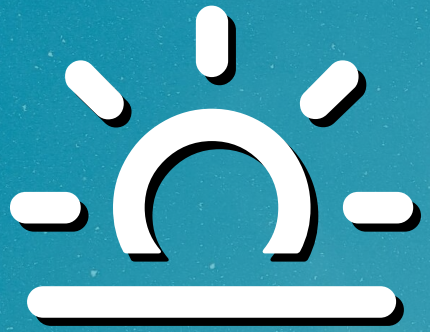
ESP32 Blood Pressure Monitor

Jacob Seman

Digital Signal Processing 2 Lab

ECEN4532 Spring 2025



Blood Pressure Measurement

Systolic and diastolic pressure are biometrics used in healthcare and biomedical industries.

- Systolic: pressure as blood is pumped out of the heart.
- Diastolic: pressure between heartbeats.

Both are typically measured by ear or equipment.

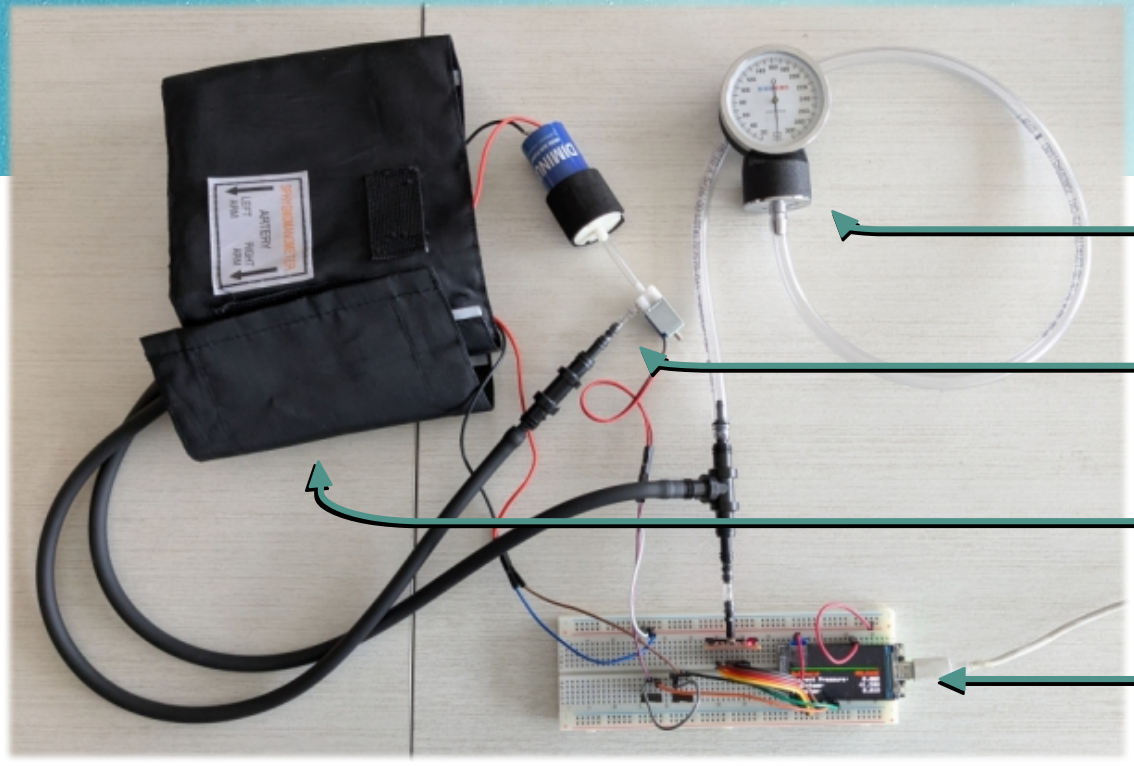
Some devices measure on the “run-up”.

Project Background

The goal of this project is to redesign an embedded system capable of taking arm-cuff pressure measurements, and supporting post-measurement analysis and identification of both Systolic and Diastolic pressures.

Reasonable accuracy compared to a reference device is a design target.

System Hardware Design



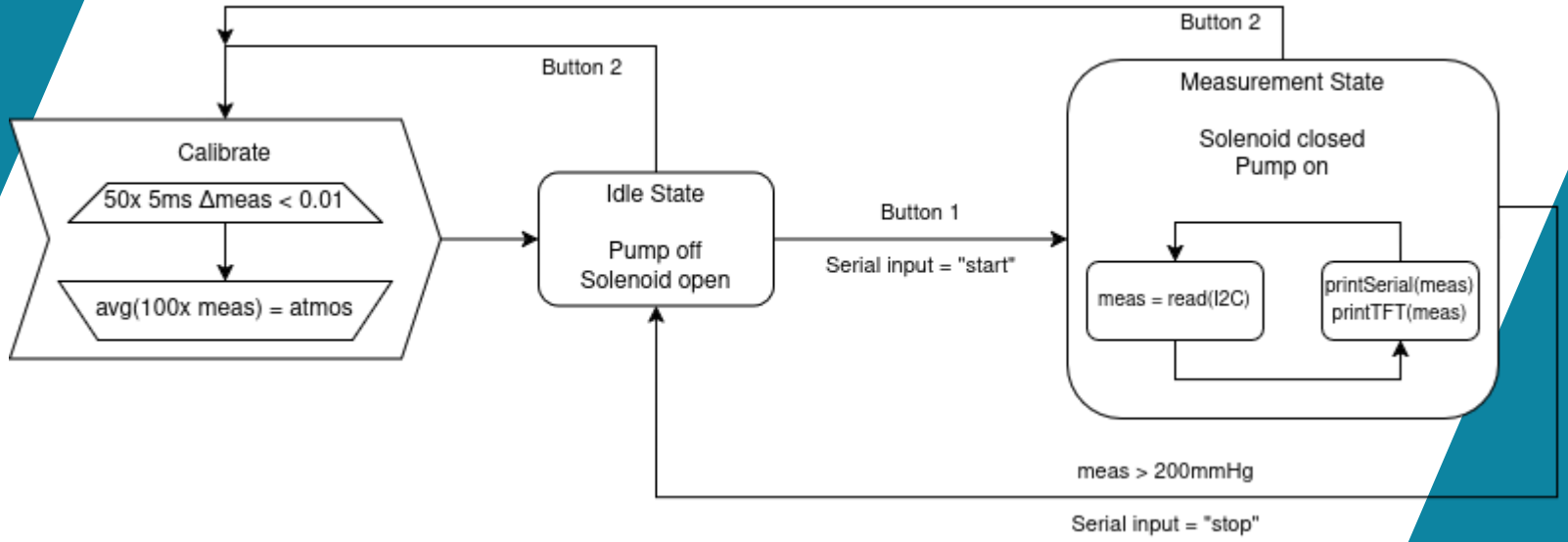
Analog Pressure Gauge

Air Pump, Solenoid

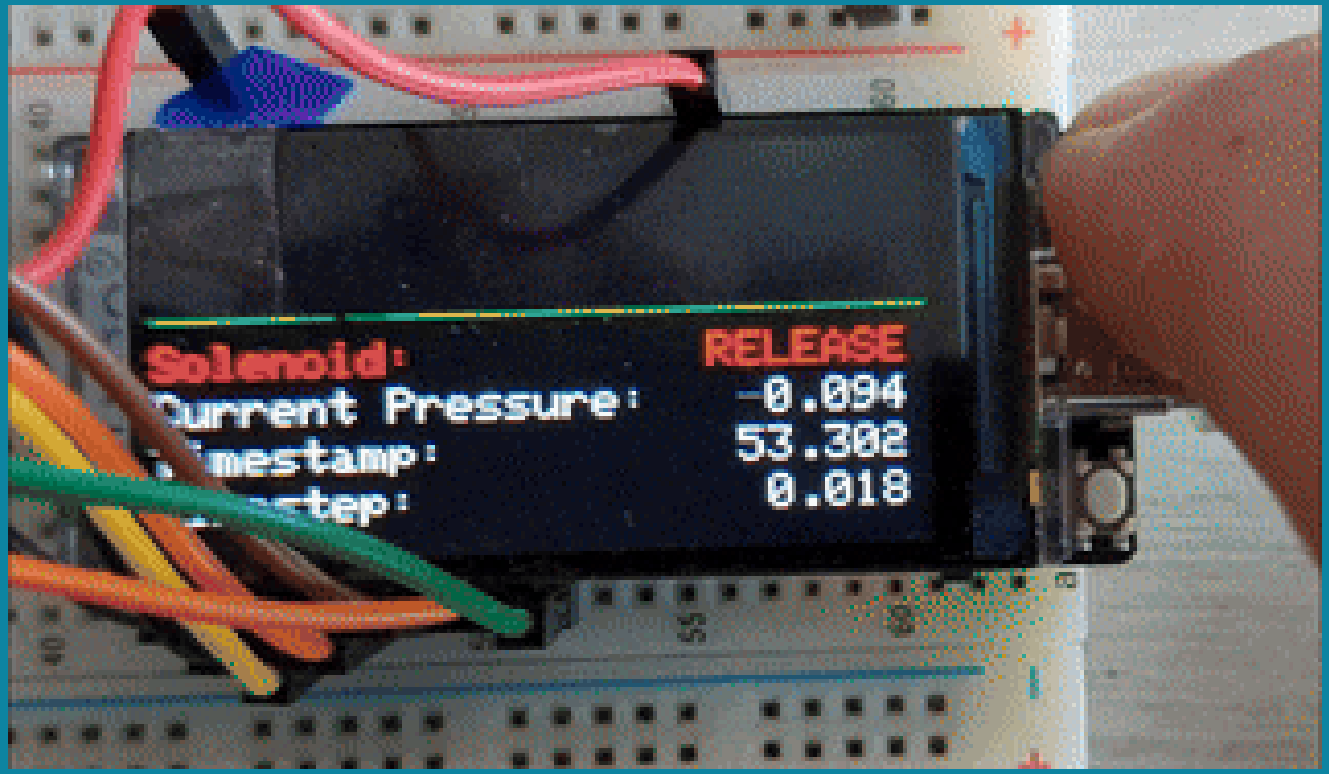
Arm Cuff

ESP32, MOSFETs,
Sparkfun MicroPressure

ESP32 Program Block

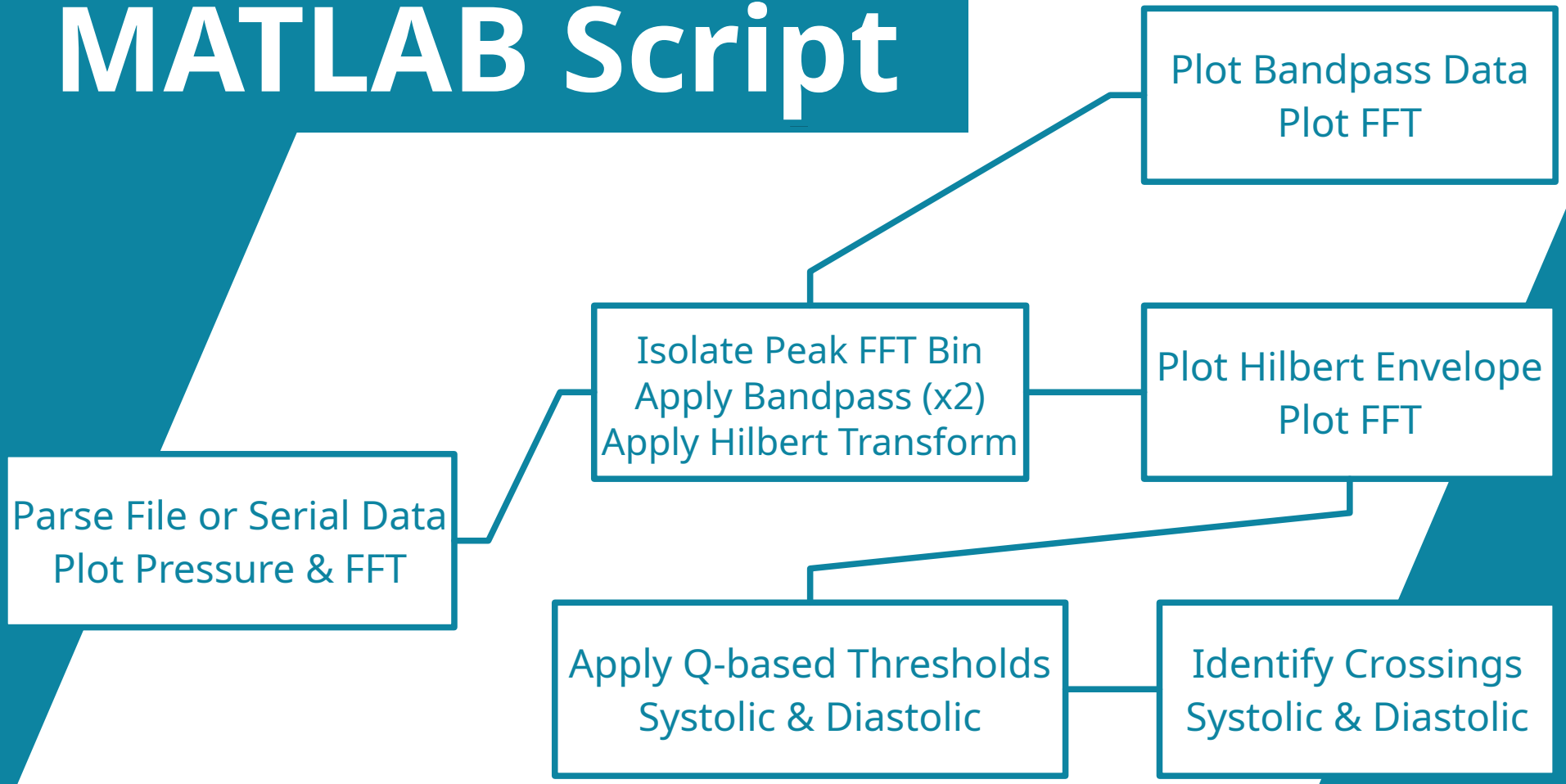


Calibration



Reference Device

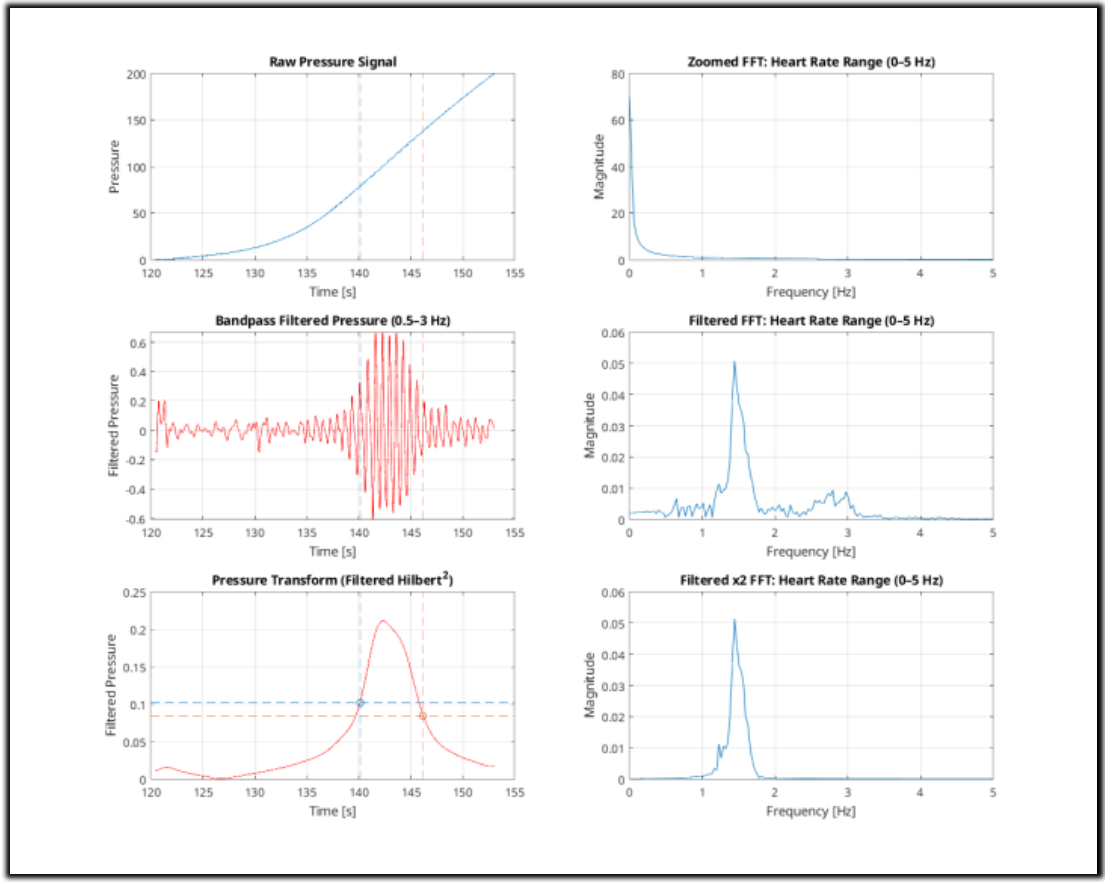
MATLAB Script



MATLAB Results

Diastolic: 79.084
Systolic: 138.463

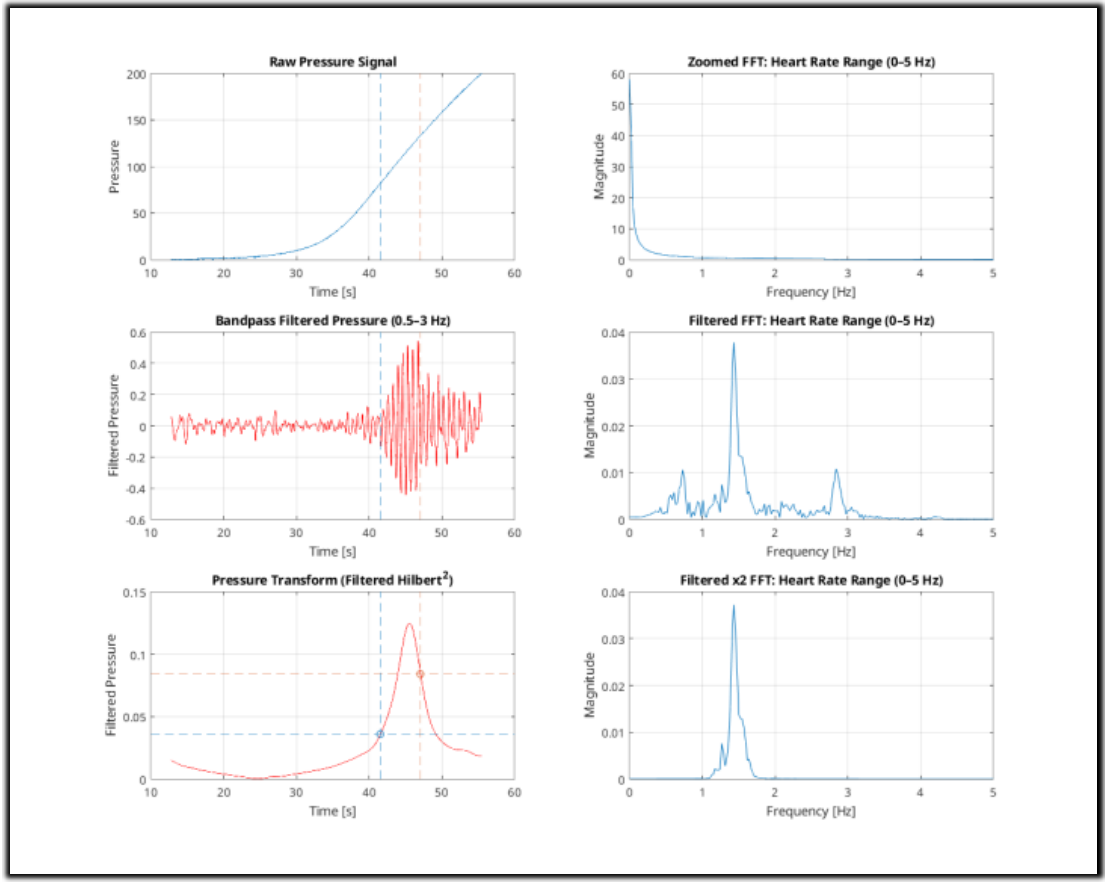
Reference:
Diastolic: 83
Systolic: 137



MATLAB Results

Diastolic: 82.020
Systolic: 133.168

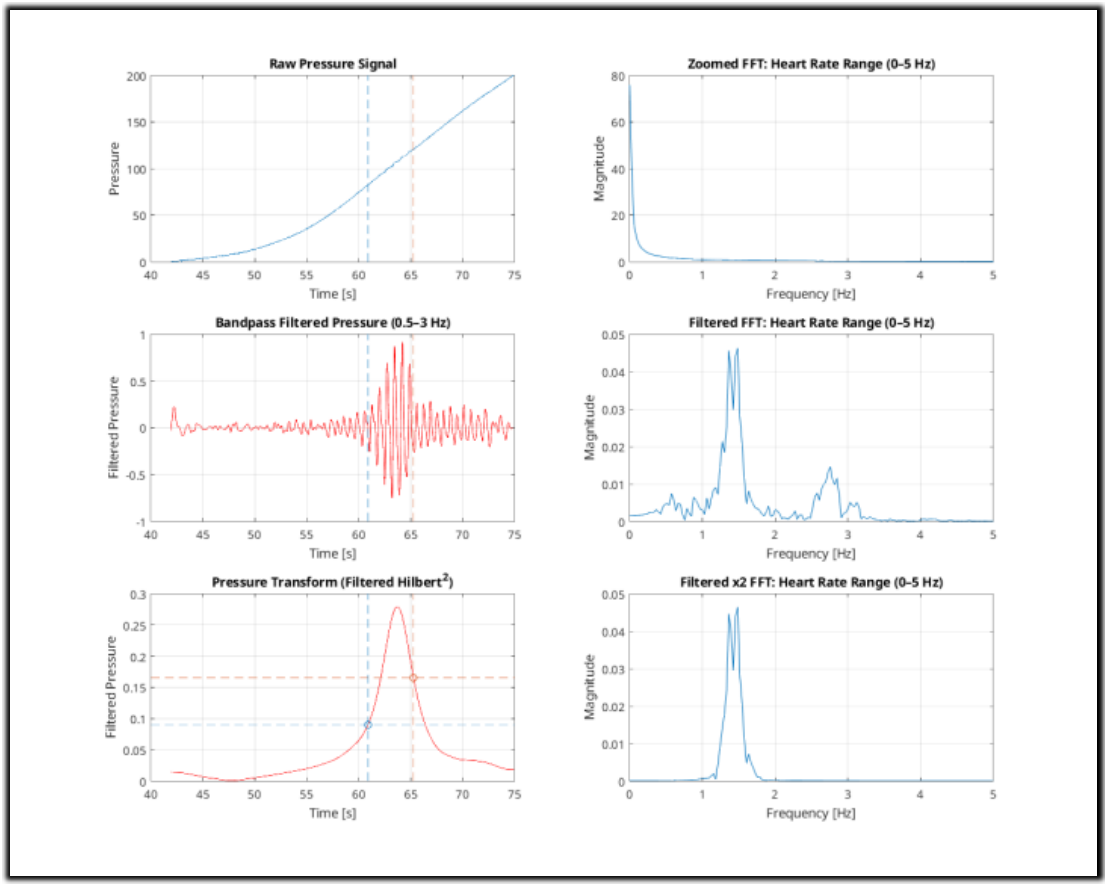
Reference:
Diastolic: 82
Systolic: 130



MATLAB Results

Diastolic: 82.768
Systolic: 120.599

Reference:
Diastolic: 82
Systolic: 127



Conclusion

The system design and measurement method was sufficient to make accurate recordings of blood pressure to record systolic and diastolic values.

Filtering of the recorded signal was very effective at isolating heart rate. Processing this data could be refined further.

Detrend strategies were tested alongside FFT and filtering, but thresholding proved to be a more immediately accessible method to determine systolic and diastolic values.

Thank You

Questions