Project Notes

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Excitation signal travels:

1. Your atria, contracts
2. Atrioventricular node (AV), delaying the signal until atria are empty of blood
3. The center bundle of nerve fibers, carrying the signal to the Purkinje fibers
4. Purkinje fibers to ventricles, causing them to contract

One full contraction of heart muscles ^

Pacemaker Hardware Reference Platform:

- Pacemaker pulse generator
- Communicates with DCM
    - DCM is user interface on your laptop

Pacemaker Testing Controller:

- Simulate electrical activity of the heart
- Verifies pacemaker system (whatever tf that means)

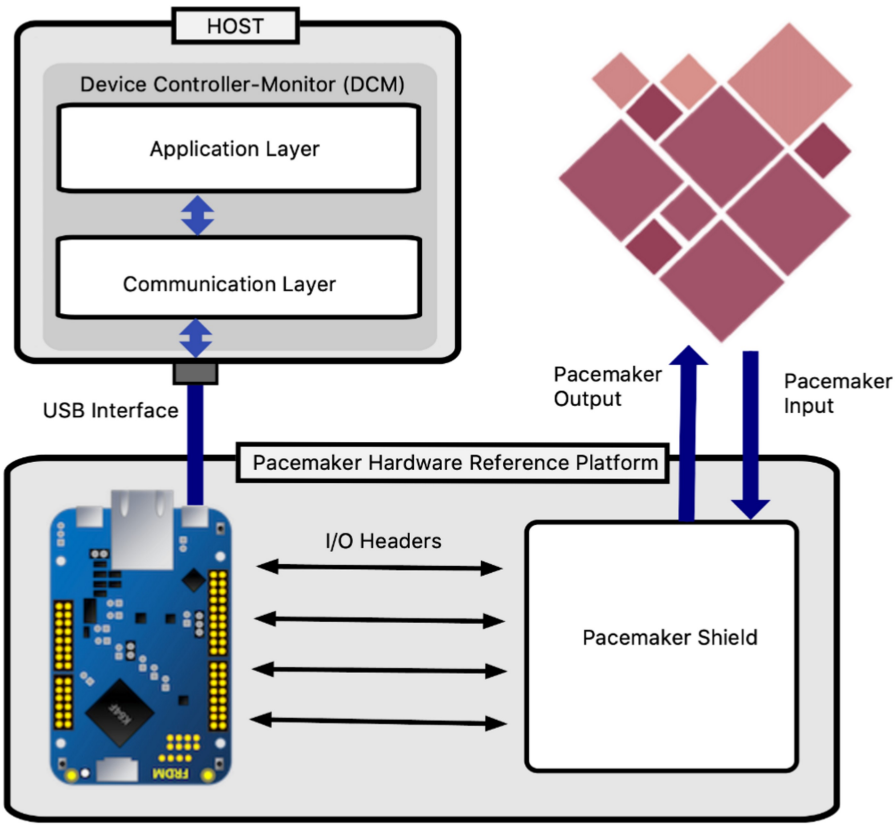

Figure 3: Pacemaker System Functional Description.

The pacemaker will only be able to sense the electrical activity generated by the testing controller, can not sense its own paces

Operating Modes:

	I	II	III	IV (optional)
Category	**Chambers Paced**	**Chambers Sensed**	**Response To Sensing**	**Rate Modulation**
Letters	O–None A–Atrium V–Ventricle D–Dual	O–None A–Atrium V–Ventricle D–Dual	O–None T–Triggered I–Inhibited D–Tracked	R–Rate Modulation

Code	Description
AOO	Atrial asynchronous pacing
VOO	Ventricle asynchronous pacing
AAI	Atrial demand pacing
VVI	Ventricle demand pacing
DOO	Dual asynchronous pacing
DDDR	Dual rate adaptive demand pacing

AOO (Atrial Asynchronous Pacing):

Based on letter code AOO literally means pulse the atrium only. Pacemaker generates and sends signals to the atria at fixed rate, regardless of the naturally occurring signals and rhythm produced by the patients heart.

Atrial pacing - pacemaker sends regular electrical impulses to the atria to simulate atrial contraction. Atrial asynchronous pacing means electrical impulses created by the pacemaker are not in sync with the natural signals of the body. Typically to help with bradycardia (slow heartbeat) or arrhythmias (irregular heart rhythm).

VOO (Ventricle Asynchronous Pacing):

Pulses only the ventricles asynchronously with the natural signals of the heart.

AAI (Atrial Demanding Pacing):

In this mode the pacemaker monitors the heart's natural electrical activity in the atria and only delivers electrical impulses when the heart's rhythm falls below a certain predetermined rate. Pulses are only created by the pacemaker when the heart rate is too slow (bradycardia) or when the natural rhythm is irregular.

Pacemaker continuously monitors the electrical activity in the atria. In this mode the pacemaker should have a threshold for the heart rate. If the heart rate falls below the threshold bradycardia is detected.

After bradycardia is detected electrical impulses are delivered to pace the atria and maintain a stable regular heart rate.

VVI (Ventricle Demand Pacing):

Similar to AAI, only ventricles. Ventricular electrical activity is monitored. If bradycardia is detected (below predetermined threshold) electrical impulses are delivered to maintain a stable and regular heart rate.

DOO (Dual Asynchronous Pacing):

Requirements/Things to focus on:

- Timing between pulses
- Pacing - how quickly pulses are being sent
- Sensing - ensuring under sensing and oversensing events does not occur
- Different modes for the pacemaker
- DCM needs to be able to monitor and change the program of the pacemaker
    - Pulse rate (frequency of pacing pulse)
    - Pulse width (the duration of the pacing pulse)
    - Pulse amplitude (strength of pulse)
    - Sensitivity of the sensing circuit
    - Mode of pacing (AOO, VOO, AAI, VVI, DOO, DDR)
    - Refractory period
    - Hysteresis on/off

Simulink stuff:

Implement state flows for:
AOO, VOO, AAI, and VVI

The state flows should use programmable parameters listed in the requirements document (Appendix A). Things of particular interest include pulse characteristics (width, and regulated amplitude), rate characteristics (limits, and delays), and what chambers are being paced. State flow should not change if the pinmap is altered, instead the correct pin should map to its corresponding component.

Hardware hiding is required, recommended to use a simulink subsystem.