EMG Computer Interface

FPR - SDP Team 12

University of Massachusetts Amherst BE REVOLUTIONARY™

Revised Problem Statement

We want to emphasize touchless options for computer interfaces

While there are many products that allow for **touchless interactions** with computers, there are no comprehensive and easily customizable gestures interfaces that allow the user to **navigate and interact with a computer** without touching any common screens or buttons.

WHERE?		WHAT?
Academic, Company, Organization Campuses	→	Presenting, Transactions, Lecturing

Updated Interface Specification & Verification Plan

Requirement	Description	Verification	Achieved
Sensing Accuracy/Gesture Recognition	Sensing system will translate and transmit inputs with better than **90% true positive/negative** and less than **10% false positive/negative** rate for **5 distinct gestures**. I.e. Fist, thumbs up, pointing	Test that the sensing system can meet true positive/negative and false positive/negative percent specifications over 100 trials for each gesture	
Reliability	Performance of the device must be consistent regardless of changes in between use	Demonstrate that **Sensing Accuracy** verification holds when pads are intentionally misplaced and across three different users	
Pre-Input Time	The time between stepping in front of an interface and inputting commands **will be less than 1 minute**	Test that pre-input connection time is on average less than a minute over 100 trials	
Power Consumption	The device should have sufficient battery life to last throughout a work day and be in **active use for three hours**	Demonstrate that device can be actively used for at least three hours by measuring current draw	

Updated Physical Specification & Verification Plan

Requirement	Description	Verification	Achieved
Ergonomics	User must be capable of writing on paper and utilizing phone while wearing device	Demonstrate the ability to write a paragraph and utilize a cellphone to make a call	
Interface Distance	User must be capable of utilizing device to interface with a computer **up to 3 meters away**	Demonstrate the ability to connect device and use from multiple distances (3 increments) up to 3 meters away from the computer	
Customizability	Allow **custom mapping of up to 5 human movements to distinct inputs**	Verify that all keyboard inputs can be custom bound to distinct movements (each finger and any finger combination)	

The Final System

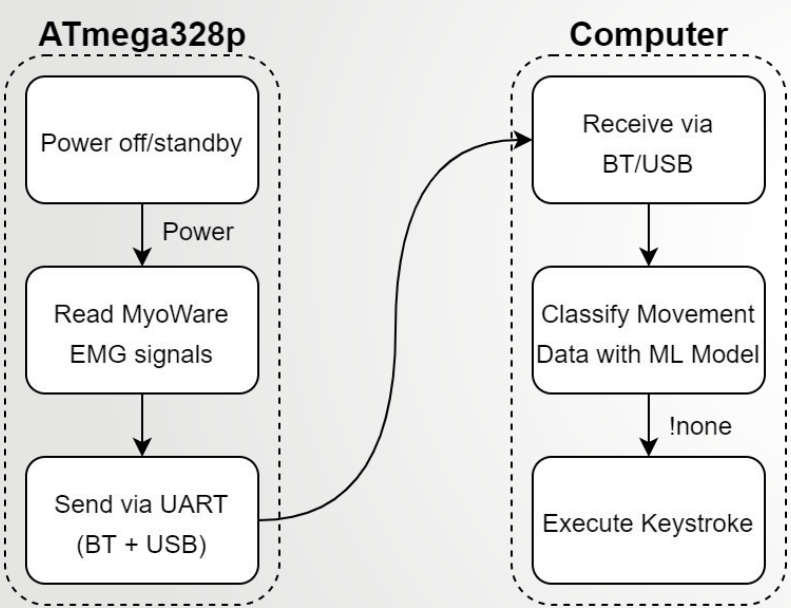
Software

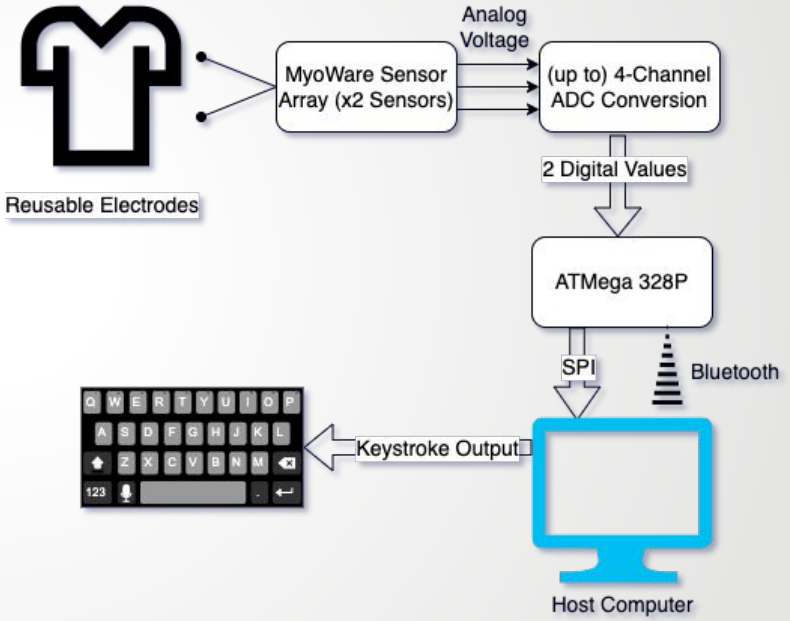
- ML classification real-time
- ATMega328p Data Collection
- Data collection and RMS classification
- Very simple GUI

Hardware

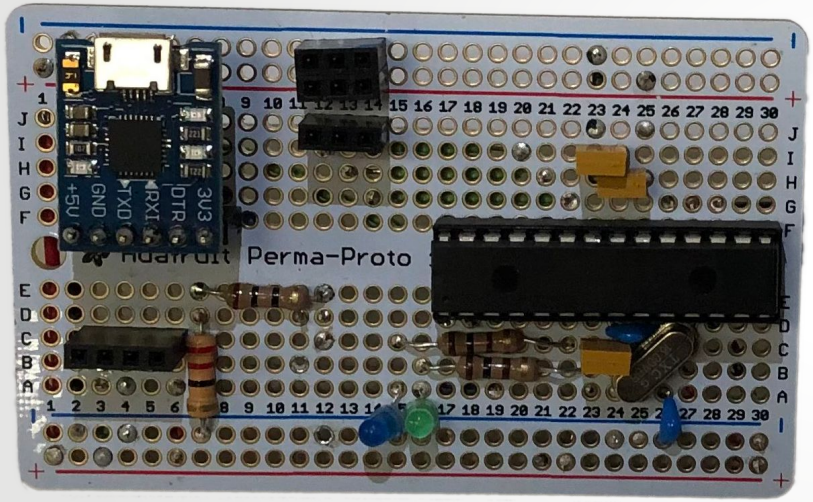
- Custom PCB w/
  - HC-05 Bluetooth
  - UART Wired Connection
  - Battery recharge system
  - ATMega328p
- MyoWare w/ Custom housing
- *2 MyoWare 2.0 Sensors

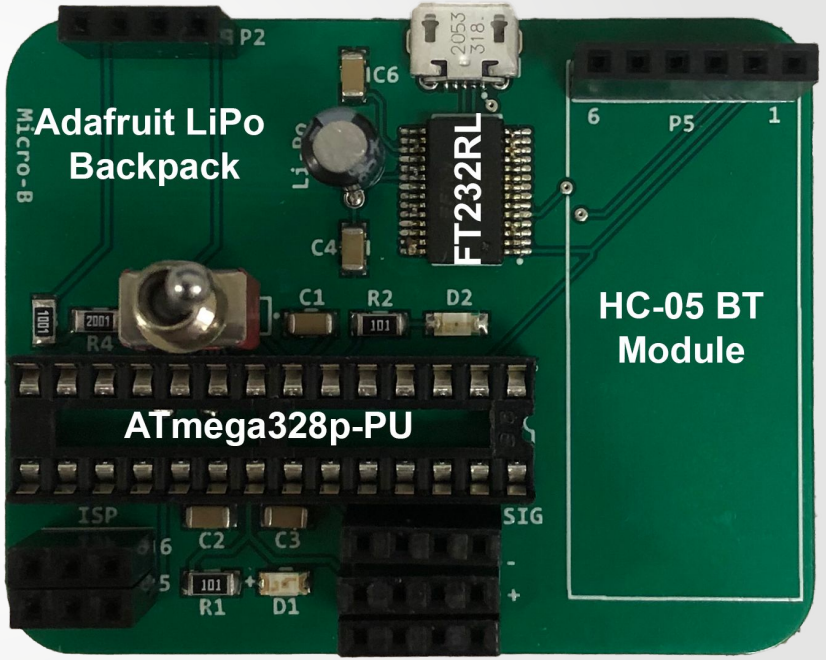
Final System Block Diagrams



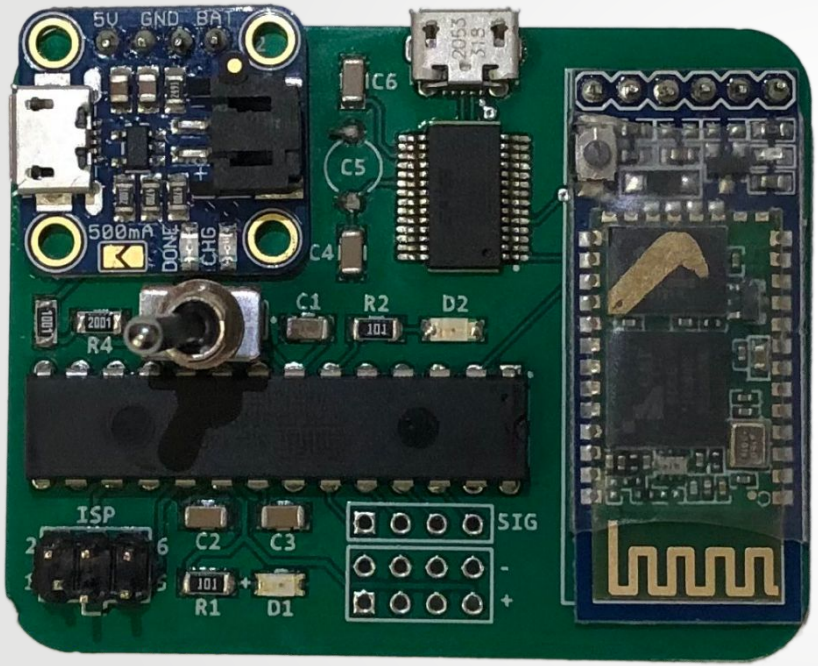


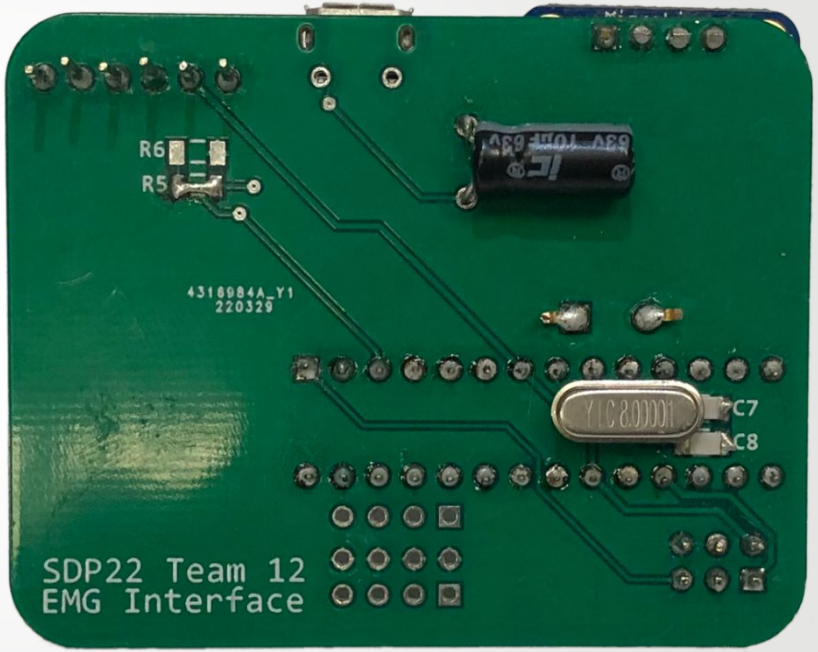
Prototyping Overview





Final PCB


5V GND BAT
500mA
DONE
CHG
IC6
C5
C4
C1
R2
D2
R4
ISP
C2
C3
SIG
R1
D1


R6
R5
4316984A_Y1
220329
C7
C8
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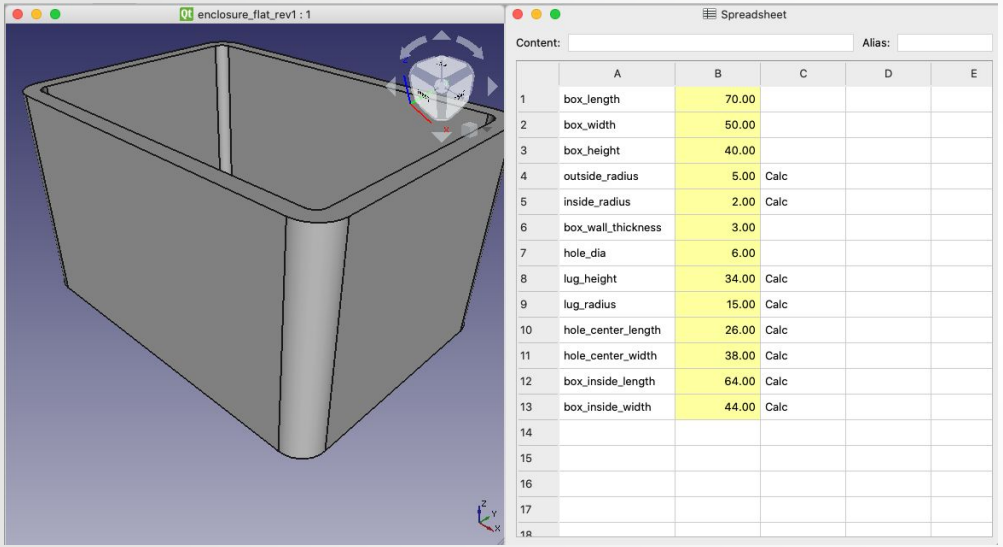
EMG Interface

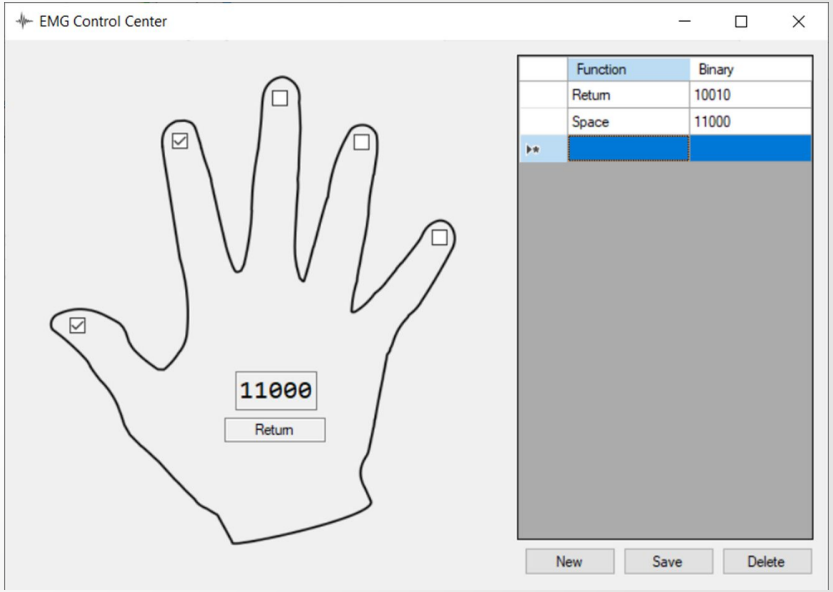
Housing and Proposed GUI



Spreadsheet

Content: Alias:

	A	B	C	D	E
1	box_length	70.00			
2	box_width	50.00			
3	box_height	40.00			
4	outside_radius	5.00	Calc		
5	inside_radius	2.00	Calc		
6	box_wall_thickness	3.00			
7	hole_dia	6.00			
8	lug_height	34.00	Calc		
9	lug_radius	15.00	Calc		
10	hole_center_length	26.00	Calc		
11	hole_center_width	38.00	Calc		
12	box_inside_length	64.00	Calc		
13	box_inside_width	44.00	Calc		
14					
15					
16					
17					
18					



How accurate can we get?

Berke			
	Thumb	Ring	Index
Correct	84	96	88
False Positive	4	0	8
False Negative	12	4	4
		ring	index
Correct		100	100
False Positive		0	0
False Negative		0	0

Sam			
	Thumb	Ring	Index
Correct	?	92	88
False Positive	?	0	8
False Negative	?	8	4
		ring	index
Correct		100	100
False Positive		0	0
False Negative		0	0

Live Demo and Questions