

### **ECG capture module**

Captures the ECG from the user via connected electrodes.

Will not be demonstrated since the board has been tested on Lab 5.

### **Heartbeat detector module (Rogers)**

Analyzes the ECG capture board output and output pulses that correspond to the heartbeats.

Demonstration:

- An oscilloscope will be connected to the output of the module. The output displayed will be comprised of one pulse for each R-peak of the ECG signal at the input of the module.

### **EXTRA FEATURE: Variable comparison threshold for the HB Detector (Rogers)**

Makes the threshold of the heartbeat detector variable depending on the power of the signal received after demodulation.

Demonstration:

- An oscilloscope probe will be connected to the output of the module and another one to the input, showing that the reference will keep tracking the input as it varies in amplitude and frequency.

### **Modulator module (Guilherme)**

Modulates the signal from the heartbeat detector module's output and transmits it via AM.

Demonstration:

- An oscilloscope will be connected to the output of the modules and the AM modulated pulses from the input will be seen.

### **Demodulator module (Guilherme)**

Receives the signal from the modulator and demodulates the signal.

Demonstration:

- An oscilloscope will be connected to both the heart beat detector and demodulator outputs, and the signals are expected to be identical.

### **Low heart rate detector (Rogers)**

Receives the signal from the demodulator and outputs a signal in case the heart rate is below a defined threshold.

Demonstration:

- The low heart rate detector will be disconnected from the circuitry and be connected to a heart beat signal generator (provided by the Agilent function generator) and the heart rate will be lowered until the module outputs a positive signal, which indicates that the heart rate is below the defined threshold ( $\sim 0.8\text{mHz}$ ).

### **Emergency signal reset module (Rogers)**

Used to silence the low heart rate alarm by pressing a button. It also ensures that the alarm is automatically silenced if the heart beat goes back to normal.

Demonstration:

- When a low heart rate input is present the alarm will sound, and when a button is pressed the alarm will be silenced. Furthermore, after reestablishing the normal heart rate and lowering it down again, the alarm should sound again.

### **Sound amplifier module (Guilherme & Rogers)**

Receives the signal from both the demodulator and low heart rate detector and amplifies the signal to a speaker

Demonstration:

- This module will be demonstrated on the go, by listening to audible signals during the demonstration. During normal operation, beeps will correspond to the heart beat rate, and a continuous sound will be reproduced during an emergency (low heart rate).

### **EXTRA FEATURE: Automatically silencing the heart beat tone when the alarm tone is on (Guilherme)**

The heart beat is silenced when the alarm is on, preventing the user from listening to both outputs simultaneously.

Demonstration:

This feature will be present during all operation. The fact that when the alarm is on the user cannot listen to the heart beat simultaneously, means that it is operating normally.

### **Demonstration of system as a whole:**

The system will be demonstrated in two steps. First the ECG capture board's electrodes will be connected to a person, and the heart beats will be heard at the speaker. For the second part, a function generator in the heart beat generator mode will be connected in place of the ECG capture board. The heart rate will be lowered until the alarm sounds, it'll then be silenced.

**Ambitious goals**

1. Emergency signal reset module: **DONE**  
Automatic reset: When the user silences the alarm, it'll be automatically reset after the heart rate goes above the threshold.
2. Low heart rate detector:  
Detect high heart rate as well.
3. Modulator:  
Use as small an antenna as possible.

**Two additional extra goals were implemented:**

1. Automatically silencing the heart beat tone when the alarm tone is on
2. Variable comparison threshold for the HB Detector