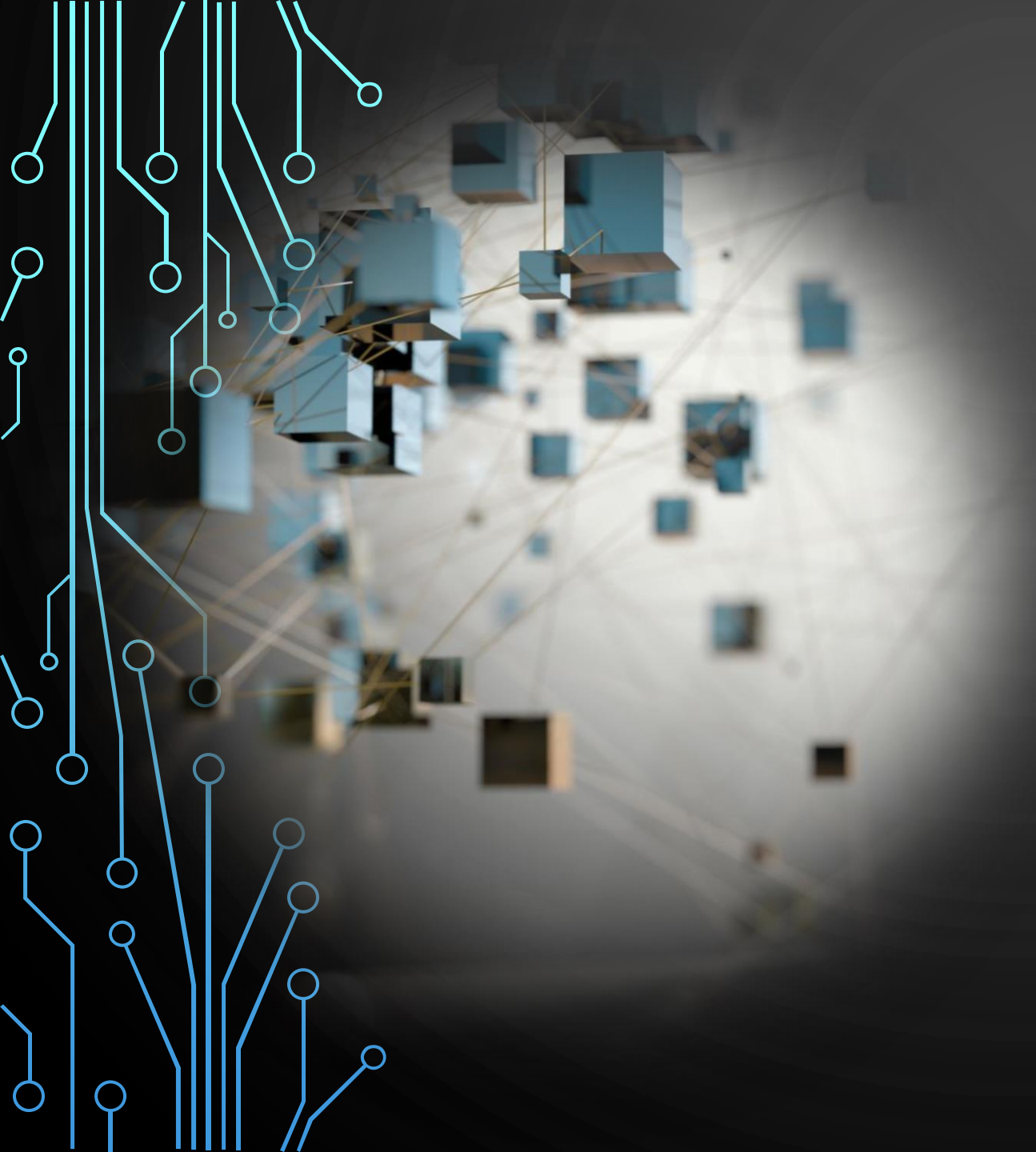


MODULAR ROBOT SWARM

BENG (HONS) SOFTWARE AND ELECTRONIC ENGINEERING

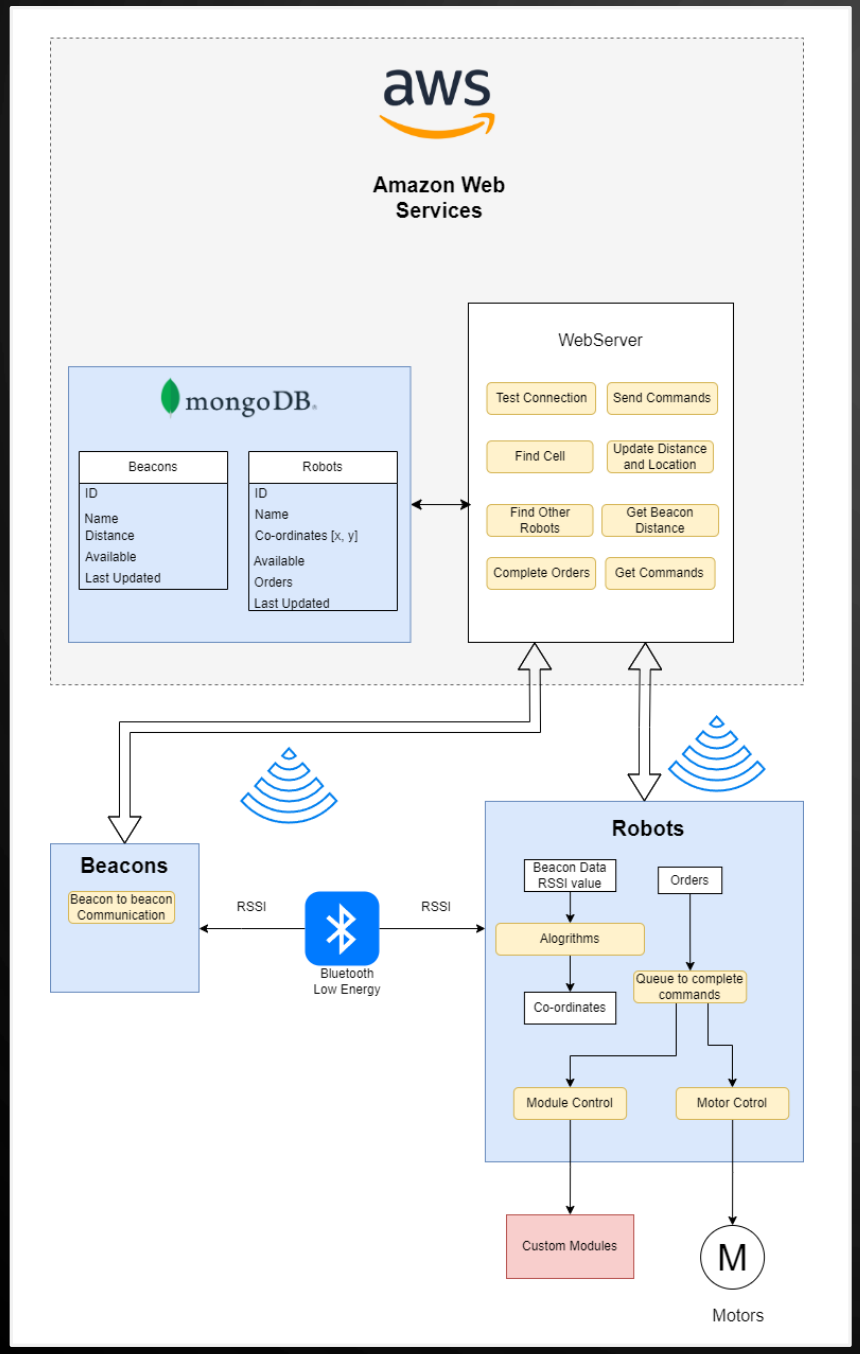
IWO KANIA

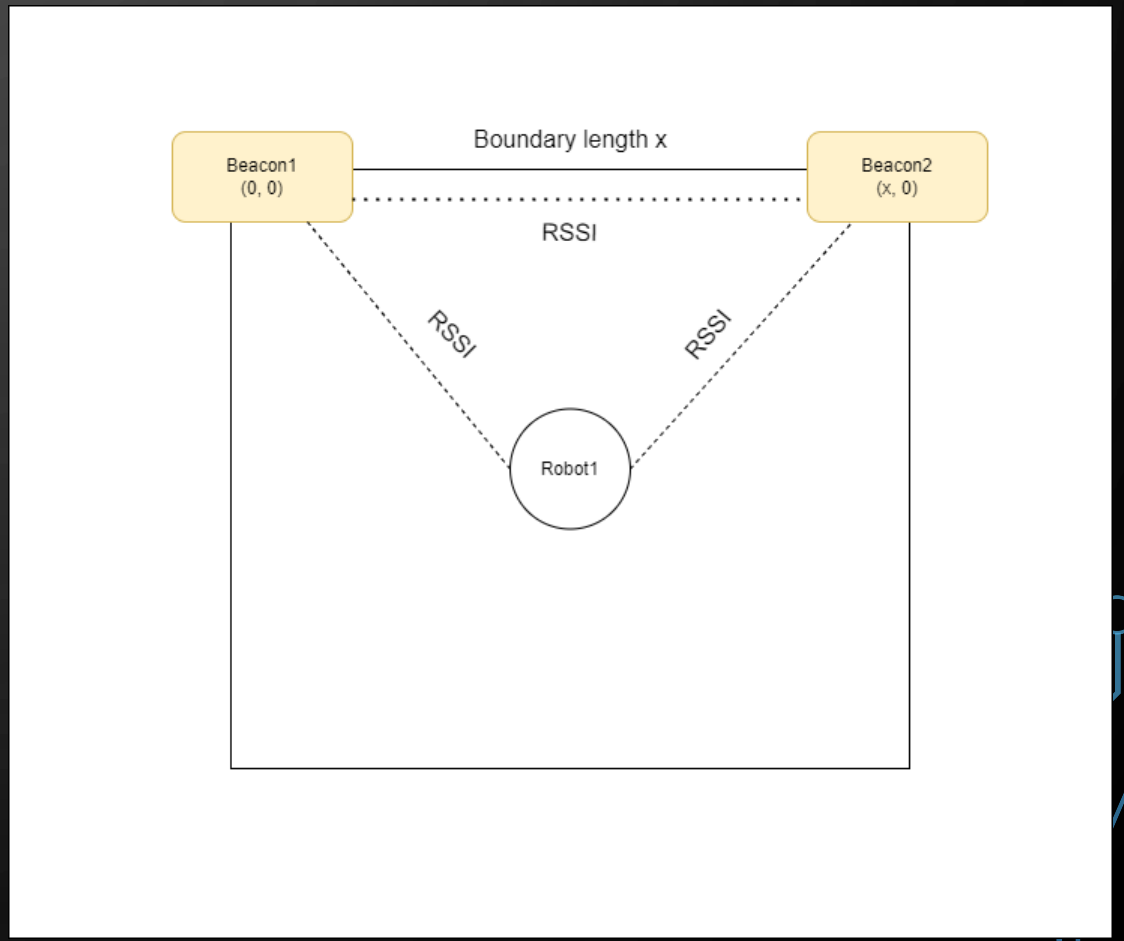
OVERVIEW

- Swarm of robots.
- Webserver to Robot communication
- Command sending and receiving
- Proximity detection
- Co-ordinate calculate
- Database communication
- Motor Control
- AWS server hosting
- BLE RSSI scanning

```
{
  "name": "Robot2",
  "orders" : [{ "direction": "left","distance": 50 },
              { "direction": "forward","distance": 10 },
              { "direction": "stop","distance": 1 }]
}
```

ARCHITECTURE DIAGRAM





RESEARCH

Differences between Arduino string and std::string.

- Arduino String is based off std::string.
- Lightweight.
- Dynamically stored and fragmented.

Arduino Libraries

- ArduinoJSON
- HTTP Client

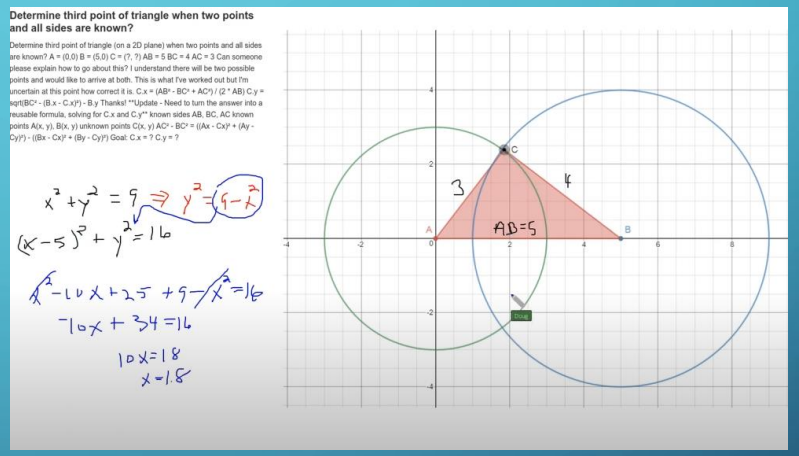
Algorithms

- Getting the distance between a line and a point

If the line passes through two points $P_1 = (x_1, y_1)$ and $P_2 = (x_2, y_2)$ then the distance of (x_0, y_0) from the line is:[4]

$$\operatorname{distance}(P_1, P_2, (x_0, y_0)) = \frac{|(x_2 - x_1)(y_0 - y_1) - (x_0 - x_1)(y_2 - y_1)|}{\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}}.$$

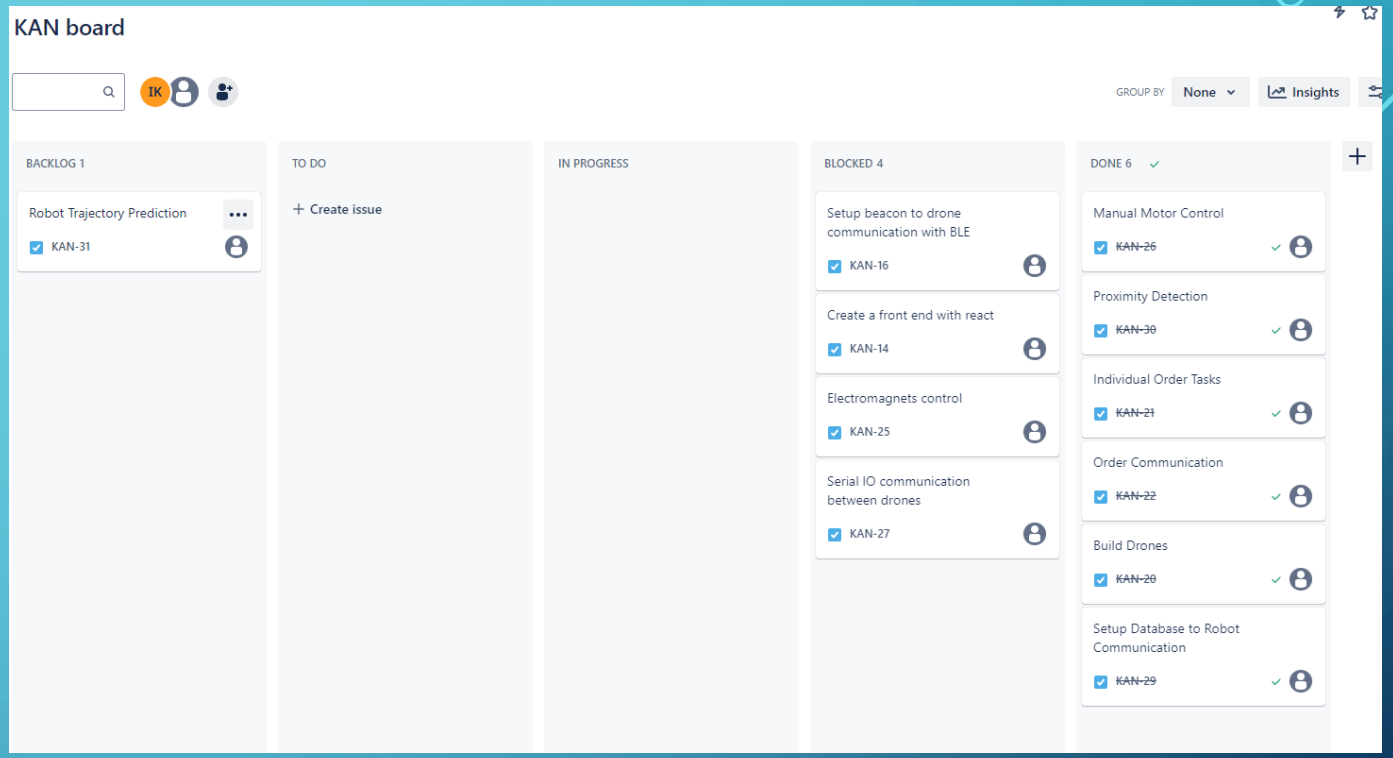
- Getting the co-ordinates of the 3rd point given 2 points and length of the 3 sides

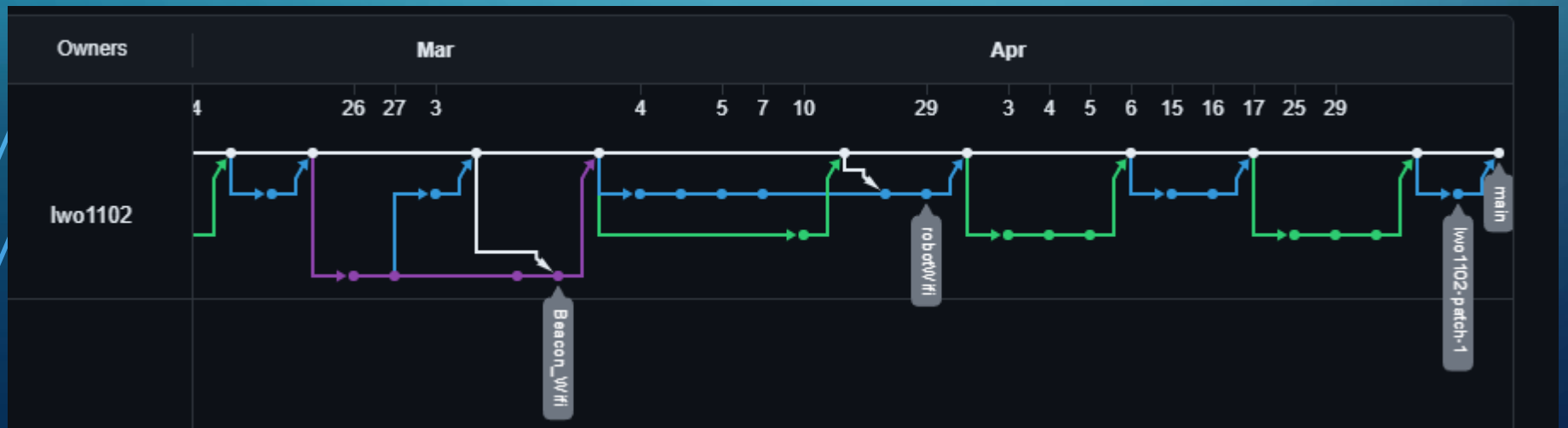


FreeRTOS on ESP32

- ESP32 Memory Allocation.
- Arduino Framework uses FreeRTOS

ORGANISATION





PROBLEMS AND SOLUTIONS

- Issue: had assertions errors on xQueueSemaphoreTake.

Solution: Initialise communication objects before tasks.

- Issue: Had a parsing error when using ArduinoJSON.

Solution: I needlessly used JSON.stringify() when sending data to be parsed.

- Issue: Had a flush error when trying to send a POST request.

Solution: Manually update the ESP32-Arduino framework as it was outdated.