



**University
of Victoria**

Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Applied Science

of

WANBO LI

BSc (Beijing University of Posts and Telecommunications, 2012)

**“Wireless ECG System with Bluetooth Low Energy and
Compressed Sensing”**

Department of Electrical and Computer Engineering

Wednesday, July 6, 2016

1:30 P.M.

Engineering Office Wing

Room 430

Supervisory Committee:

Dr. Xiaodai Dong, Department of Electrical and Computer Engineering, University of Victoria
(Supervisor)

Dr. T. Aaron Gulliver, Department of Electrical and Computer Engineering, UVic (Member)

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Dr. Ulrike Stege, Department of Computer Science, UVic

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Dr. Stephen Lindsay, Department of Psychology, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Electrocardiogram (ECG) is a noninvasive technology widely used in health care systems for diagnosis of heart diseases, and a wearable ECG sensor with long-term monitoring is necessary for real-time heart disease detection. However, the conventional ECG is restricted considering the physical size and power consumption of the system. In this thesis, we propose a Wireless ECG System with Bluetooth Low Energy (BLE) and Compressed Sensing (CS).

The proposed Wireless ECG System includes an ECG sensor board based on a BLE chip, an Android application and a web service with a database. The ECG signal is first collected by the ECG Sensor Board and then transmitted to Android application through BLE protocol. At last, the ECG signal is uploaded to the cloud database from Android app. We also introduce Compressed Sensing into our system with a novel sparse sensing matrix, data compression and a modified Compressive Sampling Matching Pursuit (CoSaMP) reconstruction algorithm. Experiment results show that the amount of data transmitted is reduced by about 57% compared to not using Compressed Sensing, and reconstruction time is 64% less than using Orthogonal Matching Pursuit (OMP) or Iterative Re-weighted Least Squares (IRLS) algorithm.