Problem Formation

We need to write about the following:

* Understanding the ECG and how to calculate the dynamic model
* Create a dynamic model that displays an ECG that simulates basic properties of a human heart
* Create the same ECG, but by reading from custom inputs or files
* Extend the functions and capabilities to include parameter fitting to experimental data

Background Information

* What is an ECG and briefly how to obtain it?
* Morphology of ECG cycle (PQRST)
* Intervals
* What would a dynamic model provide? (teaching, but mostly testing platform for user uploaded data and algorithm testing)

Literature Survey

Give a summary of previous work related to your problem in chronological order.

McSharry et al.,   
A Dynamic Model for Generating Synthetic Electrocardiogram Signals,   
IEEE Transactions on Biomedical Engineering; 2003 Mar. 5 3:289-94 <http://web.mit.edu/~gari/www/papers/ieeetbe50p289.pdf>

ECGSYN  
An implementation of ECGSYN in MatLab, Octave, C and Java

R Sameni, MB Shamsollahi, C Jutten, M Babaie-Zadeh,   
Filtering Noisy ECG Signals Using the Kalman Filter Based on a Modified Dynamic ECG Model   
Computers in Cardiology; 2005 32:1017-1020  
<http://www.cinc.org/Proceedings/2005/pdf/1017.pdf>

<https://yan-lu.github.io/pdf/lu_denoising_bibm09_final.pdf>

Yan Lu, Jingyu Yan, Yeung Yam  
A Generalized ECG Dynamic Model with Asymmetrical Gaussians and its Application in Model-Based ECG Denoising  
BMEI; 2009 Oct 17-19  
<https://www.researchgate.net/publication/220715500_A_Generalized_ECG_Dynamic_Model_with_Asymmetric_Gaussians_and_its_Application_in_Model-Based_ECG_Denoising>

Vega Pradana Rachim, Sung-Chul Kang, Wan-Young Chung, and Tae-Ha Kwon  
Implementation of Extended Kalman Filter for Real-Time Noncontact ECG Signal Acquisition in Android Based Mobile Monitoring System  
Journal of Sensor Science and Technology; 2014 23:7-14  
<https://pdfs.semanticscholar.org/5f10/8d21970bc2fccab0dee7ee70ba51c98609b2.pdf>

Omid Sayadi, Mohammed B. Shamollahi, Gari D. Clifford  
Synthetic ECG Generation and Bayesian Filtering Using a Gaussian Wave-Based Dynamical Model  
Physiol Meas. 2010 Oct; 31(10): 1309-1329  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3148951/>

Timeline

Term 1

Week 1 – Week 2

* Develop understanding the basic dynamic model of ECG
* Reading and consideration of potential solutions to the ECG model

Week 3 – Week 4

* Create a basic model written in MatLab for experience and proof of development.

Week 5 – Week 10

* Create a basic model that works in chosen solution
* Potential extensions to the basic simulation (baseline wander, RSA, Mayer Waves)

Term 2

Week 1 – Week 10

* Potential extensions to the basic simulation (baseline wander, RSA, Mayer Waves), cont. from Term 1
* Implement basic user input (allow user to input values in one way or another)
* GUI development
* Optimization (optional, just in case)

Term 3

Week 1 – Week 10

* Refinement/implementation of features mentioned above
* Implement parameter fitting to user uploaded data
* How to package/distribute