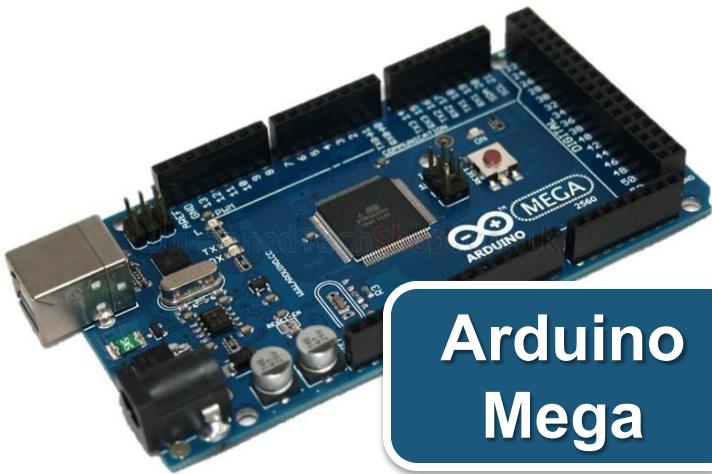
Requirement – Mobility



Requirement – Navigability



Hardware Platform



Arduino
Mega



16MHz
(CPU Speed)

256KB
(Code)

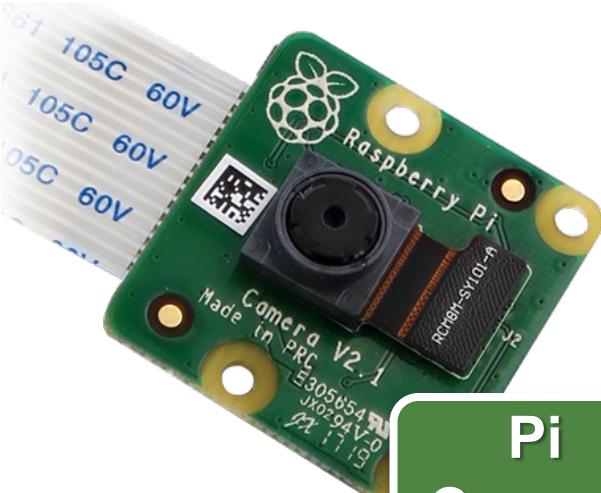
8KB
(Data)

4 x 1.2GHz
(CPU Speed)

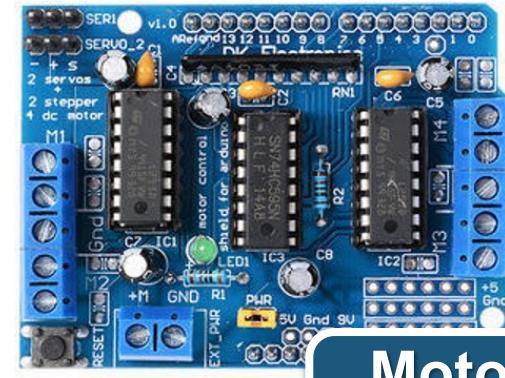
≤ 32GB(?)
(Storage)

1GB
(Memory)

External Components



Pi
Camera



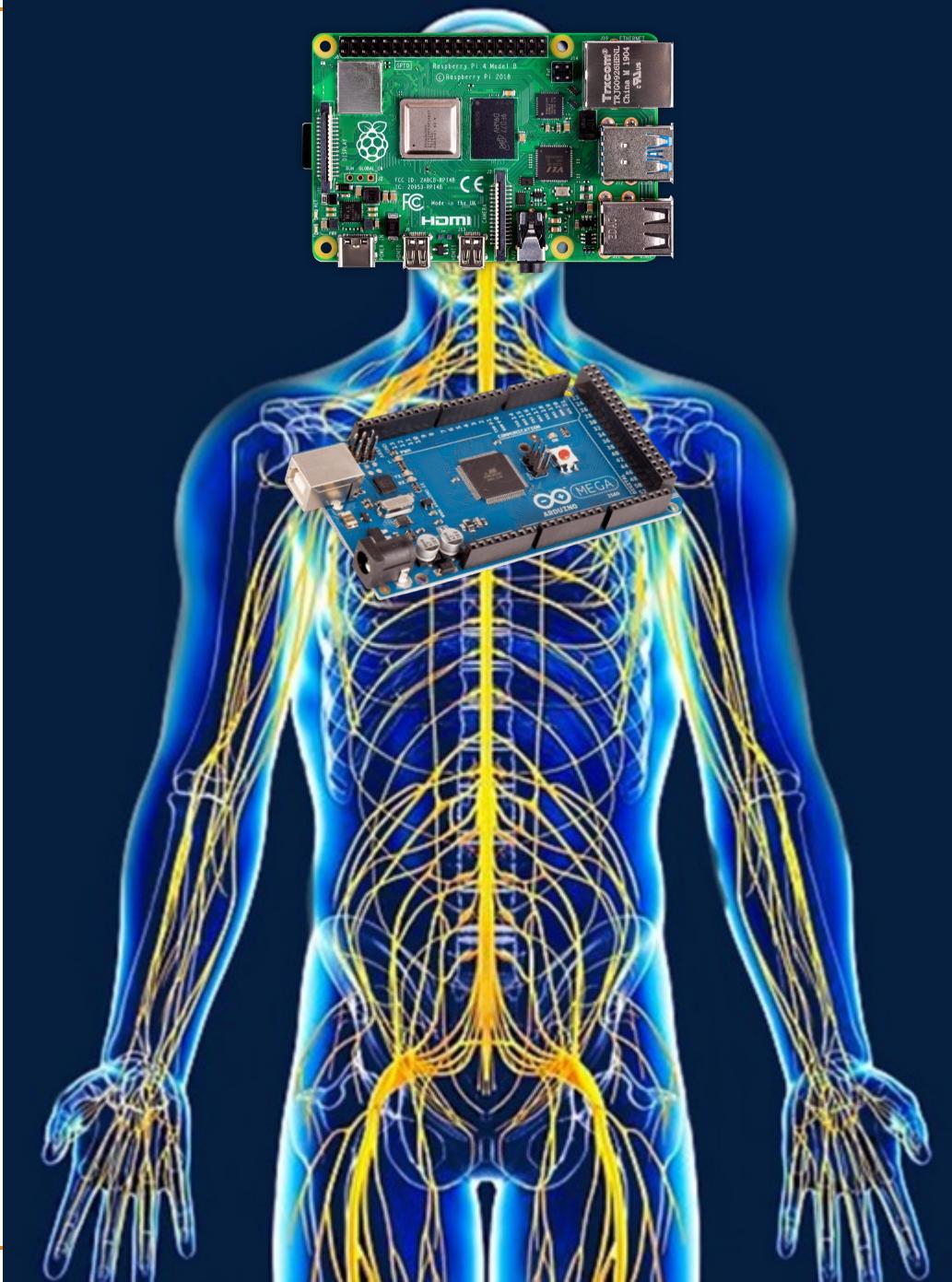
Motor
Driver



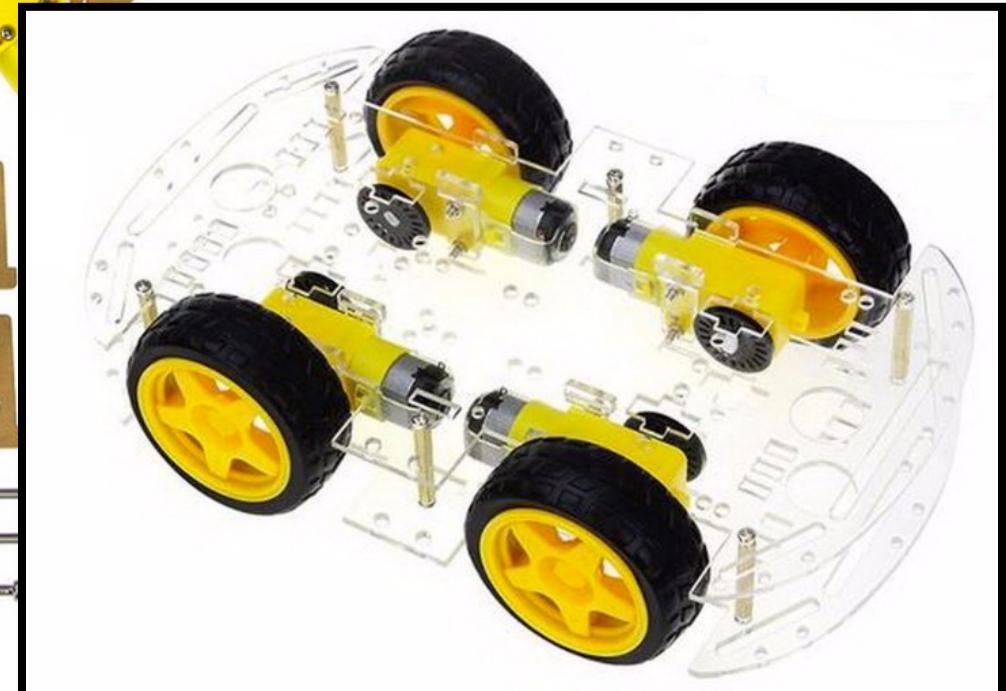
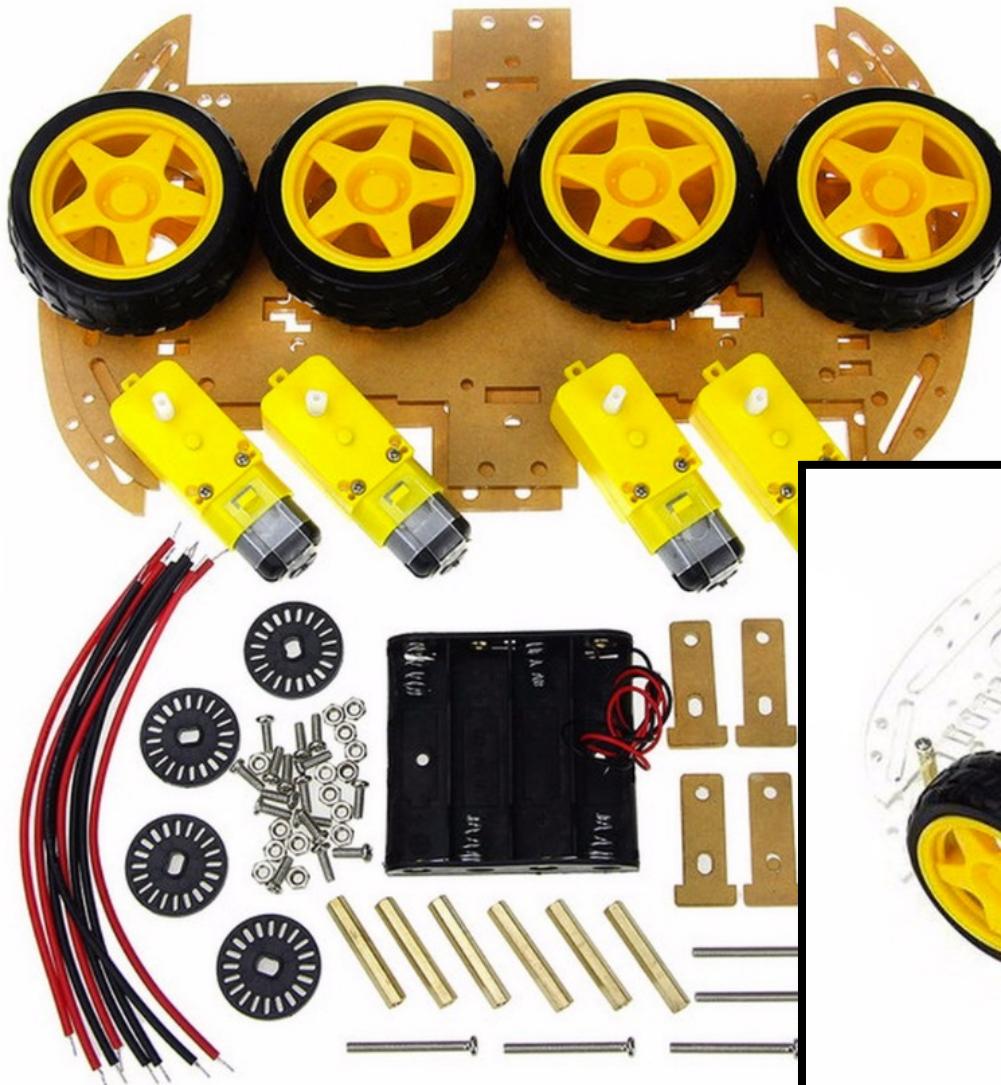
Ultrasonic
Sensor



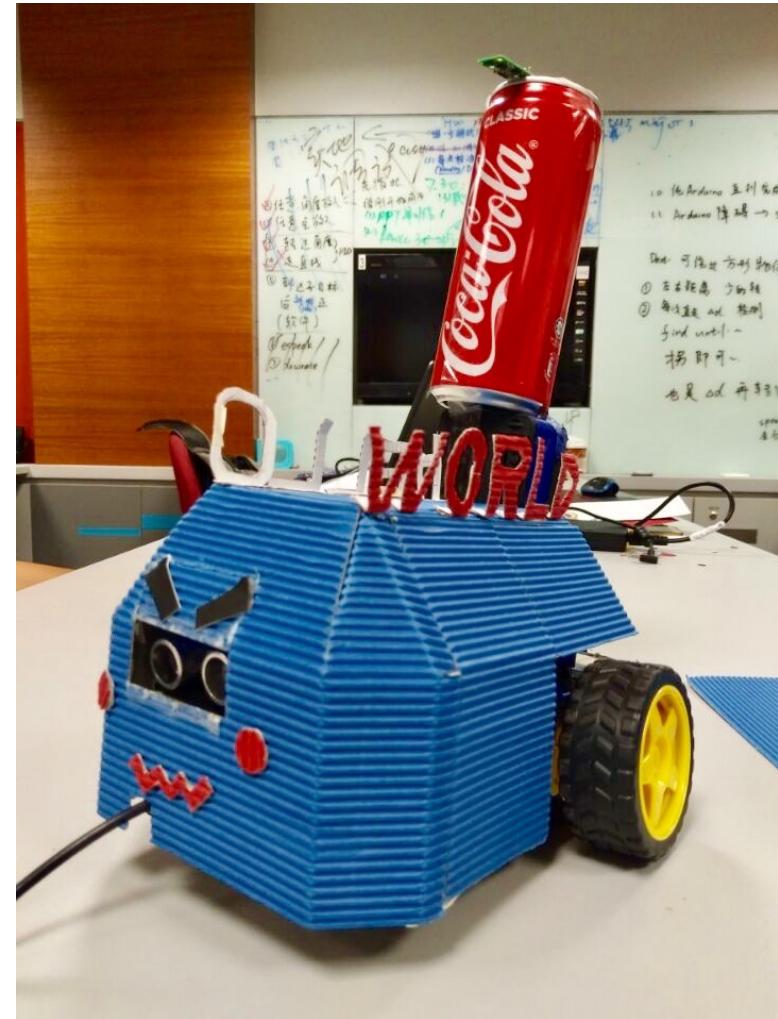
Gyroscope
/ Compass



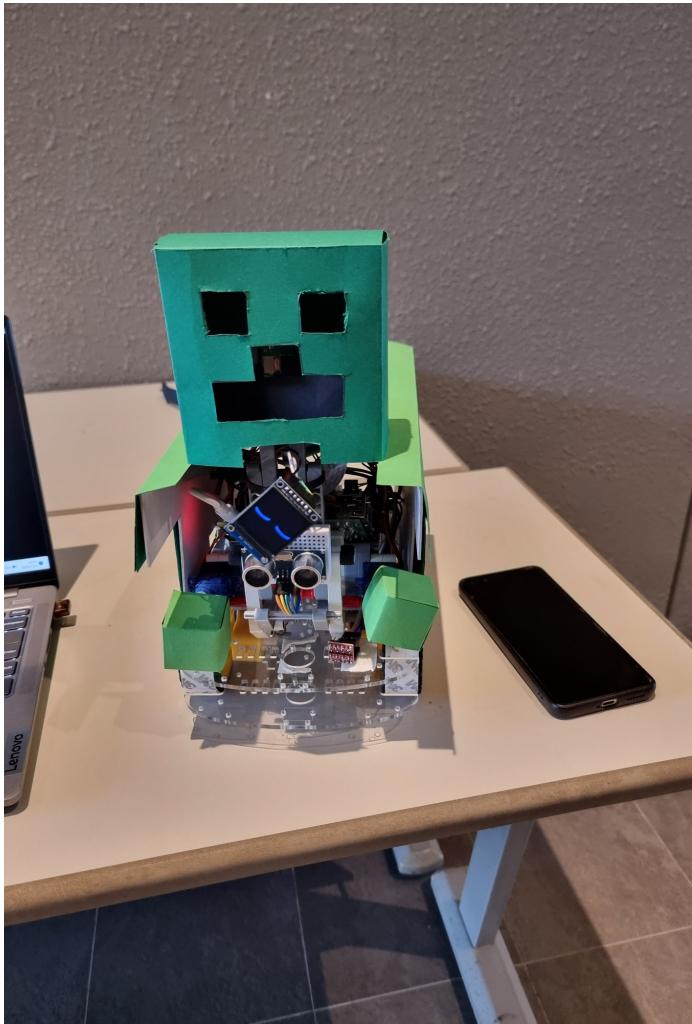
Vehicle Chassis



Customization – Make it yours!



Customization – Make it yours!

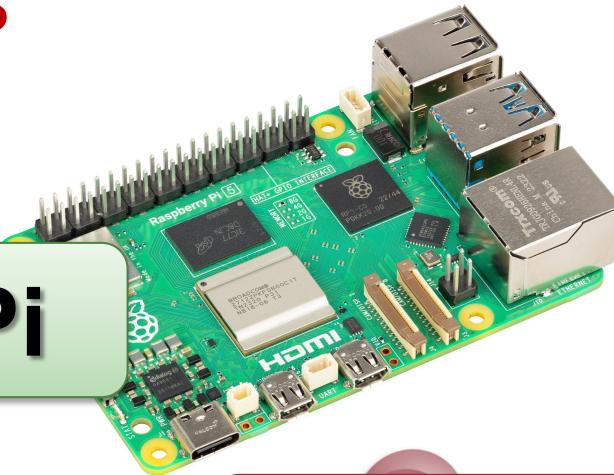


Customization – Make it yours!



Topics

Pi



Pi Camera

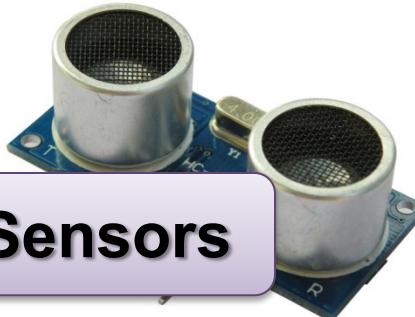


Communication

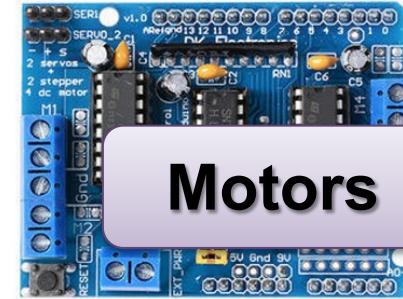
Arduino



Sensors



Motors



Project Schedule

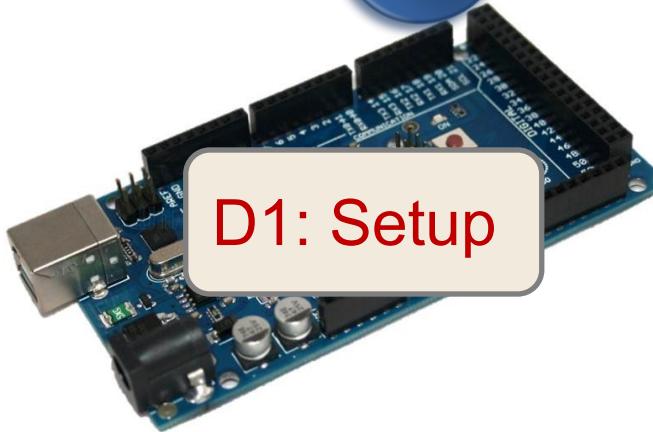
Tentative Topic Schedule

Topic	Category	Lecture Sets
Pi Basics	Pi	L2
Pi Camera	Pi	L2
Arduino Basics	Arduino	L3
External Components	Arduino	L3
Interrupt Handling	Arduino	L3
Communication Protocol	Communication	L4
Multitasking	Arduino	L5
Simple Control Mechanism	All	L6

Hmm... ~16 days?



D2: Communication



D3: Road Test!

D4: Integration

D5-6: Treasure Hunt

D7-8: Advanced Model Design

D8-10: Advanced Model Implementation

D11-12: Evaluation

D13: Showcase

Project Overview

1 + 1 > 2 ?

■ **Baseline Model:**

- Remote controlled vehicle with camera
- Ability to classify images
- "Treasure Hunt" Robot!

■ **Advanced Model:**

- Your imagination is the limit
- We provide components, consultation, suggestions and evaluation to **push you to the limit!**

Advanced Model Examples

■ Mobility + Intelligence = ???

■ Some possibilities:

□ Autonomous / Remote controlled explorer

- Map out area
- Take photo of locations
- Identify / flag the locations (e.g. office occupier)

□ Search and rescue bot

- Explore area to look for survivor (humanoid or otherwise)

□ Semi-autonomous explorer

- Navigate via "signpost" along the path etc.

The last slide!

- Highlight of SWS3009:
 - You will build a **real platform** interacting with **real world**
 - Pick up practical know-how (tensor flow, electronics etc)
 - You can decide how crazy / fun the final deliverable

Course Teaching Modes

- Learning by **doing**

- "Learning by googling ☺"

- Learning with **peers**

- Group based

- Learning by **exploration**

- Look for alternatives, no definite answer

Course Caveats

- The coverage is **HUGE**
 - We wont be able to cover most topics in details
- Hardware debugging is "**messy**"
 - Expect to spend time on strange, hard to debug problems
- Time is **SHORT**
 - Extremely condensed coverage
 - Hands-on takes time

END