

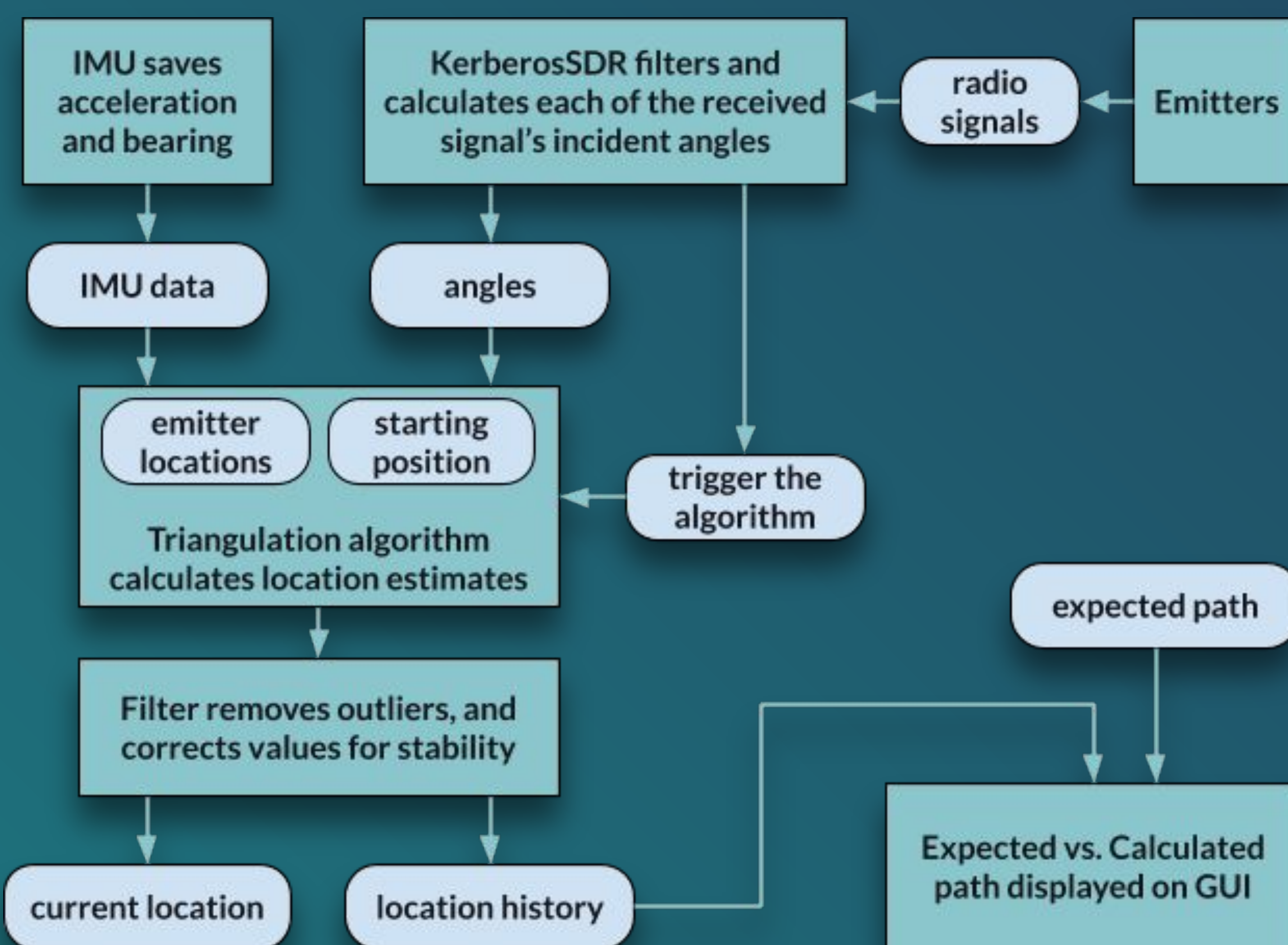
Background

Loss of GPS can result from cyberwarfare or poor signal. Bermuda is a proof of concept navigation system that utilizes radio emitters and directional antennas as opposed to satellites, to bypass this issue. Its applications parallel those of GPS, and have greater potential in vertical navigation such as for warehouse navigation, precision landing, defense, surgery, and space exploration.

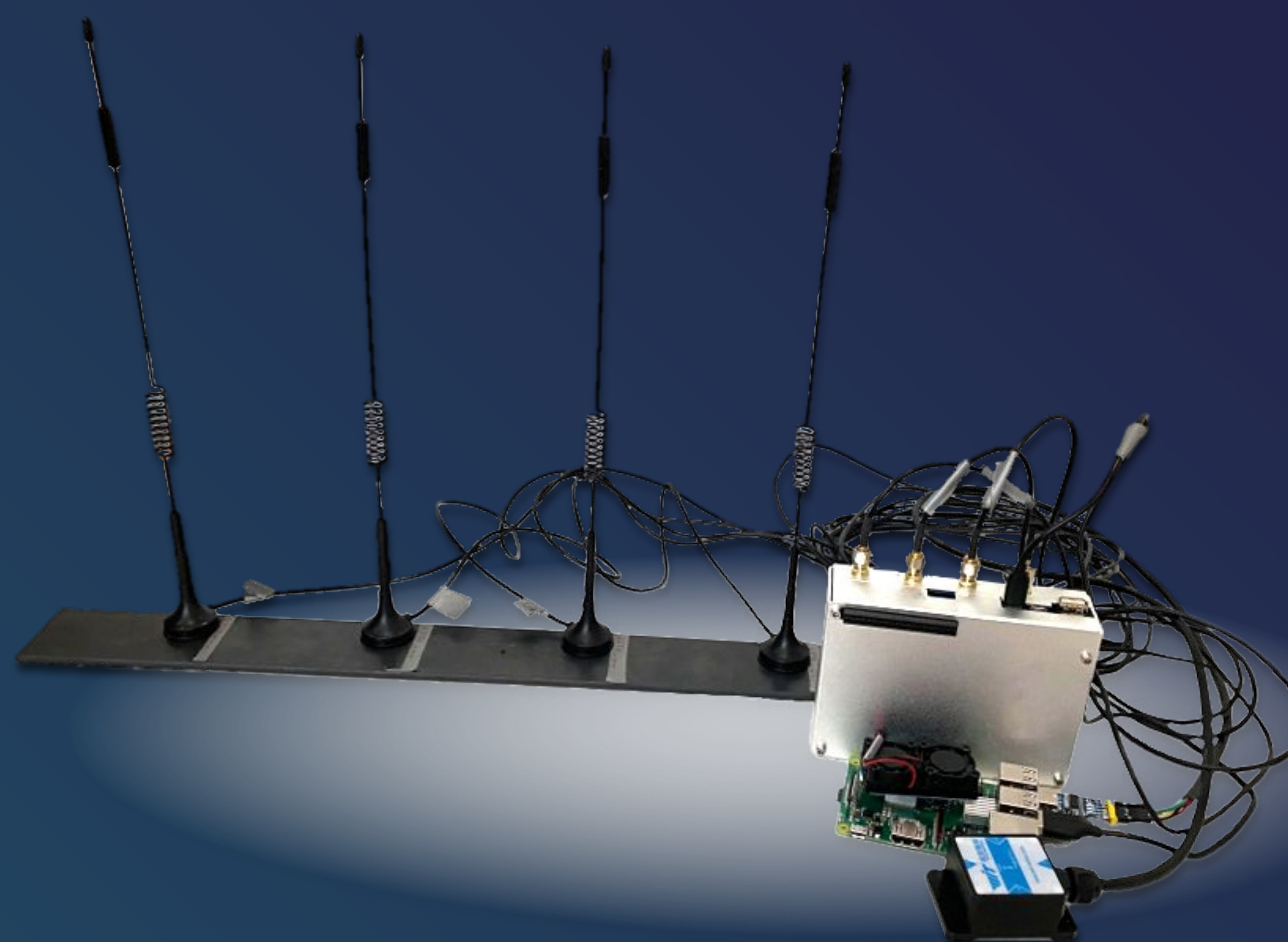
Overview

The system comprises of a multi-channel software defined radio (SDR), an inertial measurement unit (IMU), and a microcontroller. While in motion, Bermuda processes the directional signals it detects from scattered radio emitters to calculate its current location relative to its initial location.

Functional Flow Diagram



Local Positioning System



Critical Hardware Components



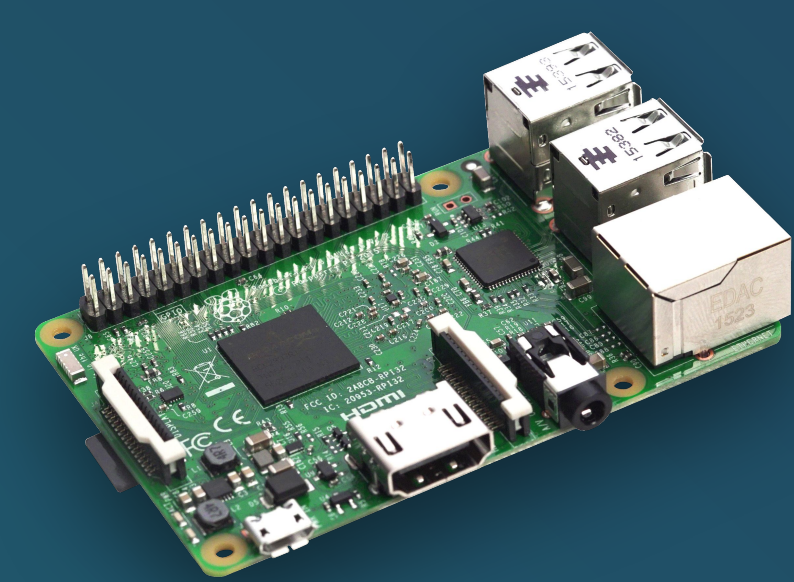
KerberosSDR

- Receives radio signals, and computes their incident angles



WitMotion IMU

- Bearing
- Acceleration



Raspberry Pi 3B+

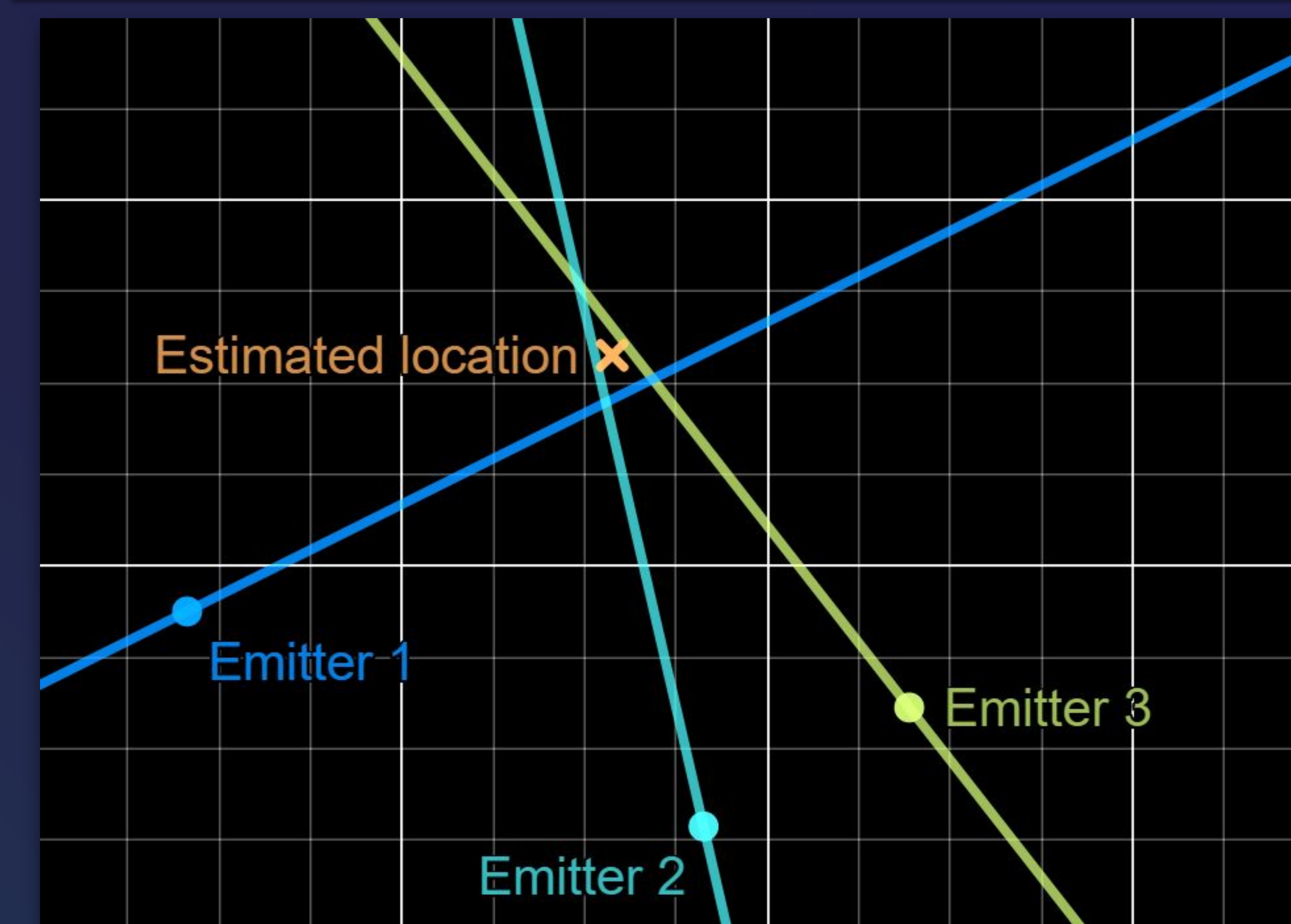
- Computes location
- Interfaces:
 - KerberosSDR via USB
 - IMU via UART



Adafruit Feather M0

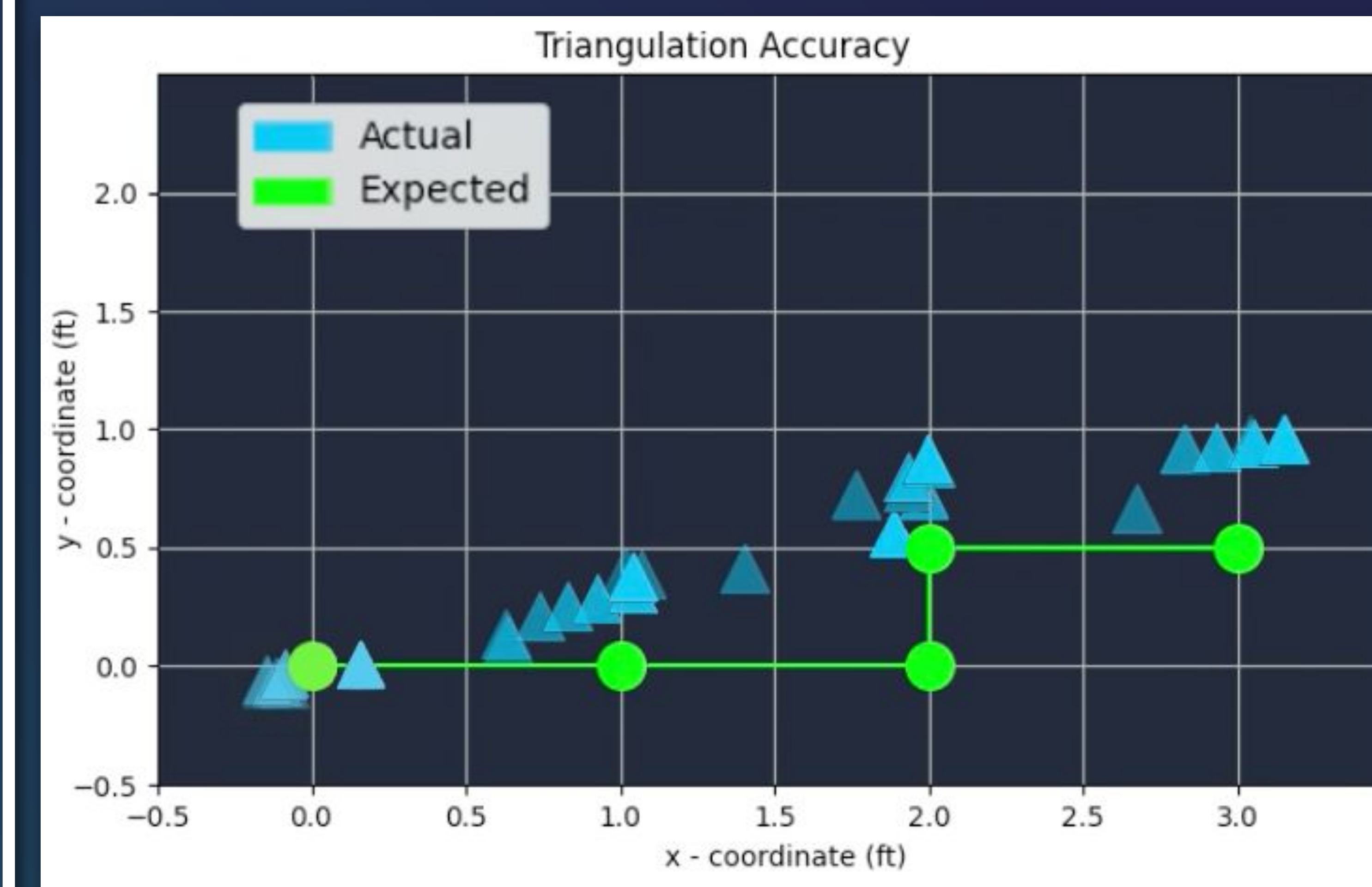
- Emits radio signals at individual frequencies

Location Finding



Simplified Triangulation Algorithm

Lines, with slopes corresponding to the incoming angles, are drawn through known emitter locations. The calculated location is at the lines' intersection.



Example expected vs calculated path the device took, as a time-lapse of the GUI display

