



CardiOwls: Wireless Electrocardiogram for Space Habitation Health Monitoring

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Motivation

- Long-term habitation under zero-g conditions leads to physical atrophy
- ECGs assess cardiovascular health condition of astronauts in orbit
- Market niche exists for portable, easy to use 12 lead wireless ECG system



Our Mission

- Perform ECG data acquisition and wireless transmission on patient
- Display waveforms with custom GUI suitable for medical analysis
- Design easy to use body mount to manage cables and electrodes



Product Features

- Full 12 Lead ECG Acquisition
- Low Power Operation
- High Signal Fidelity
- Strong Wireless Network
- Ambulatory Measurement
- Adjustable Body Mount
- Patient Protection
- Plug and Play Setup
- Configurable GUI
- Diagnostic Data

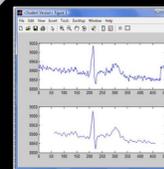
The CardECG System

Subsystems

Patient Interface	Body Mount, ECG Electrodes, Right Leg Drive
Data Acquisition	CardECG Board
Wireless	Zigbee Network, Receiver
End Application	CardiUI Graphical Interface, Signal Analysis

Signal Analysis

- Lowpass filter for 60 Hz noise
- Baseline wander adjustment
- Potential for feature detection in real time



Body Mount

- Holds device
- Adjustable straps
- Easily attached



ECG Electrodes

- Ten attach to body
- Reusable
- Conductive gel



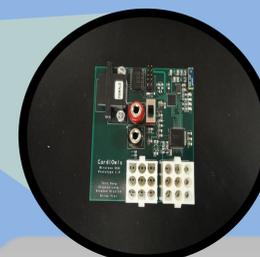
Right Leg Drive

- Prevents clipping
- Decreases common mode noise



CardECG Board

- Analog front end/ADC performs sampling
- 8051 MCU with ZigBee transceiver controls board
- Powered by four AAs with LDO regulators
- Small PCB antenna for wireless communication



ZigBee Network

- 2.4 GHz band comm. using ZigBee protocol
- CardECG is end device
- USB dongle/SmartRF05 serves as coordinator
- TI Z-Stack protocol stack
- Wired option available



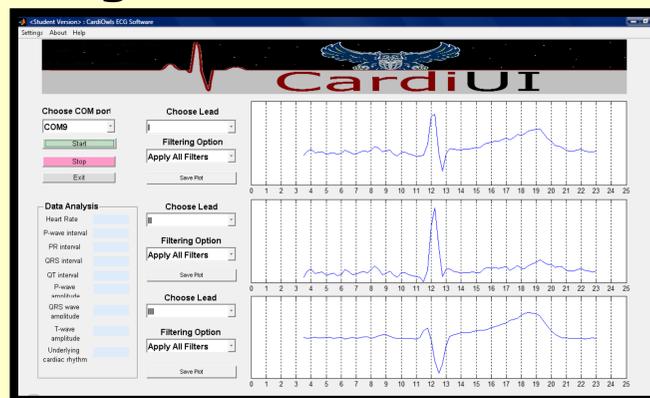
CardiUI

- MATLAB based user interface
- Intuitive Start/Stop
- Multiple leads viewable at once



CardECG: An Efficient and Configurable Solution

CardECG System Specifications			
	Specification	NASA	CardECG
Operation	Battery Life (12 lead)	6 hrs	120 hrs
	Range	10 ft	35 ft
	Latency	N/A	< 100 ms
Physical	Mass	300 g	121 g
	Volume	400 cm ³	182 cm³
	Current Draw	N/A	25 mA
Signal	Channels / Leads	8 / 12	8 / 12
	Sampling Rate (wireless)	500 Hz	100 Hz
	Sampling Rate (wired)	500 Hz	500 Hz
	Resolution	12 bits	16 bits



Note the presence of distinct P, QRS, and T waveforms with 60 Hz noise effectively removed through filtration. The plots include standard time axis labeling (in mm) for clinical diagnosis. The difference in the leads arises from different "viewing angles" of the heart.

Monitoring Made Quick And Easy

Three easy steps in less than two minutes

1. Insert the USB receiver into a computer for display
2. Attach the body mount and activate the CardECG
3. Open the CardiUI monitoring program and click "start"

A complete package with numerous innovations

1. Portability: low mass, small volume, high range
2. Usability: customizable, intuitive user interface
3. Simplicity: plug and play setup, wearable body mount



ACK Packets

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