# Terse Project Proposals

Please prepare very terse (1/3 to 1/2 page each) proposals for three projects. Upload the proposals to the Google Drive folder at `https://drive.google.com/drive/folders/14FBXetuT7B31OWJm3Np-zgUEAMNq1Eqo?usp=sharing`. You are encouraged to read the proposals of other students, using them to determine team goals and form teams.

Each proposal should be 1/3 to 1/2 page in length. Please use the organization of the example on the following page. The uploaded file should be in PDF format and should have the following name: [unique name]-[terse mnemonic].pdf. For example, "dickrp-cardiac.pdf". It is also acceptable to prepare Google Documents following the same naming convention, but without the ".pdf" suffix.

Goals of assignment:

1. Formalize your thinking about the most promising project topics you have identified.

2. Allow classmates to prepare for the team formation meeting and converge around the most promising and appealing projects. Simply stating your project title in the team formation meeting may then pull in others interested in being team members.

# Human Mechanical Power Sensor for Use in Cardiac Patient Risk Stratification and Remote Virtual Rehabilitation Programs

Robert Dick

**Customer**: *Who would care enough about this to support it. If you are motivated by personal curiosity, the answer is "me".*

Doctors of cardiology, perhaps as mediators for insurance companies.

**Value:** *What value does it provide or what problem does it solve?*

Enables rapid, inexpensive estimation of a patient's chemical energy use rate, enabling the condition of the cardiovascular system to be determined. This enables estimates of hospital readmission and mortality rates for determining when, and into what care environment, cardiac patients should be discharged from hospitals. It also enables remote, real-time exercise intensity guidance, and tracks changing cardiovascular condition over time. It has the potential to reduce mortality and hospital readmission rates, and thereby reduce costs/penalties to hospitals and insurance companies.

**Approach:** *At a high level, how does it work?*

Develop an electrocardiogram and inertial measurement unit (IMU) based wearable sensing system capable of measuring heart rate and fine-grained motion of the body's center of mass, and using signal processing algorithms to estimate the power generated by the patient resulting in the measured motion pattern.

**Essential System Components:** *What must you integrate into the embedded system for it to have basic functionality?*

1. IMU.

2. Bluetooth SMART transceiver for communication with smartphone.

3. Signal processing algorithms running on ARM processor.

**Optional System Components:** *What additional components have the potential to improve the system's value?*

1. Signal processing algorithms accelerated via FPGA implementation.

2. Speaker and associated tone or voice synthesis algorithms.