

## Introduction

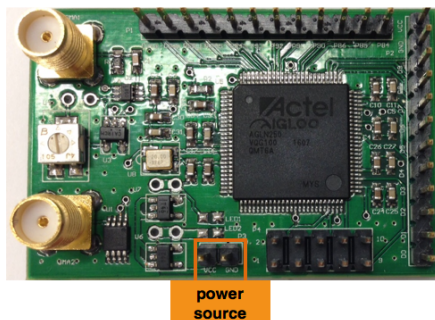
HitchHike is a hardware platform that can be used to implement the HitchHike system (published in SenSys 2016) and the FS-Backscatter system (published in SIGCOMM 2016). In this document, we will describe how to use the HitchHike hardware to backscatter ECG data on top of existing WiFi signals.

## Hardware and software

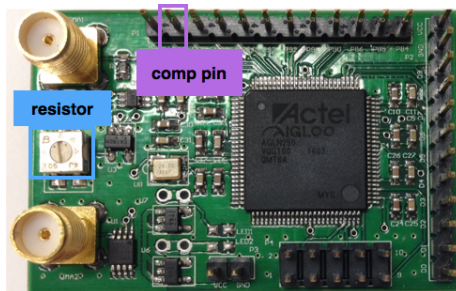
1. HitchHike hardware can be downloaded from here. We provide the schematic, PCB layout, and gerber files for building the HitchHike board.
2. HitchHike FPGA program can be downloaded from here.
3. The ECG sensing board hardware can be downloaded from here. We provide the schematic, PCB layout, and gerber files for building the ECG sensing board.
4. The software running on the Apple laptop can be downloaded from here. We provide software for sniffing the backscattered WiFi packets, extract the ECG sensor data, and display the data in real time.
5. Intel NUC computer with the Intel 5300 WiFi card for transmitting the WiFi packets. You can download the Intel 5300 WiFi driver from here.

## Instructions for running the ECG sensing application

1. Power the HitchHike platform using a 3.3V power source via the power interface (orange module in the figure).

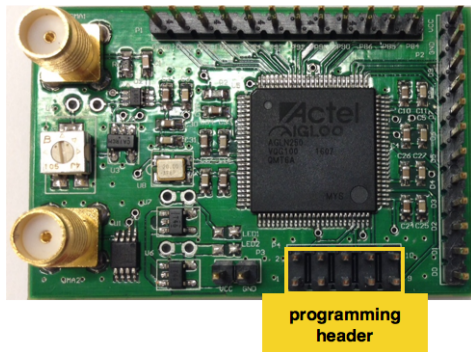


2. Tune the resistor (blue module) such that the comparator output pin (purple module) does not generate false positive signals. These false positive signals are generated by ambient WiFi signals.

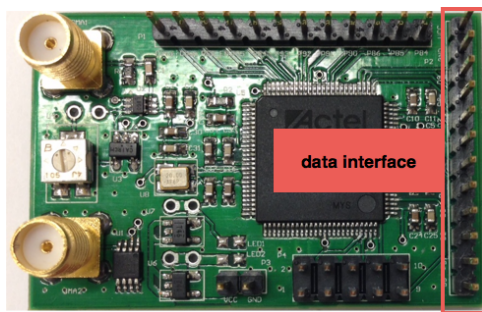


3. Download the codeword translator program into the FPGA using the programming header (yellow module). You need to be a bit careful when you connect FlashPro 5 programmer with the FPGA programming header. Make sure that your connection is

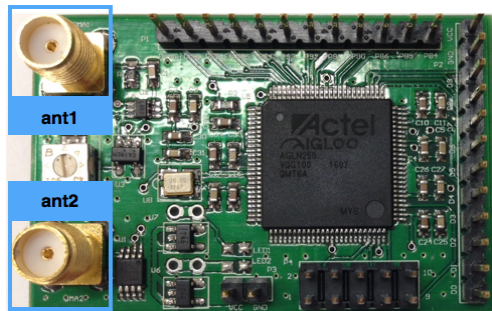
correct (first pin of the programmer is mapped to the first pin of the FPGA programming header). **Wrong connection could destroy the FPGA.**



4. Download the ECG sensing firmware to the ECG sensing board.
5. Connect the HitchHike board with the IMU sensing board via the data interface (red module).



6. Connect two 2.4GHz antennas on the SMA port (blue module).



7. Turn on the Intel WiFi transmitter. Transmits WiFi data using this code in the injection mode.
8. Run the WiFi reception code on the Apple laptop. Decode the backscattered WiFi packets, extracts the ECG sensing data, and display the data in real time.