A 9.2-GRAM FLEXIBLE WIRELESS EEG MONITORING AND DIAGNOSTICS HEADBAND

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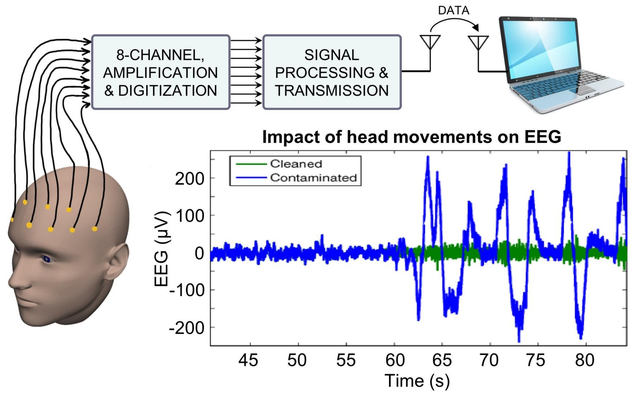
MOTIVATION

Electroencephalography is a method used to monitor the electrical activity of the brain.

Clinical EEG tests:

- require trained technicians
  - long wait times
- need conductive gels
  - uncomfortable
  - needs post-use cleaning
  - lengthy preparation time
- wired connections
  - patient tethered
  - needs computer for displaying and processing

DESIGN REQUIREMENTS



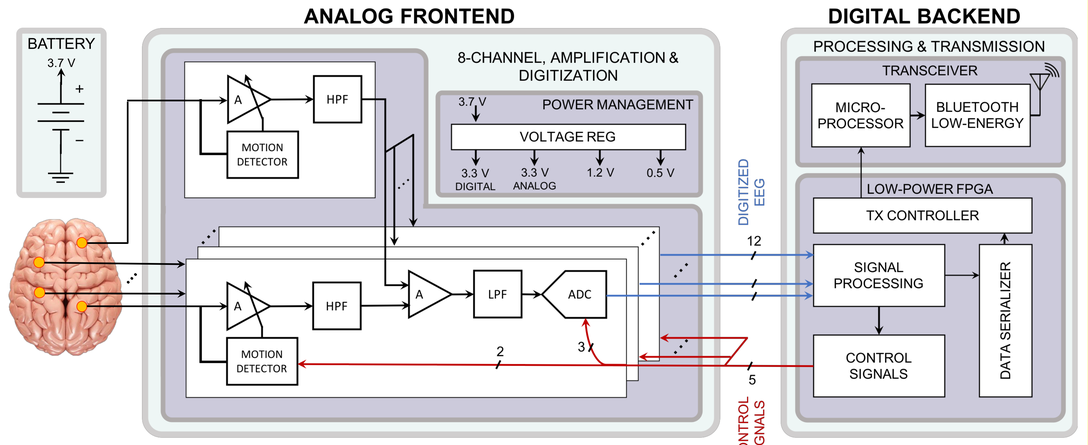
Application Level	System Level	Circuit Level
Quick setup time	Multi-channel	Bandwidth: Up to 1 kHz
Comfortable	Wireless	Amplitude: 10μV to 1mV
Light weight	On-device processing	Robust to interference
Adjustable size	Programmable	Minimal input referred noise
		Removal of motion artifact

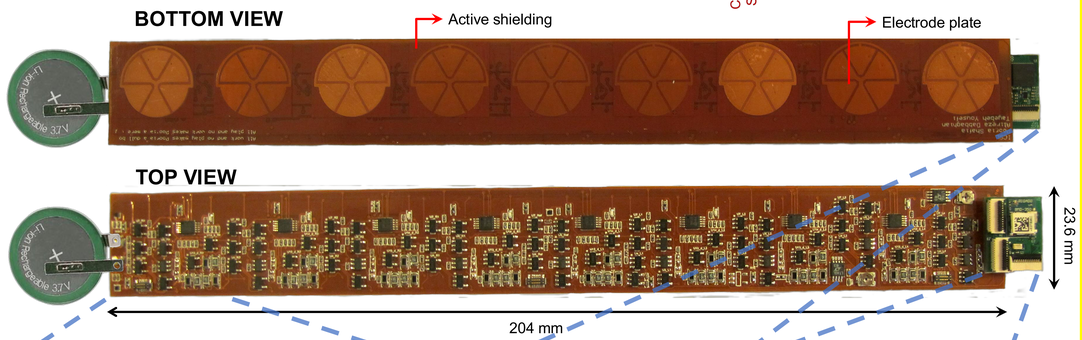
COMMERCIAL HEADSETS

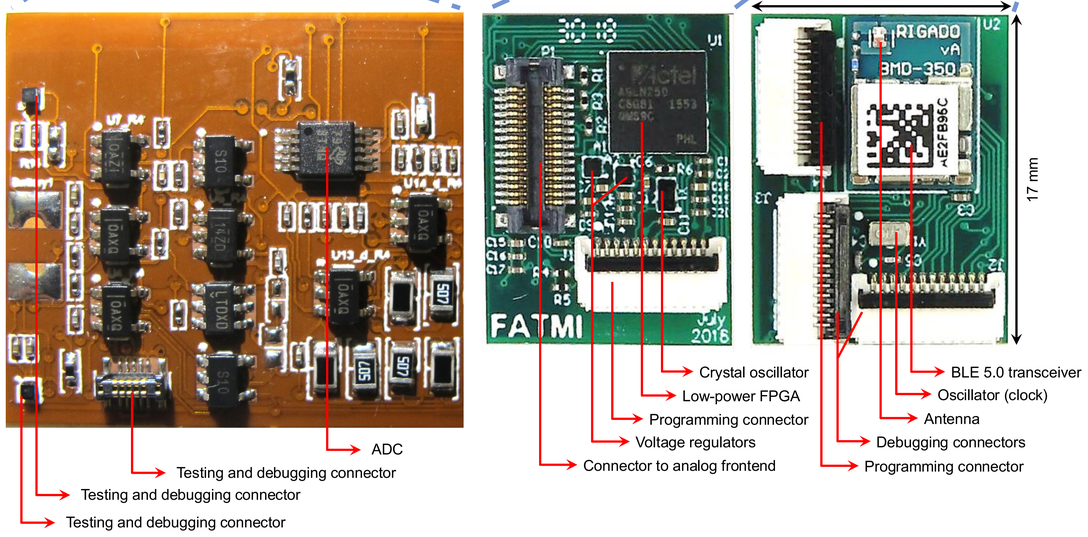
Cognionics (Headband)	Cognionics (Quick 30)	Muse (2014)
6 Channels	32 Channels	4-6 Channels
Dry Active Electrodes	Dry Active Electrodes	Dry Passive Electrodes
BW: < 130 Hz	BW: < 262 Hz	BW: N-R
Bluetooth 4.0	Bluetooth 4.0	Bluetooth 2.1
110 g (bulky)	610 g (bulky)	61 g

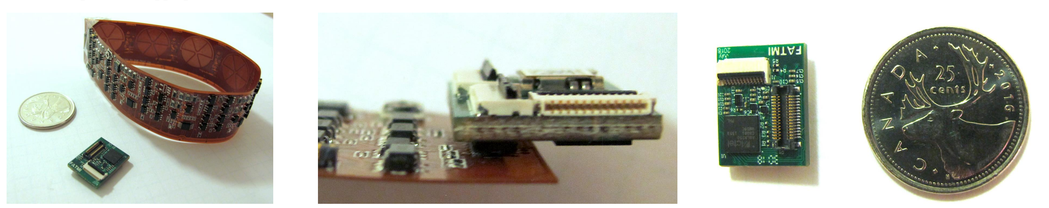
No motion artifact removal present in any of these products

DESIGN

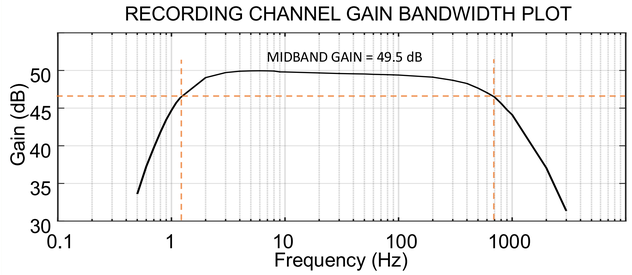




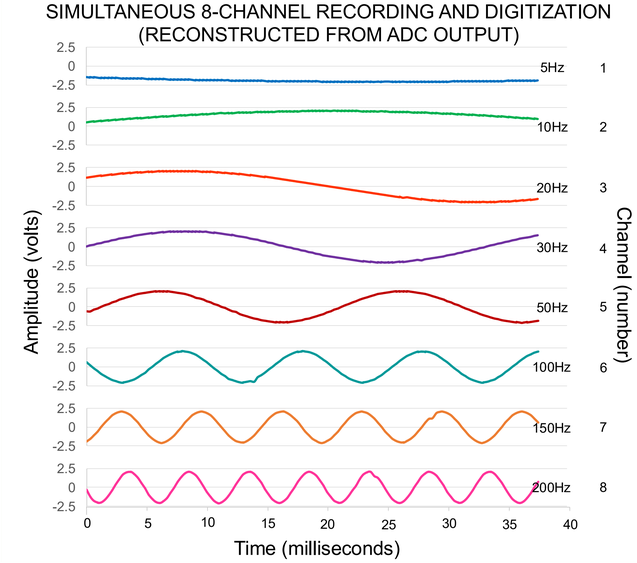




RESULTS



System	Frontend	Backend
	Gain: 260 V/V	Max Wireless Data Rate: 1 Mbit/s
9.2 g	IRN PSD: 240 nV/√Hz	Logic Elements 3000
8 Channels	BW: 1.5 – 700 Hz	Power: 14.8 mW
	Power/Ch: 1.5 mW	



IMPACT

Quality brain monitoring:

- 8 recording channels
- Motion artifact removal
- Embedded processor
- Platform for diagnostics
- Wireless

Comfortable:

- Fully flexible
- Light weight: 9.2g
- Small form factor
- Long battery lifetime
- Dry electrodes

* Pooria Shafia is the designer of the frontend
† Syyeda Zainab Fatmi is the designer of the backend