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# TEAM ADEPT

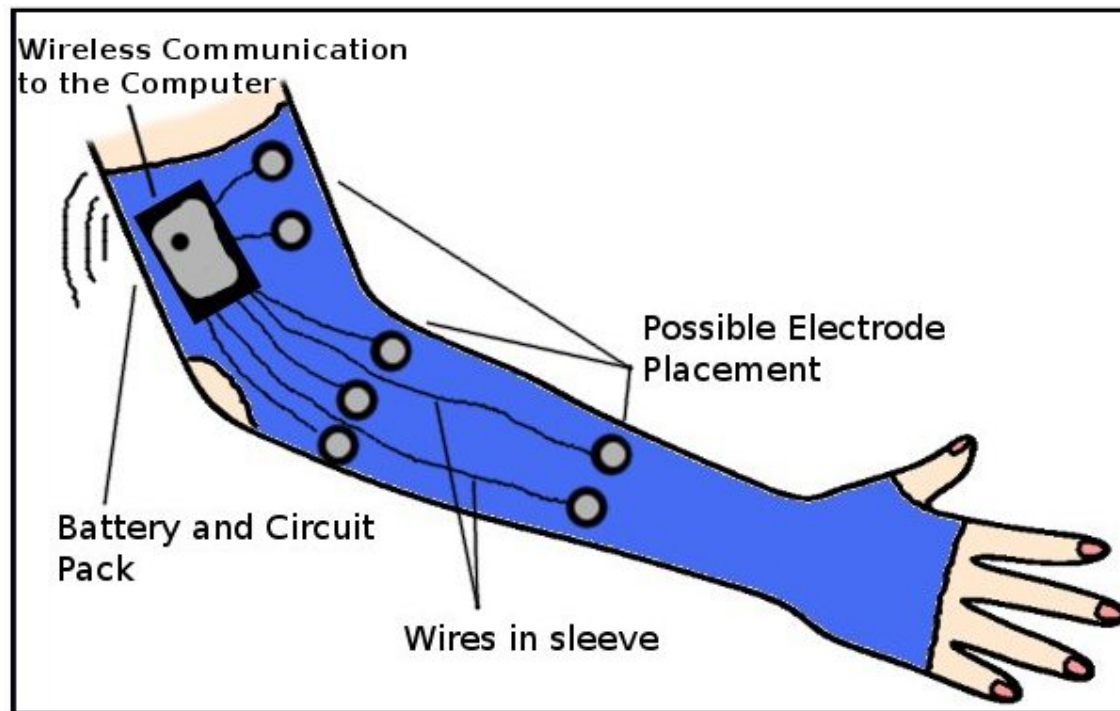
*Advancing Development of EMG-based  
Physical Therapy*



University of Maryland  
Thesis Proposal Defense  
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# Research Project

- Improve physical therapy by using surface EMG-based biofeedback and delivering it to the patient through a video game



# Prior Work

- Team CHIP
  - Wired electrodes to record individual muscles
  - Recorded & amplified signal
- Wireless electrodes in clothes
- Importance of biofeedback



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# Specific Goals

- Get rid of the wires!
    - Simplify the hardware so that a non-technical end-user can wear and operate it
    - Introduce a “sleeve” to hold dry electrodes in place
  - Simple video game interface for biofeedback
  - Measure efficacy of physical therapy with and without sleeve
  - Natural mapping of movement to action
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# Sleeve Design

- Needs to be form fitting
  - Materials choice
    - Candidates include Polyurethane/Nylon/Spandex
    - Conductive silver fabric/yarn
    - Must be able to withstand disinfection
  - Researching standardized electrode placement
  - Aesthetics, comfort of patient also considered
    - Should not hinder the PT in any way
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# Hardware

- Ideally will use wireless, dry electrodes
  - Program microcontroller to do basic signal processing
  - Have acquired ADS1298 demo board for amplification and signal collection
    - Analog inputs → Digital bits
    - Looking into wireless prototyping kits
    - Digital bits → Software processing/Video game
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# Software

- Design a mini-game suite
- Include change-over-time patient tracking
- Biofeedback screen
- Signal processing algorithms in Matlab



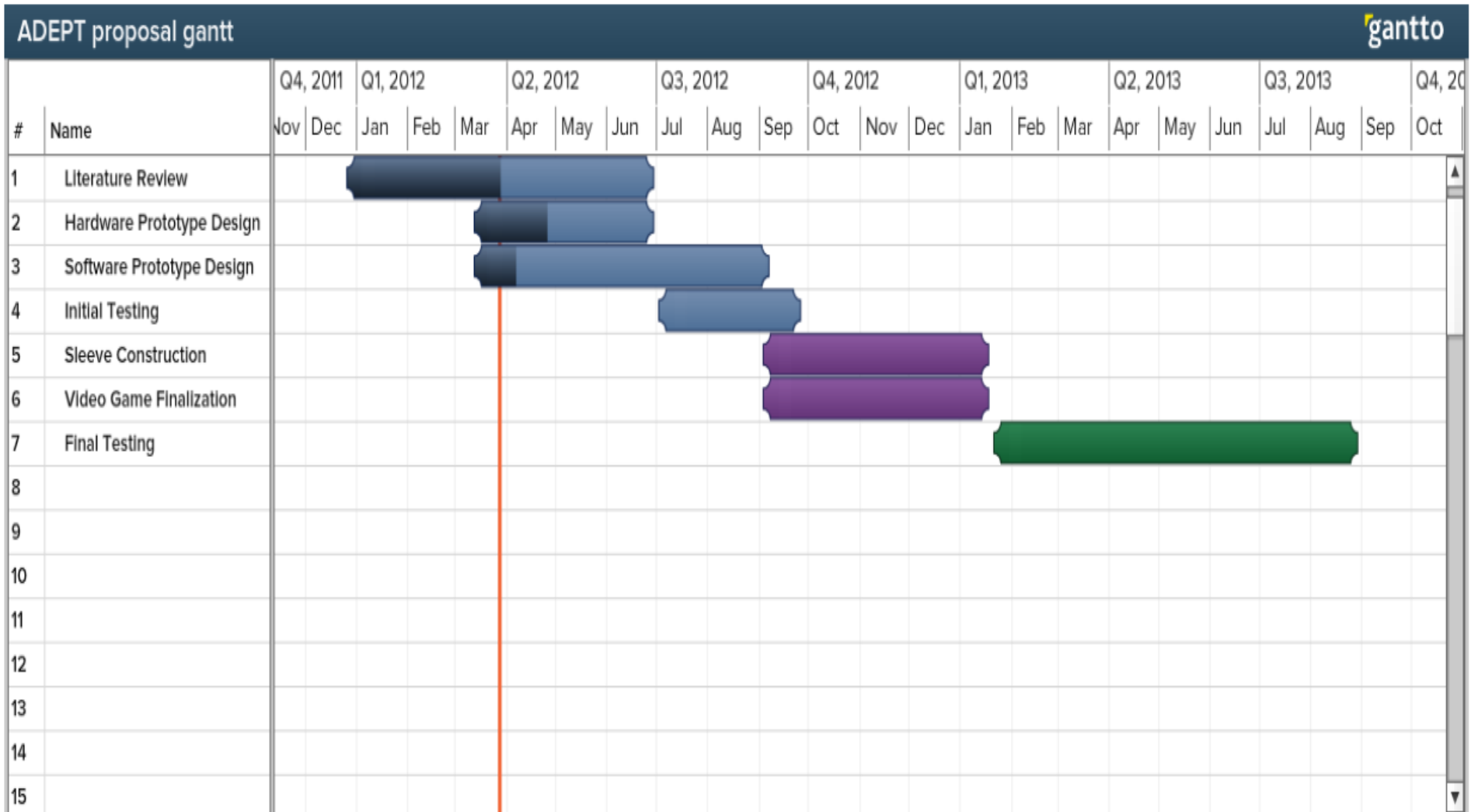
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# Methodology

- ▣ Our basic approach:
    - ▣ Build experimental standard
    - ▣ Ask users for feedback (focus group)
    - ▣ Build sleeve
    - ▣ Ask users for feedback (focus group)
    - ▣ Run parallel trials with the experimental standard, sleeve, and no device to test if there is a difference in improvement
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# Timeline

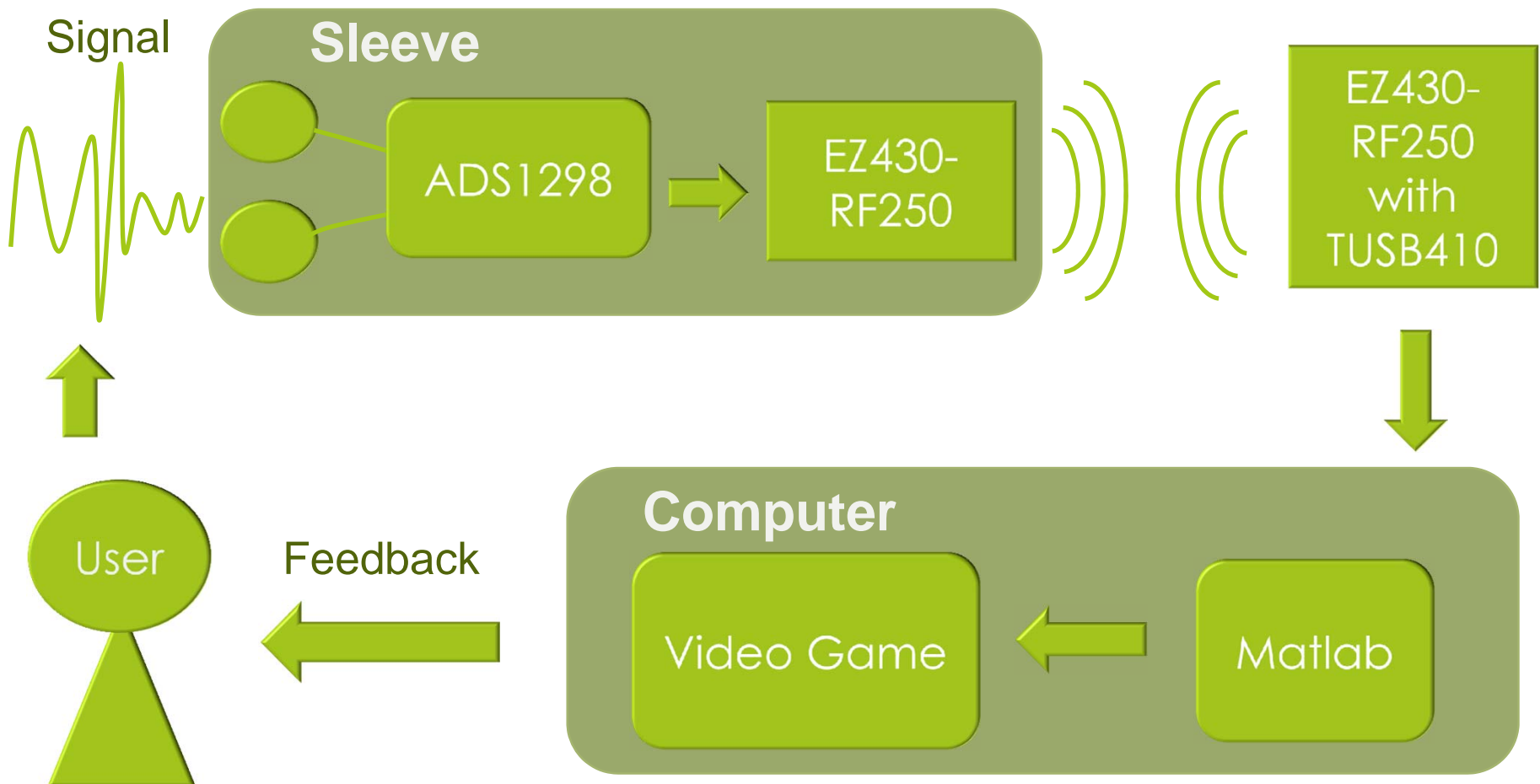


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# Short-term Goals

- Build functional prototype
    - Instrumentation/ADC – TI ADS1298 eval board
    - Wireless interface – TI EZ2500
  - Wired prototype for comparison
    - Visual biofeedback for patient
  - Apply for grants
  - Mockup of sleeve/electrode setup
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# Feedback Loop





# References

- [1] E. Sluijs, G. Kok, J. van der Zee, "Correlates of exercise compliance in physical therapy," *Physical Therapy*, vol. 73, no.11, 1993, pp. 771-782.
- [2] Aimee L. Betker et al. "Video game-based exercises for balance rehabilitation: A single-subject design." *Archives of Physical Medicine and Rehabilitation*. vol 87, pp 1141-1149, 2006.
- [3] A. Bardack, P. Bhandari, J. Doggett, M. Epstein, N. Gagliolo, S. Graff, E. Li, E. Petro, M. Sailey, N. Salaets, B. Tousley, and J. Turner, "EMG biofeedback videogame system for the gait rehabilitation of hemiparetic individuals," Gemstone Program, University of Maryland., Department of Electrical and Computer Engineering, University of Maryland: College Park, College Park, MD, 2010.
- [4] J. Taelman, T. Adriaensen, C. van der Horst, T. Linz, and A. Spaepen, "Textile integrated contactless EMG sensing for stress analysis," in *29th Annual International Conference of the IEEE on Engineering in Medicine and Biology Society, 2007*, pp. 3966-3969.