

Introduction:

Welcome to the ELEC520 Lab sessions. Distributed systems can be found in almost any device and form a major foundation of how technology operates in the modern day and age. Processing is cheap, up until a point. Once you exceed this barrier, suddenly far more resources are required, and this can become very expensive. For this reason, many devices will contain multiple processors to do basic tasks to simplify the end computational need.

Look at cloud gaming for example. This uses a

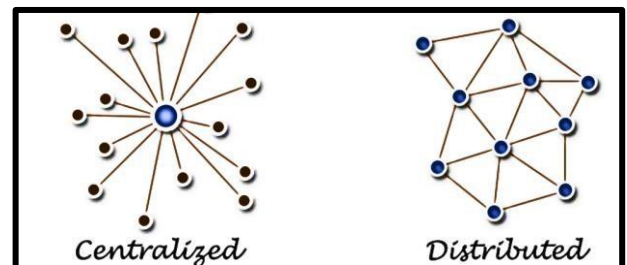


Figure 1 - The difference between a distributed and a centralised system

gamepad which takes your inputs, sends it off to an external server which does all the required processing based upon your input, then it streams that to your television. Even the gamepad by itself has a processor inside, reading all of the sensor inputs from the user, formatting it into a data stream, then sending it off to a computer/another device. Practically all technology now-a-days uses this distributed structure as you can then optimise designs for cost to performance which is critical when you get to the manufacturing stages of production.

Even a servo has a micro-controller inside doing the PI control for the motor and encoder.

With these labs you will be expected to work in groups of 4. Every group will receive a kit of standard parts, however what you do with those parts and what you build is quite open. At the end of these labs, you will be graded based upon a final presentation and a project report.

Presentation Date: 12/12/2023

Final Submission Date: 13/12/2023

Aim:

To design and build a project which utilises a distributed system to benefit the overall functionality and affordability of the project.

Coronavirus Contingency's

Without further Coronavirus interruptions you will be designing and building prototypes, which you will then be able to prototype, construct and practically test.

If further lockdowns or restrictions are implemented, your marking will be adjusted accordingly. Practical elements may become unviable to pursue, as such they would then be replaced with alternatives. E.g. 3D printing replaced with physics engine based collision simulation with Coppeliasim.

Distributed Systems with Toby Whitley, Adrian Ambrose & James Rogers

Kits:

The distributed system kits feature the following items:

- ❖ Breadboard
- ❖ Breadboard power supply
- ❖ Jumper wires
- ❖ Ultrasonic sensor
- ❖ Moisture sensor
- ❖ 2x NRF24I01
- ❖ Amp & Speaker
- ❖ Sound Level Trigger ❖ Keypad
- ❖ I2C LCD
- ❖ DHT11 temperature and moisture sensor
- ❖ IR Receiver
- ❖ IR Remote
- ❖ IMU

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Lab: Building a Distributed Multiplatform System

- ❖ Arduino Nano
- ❖ Raspberry Pi Pico

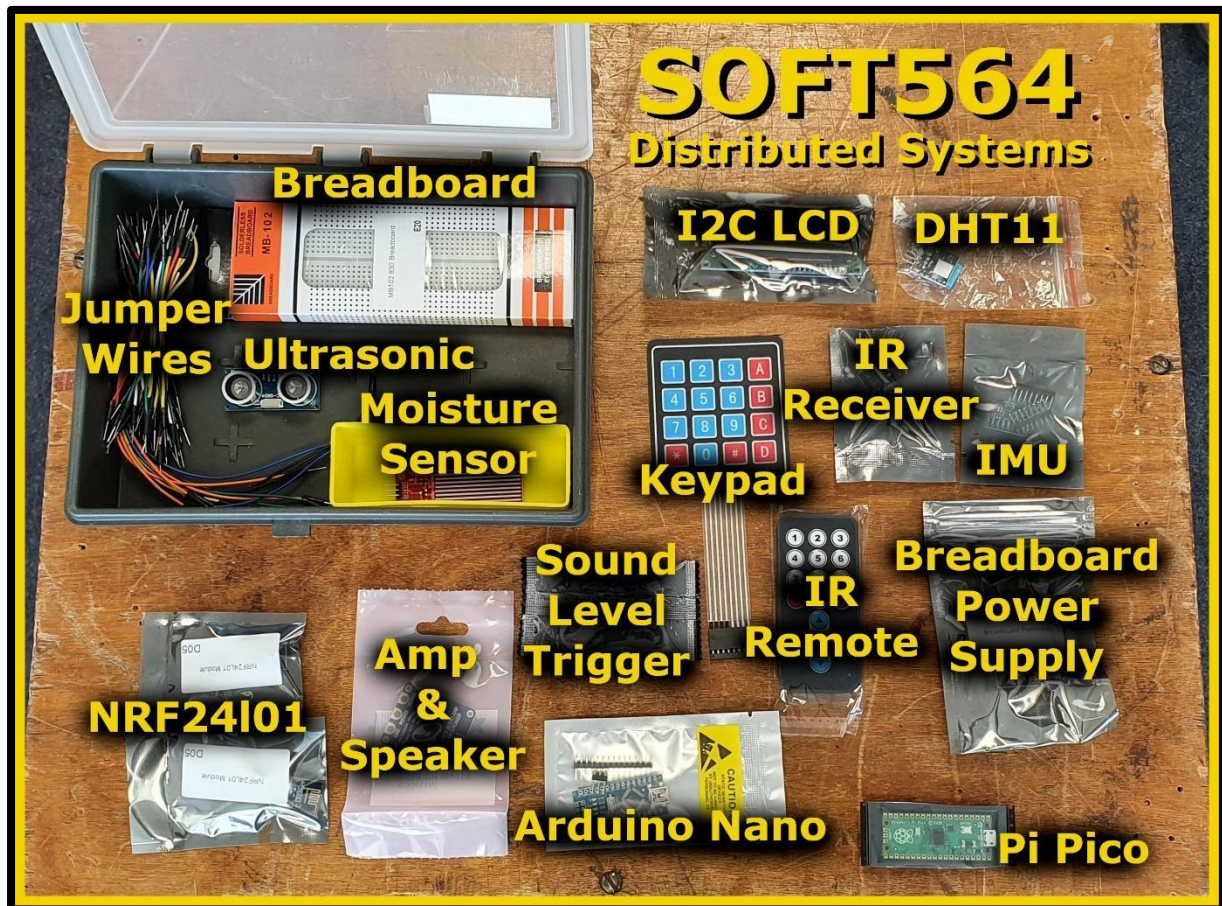


Figure 2 – Distributed Systems Complete Kit

Distributed Systems with Toby Whitley & James Rogers

Lab Session Breakdown:

Lab sessions will occur 11am-1pm on Tuesdays and each group can book out two kits to use to aid in development and testing.

Date	Lab session
27/09 - WK1	introduction, arrange groups
4/10 - WK2	Initial project proposals
11/10 - WK3	Design and build
18/10 - WK4	Design and build
25/10 - WK5	Group Design Review - PDR
1/11 - WK6	Prototyping Design Idea Iterations
8/11 - WK7	Prototyping Design Iterations
15/11 - WK8	Group Design Review - CDR

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Lab: Building a Distributed Multiplatform System

22/11 - WK9	Programming & Testing
29/11 - WK10	Programming & Testing
6/12 - WK11	Programming & Testing
13/12 - WK12	Showcase/Presentations

Week5: It will be expected that each group will present their work as part of a preliminary design review. This will be to all of the other students to then explain their project and to answer any questions staff and/or students may have. This is a big step to help guide the project and presentations must be 5 minutes at most.

Week8: It will be expected that each group will be at the final stages of their project prototype having finalised all the features and functionality planning, and the design of their project, but not having completed the software infrastructure. They will then be asked to perform another presentation to the whole class to fully explain their project and the reasons behind it. This will be followed by a Q&A session for each group with questions and feedback from staff and students. Presentations must be 5 minutes at most.

Week12: This will be your final presentation where you can explain and describe your design and the process you underwent to achieve that, including the results. This will be to the whole class with other academics invited to attend.



Figure 3 - Showcase and Presentations in December

Distributed Systems with Toby Whitley, Adrian Ambrose & James Rogers