REAL-TIME ELECTROCARDIOGRAM MONITORING AND HRV ANALYSIS

ALEX RIVAS

PARTH PATEL

DECEMBER 4 2018

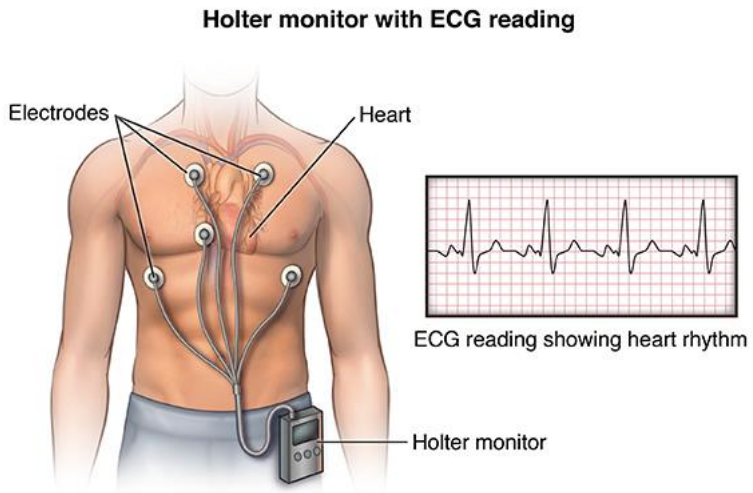
FIBROMYALGIA

What is it?

- Widespread chronic pain, fatigue
- Depressive mental health and worsened quality of life
- Disturbed sleep
- Tender points located in pairs throughout the body
- is **not** accompanied by inflammation of the **affected tissue**, and therefore said patients do not experience tissue damage or deformity despite potentially disabling body pain. [2]

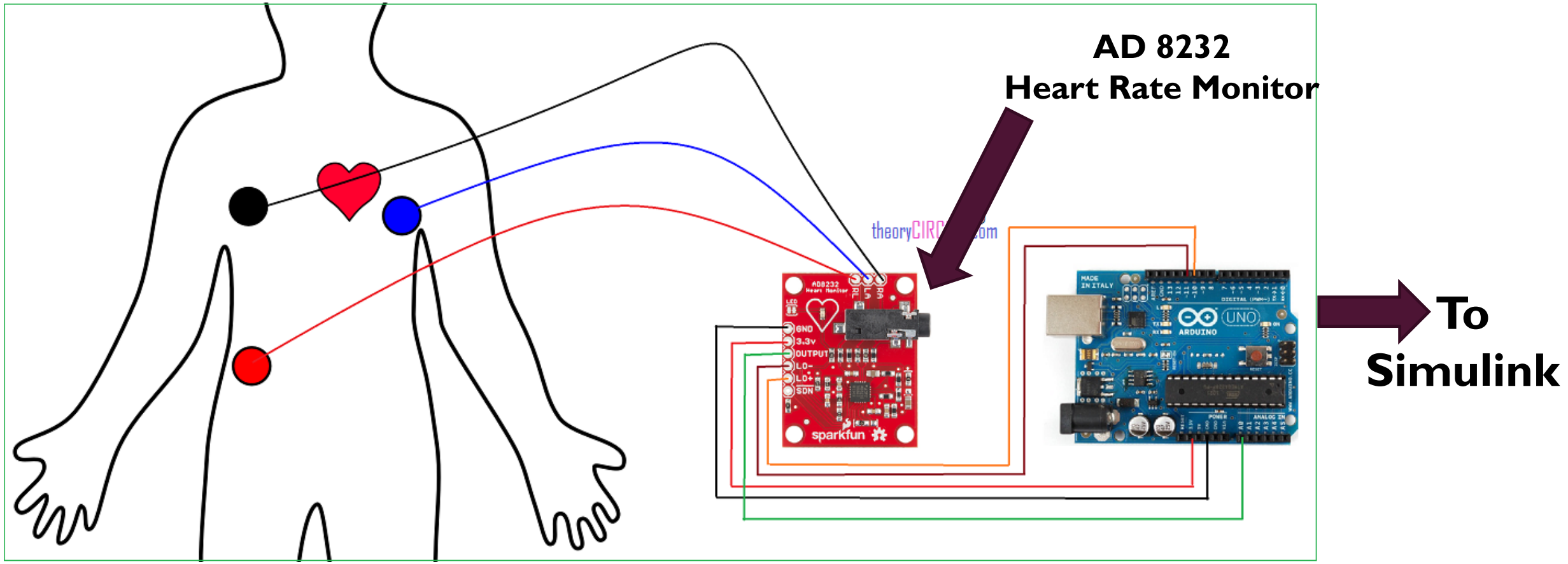
HOLTER MONITOR

- **Current standard** for portable EKG recording: Holter monitor
- A portable ECG monitor that records patient heart data for later review by a physician.
- But, Holter monitors **only record** patient data, requiring a physician to review it after it has been collected.
- There is currently **no devices** that notifies **in real-time**.



OUR SOLUTION

- Implement an embedded system to monitor ECG signal **in real-time**.
- Utilize ECG processing techniques that have been refined to ensure accuracy and speed.
- Develop HRV monitor ECG sensor that runs on Arduino Mega 2560 and MATLAB and Simulink


AD 8232
Heart Rate Monitor
GND
3.3v
OUTPUT
LO-
LO+
SDN
sparkfun
To
Simulink

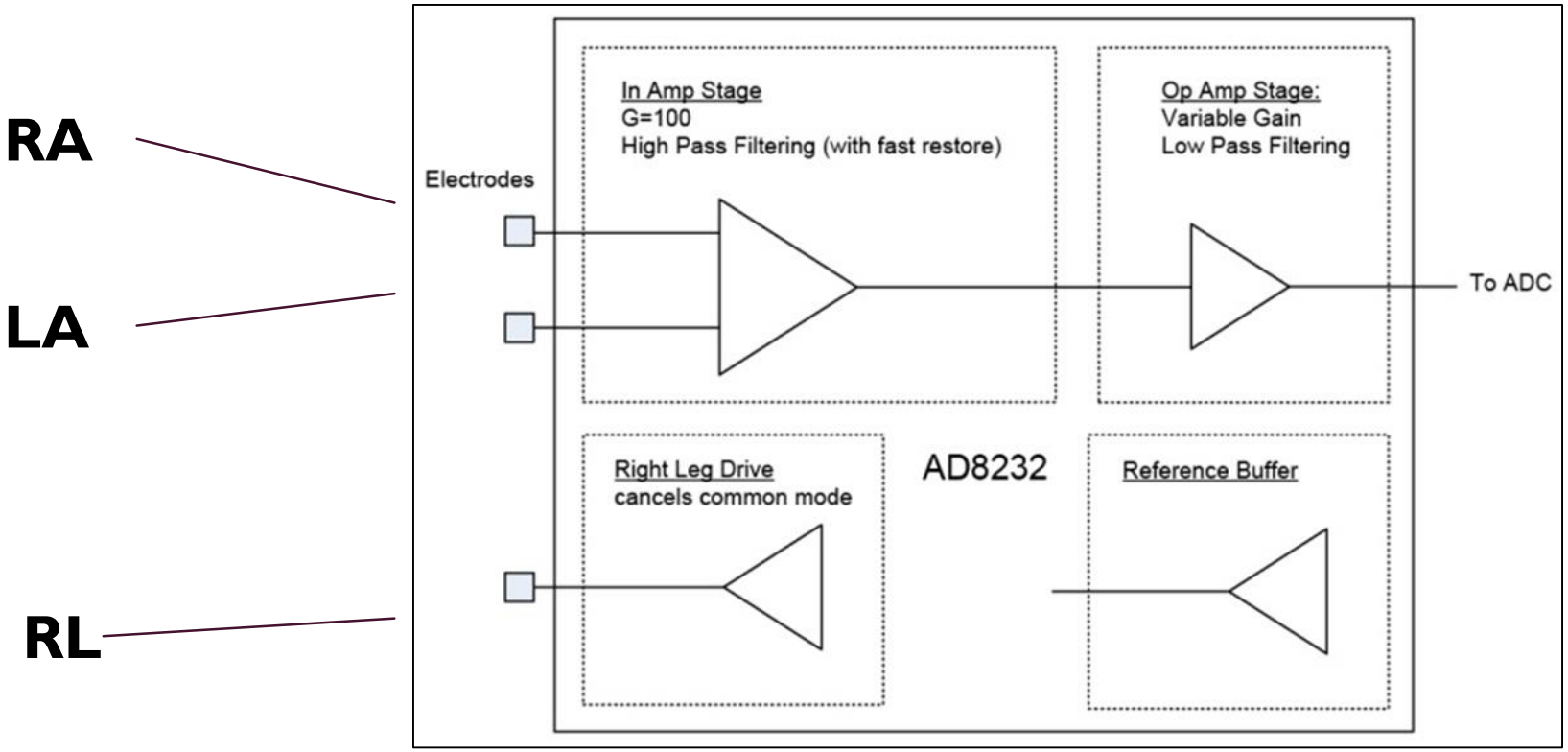
AD8232

- Measures the electrical activity of the heart
- Amplify, and filter small biopotential signals

Can be operated between 2.0 V to 3.5 V

Working frequency 0.5 Hz to 40 Hz

SIMPLIFIED CIRCUIT DIAGRAM OF THE AD8232



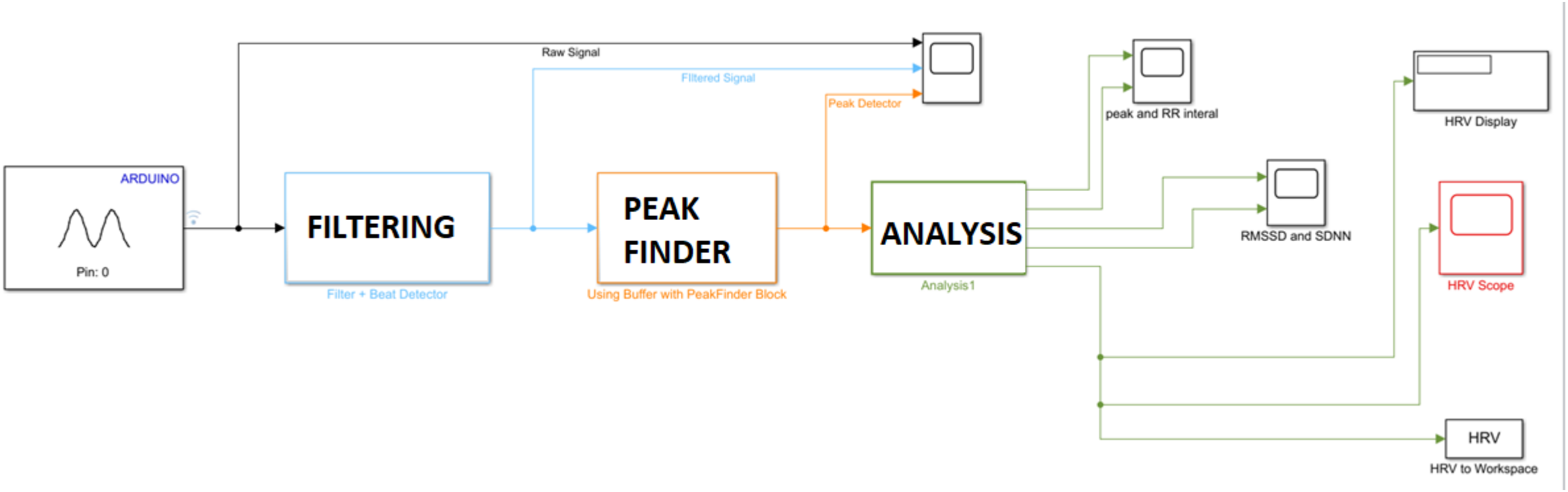
WHY DID WE CHOOSE THIS SENSOR

Actual ECG signal,

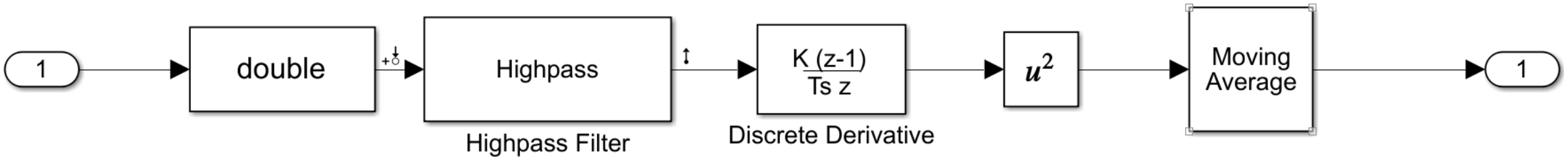
Bandwidth	0.1 Hz to 250 Hz
Amplitude	50 μV to 5 mV

- Holter works between 0.5Hz and 50Hz [a]
- QRS complex is found in the range of 0–20 Hz [b]

SIMULINK MODEL

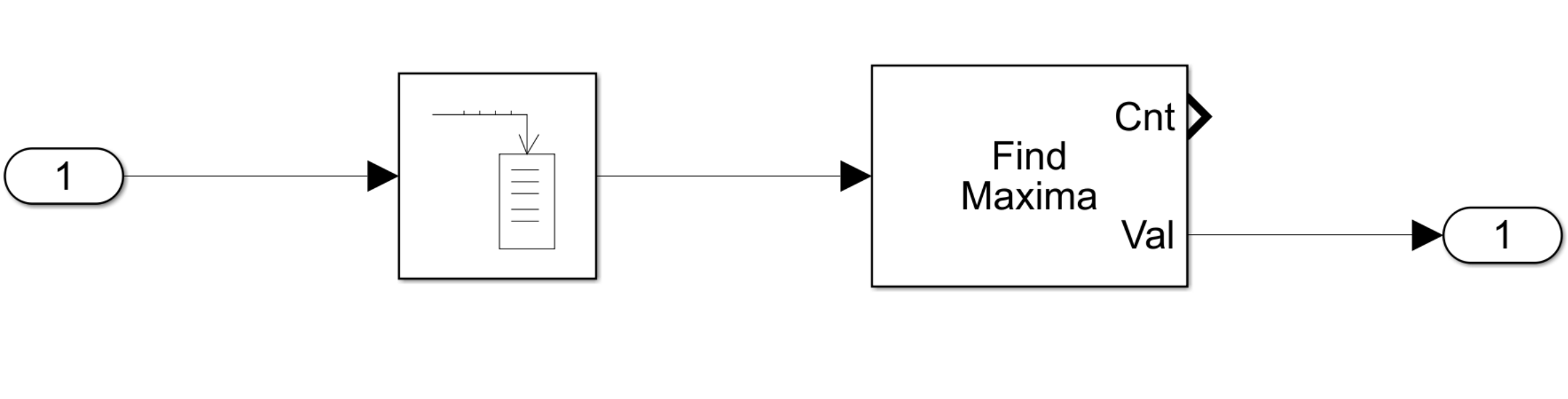


FILTER AND BEAT DETECTOR



- High-pass IIR filter with 2 Hz cutoff freq.

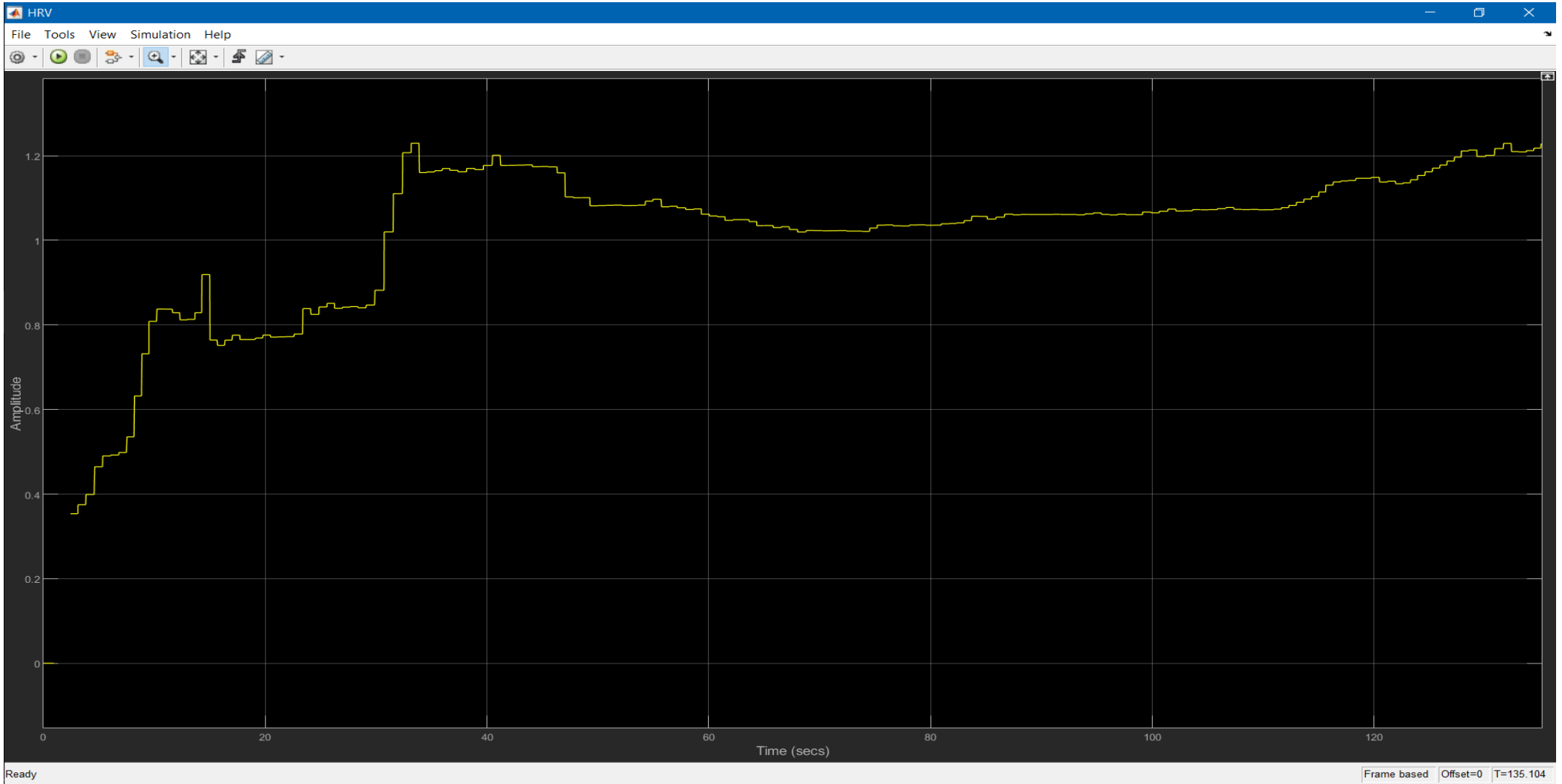
PEAK FINDER



ANALYSIS

- Preset threshold and minimum peak distance
- Counts time between peaks
- Calculates SDNN, RMSSD, and HRV (SDNN/RMSSD) when a new interval is detected
  - **Fibromyalgia patient :** 1.36 ± 0.38
  - **Healthy Person:** 1.07 ± 0.2

HRV (SDNN/ RMSSD)



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