

## Group 27:



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# Twerty

The next generation  
keyboard minus the board



# Concept

- Problem

- Today, users of tablets are forced to either use **onscreen keyboards** that **consume valuable screen real-estate** or **physical keyboards** that **lack portability**

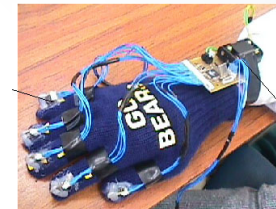


- Solution

- Twerty provides a **portable, space efficient alternative to keyboards for people using tablets.**
- Our prototype uses gloves outfitted with sensors that:
  - detect key strokes
  - communicate via Bluetooth
  - provide tactile feedback



# Competitive Analysis



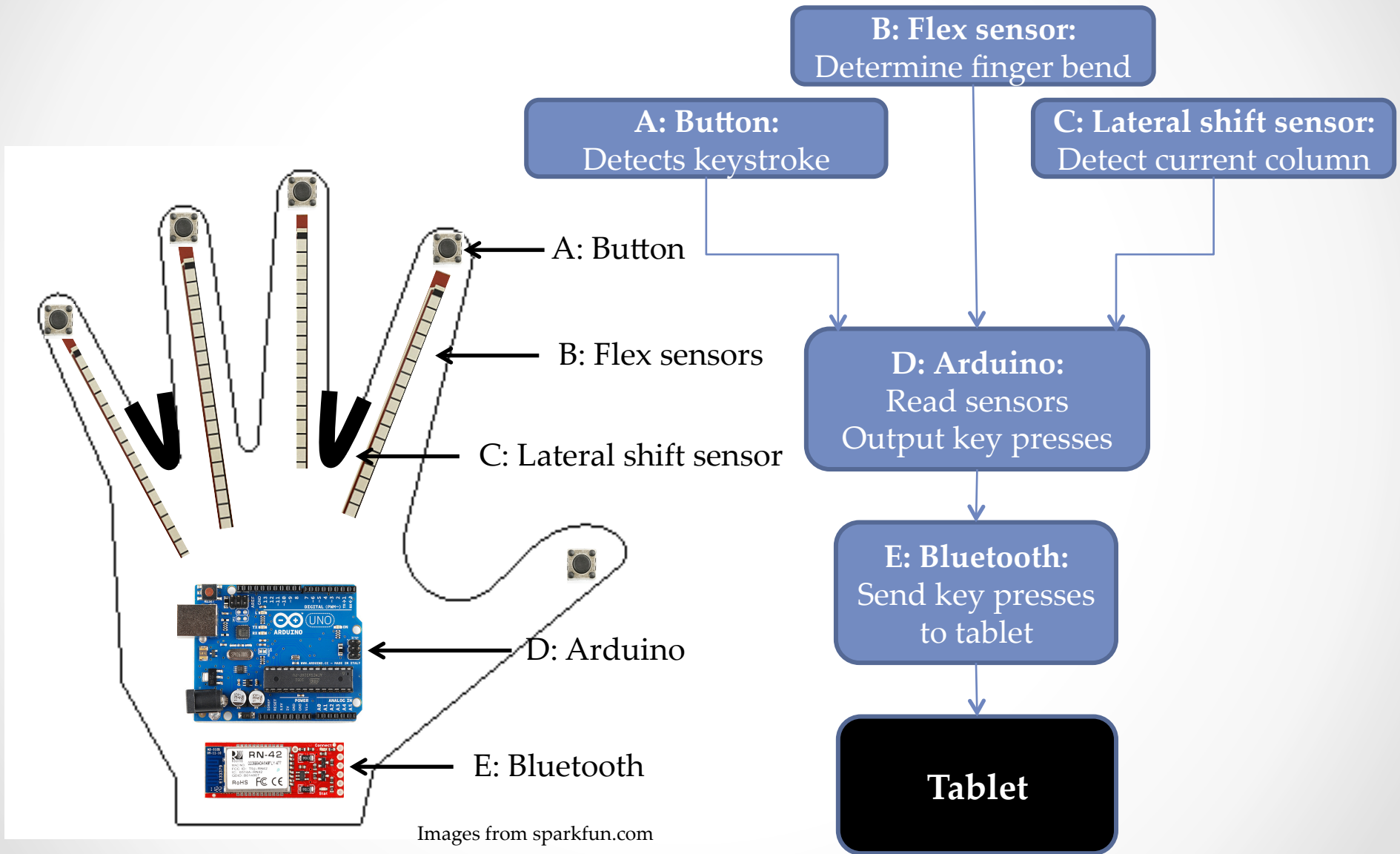
	Twerty	The Magic Cube	Keyglove Wearable Input Device	Acceleration Sensing Glove
Keyboard Functionality	●	●	●	
QWERTY Layout	●	●		
Tactile Feedback	●			
Portability		●	●	
Self-Contained			●	
Comfort	●	●		

# Goals

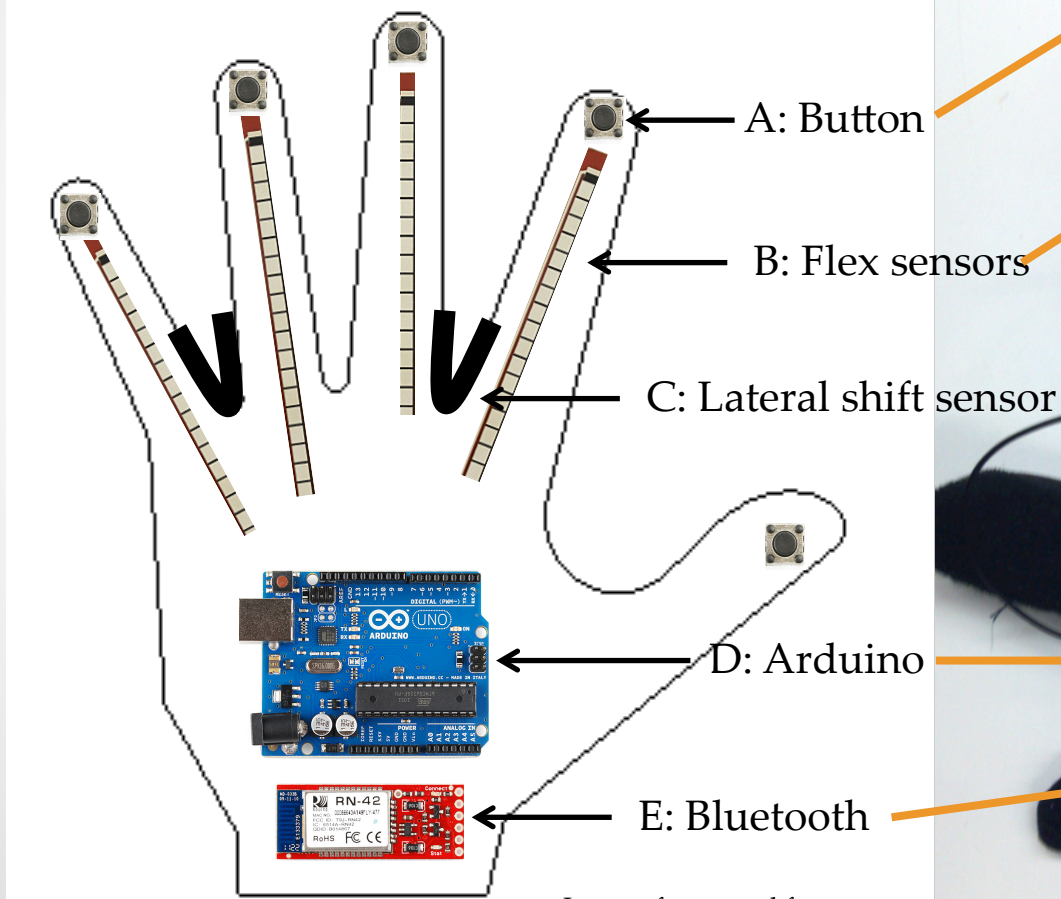
- Functional
  - Tactile Feedback
  - Bluetooth Connectivity
  - Probabilistic Typing
- Non-Functional
  - Typing speed
    - >40 wpm (average typing speed of iPad)
  - Multi-surface
  - Learning curve
    - 30 second rule



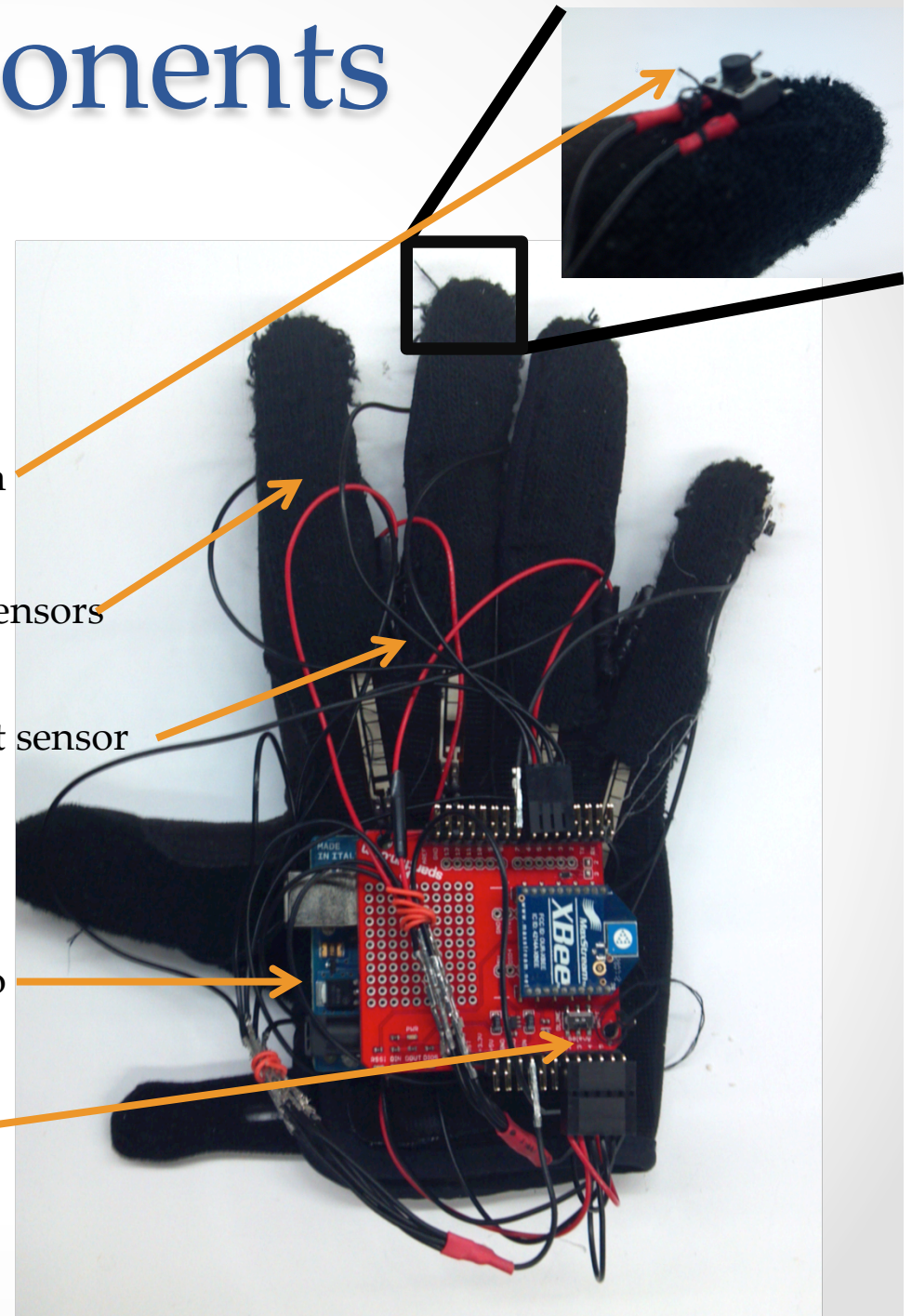
# Architecture



# Components



Images from sparkfun.com



# Metrics

The metrics below were chosen based on

## Functional Tests

- Latency
  - Time to send a character over Bluetooth using HID profile
- Raw Throughput
  - Maximum number of characters that can be received by a tablet per second

## User Tests

- Accuracy
  - Given a passage, number of characters typed to complete the passage

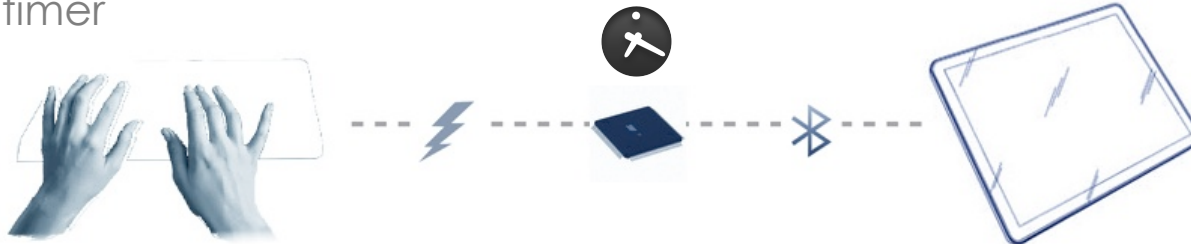
# Latency

## Procedure

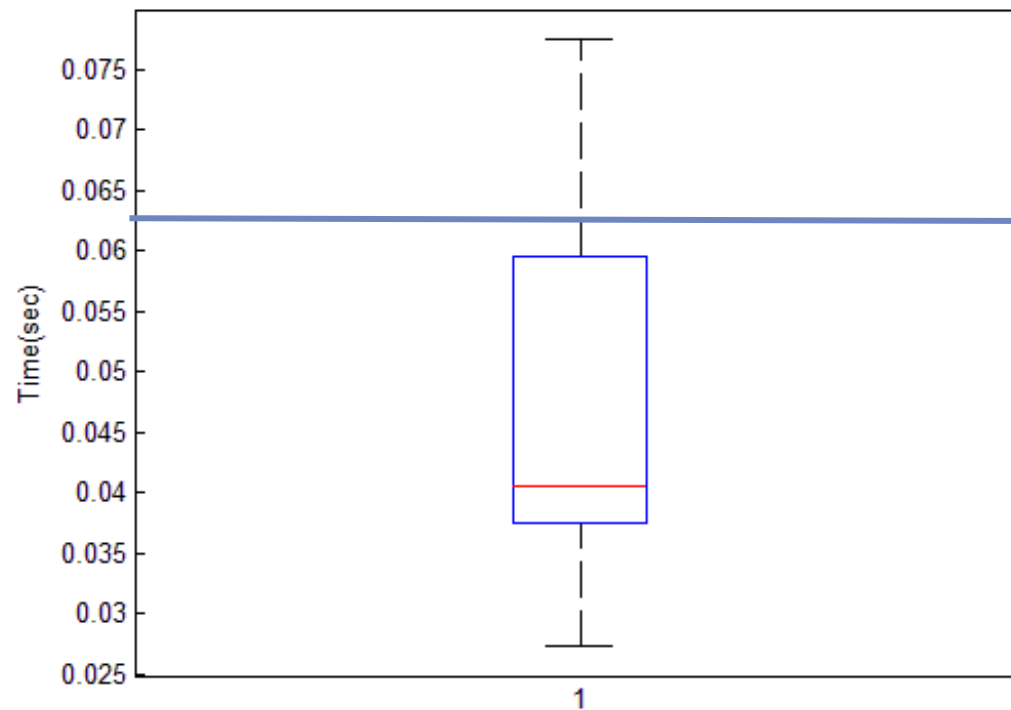
1. Send character from computer to gloves via serial
  - Start a timer
2. Have glove echo the character back to the computer through the HID profile.
  - Stop timer

## Expectation

- There should be no visible lag, the latency should be less than 0.0625 seconds

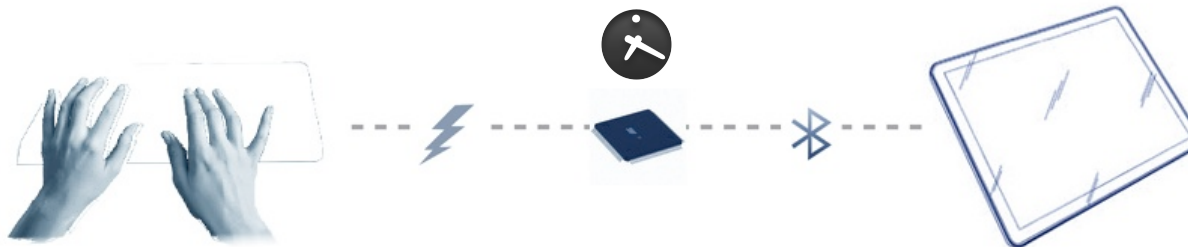


# Latency



Minimum  
noticeable delay  
.0625 seconds

Result of 11 Tests



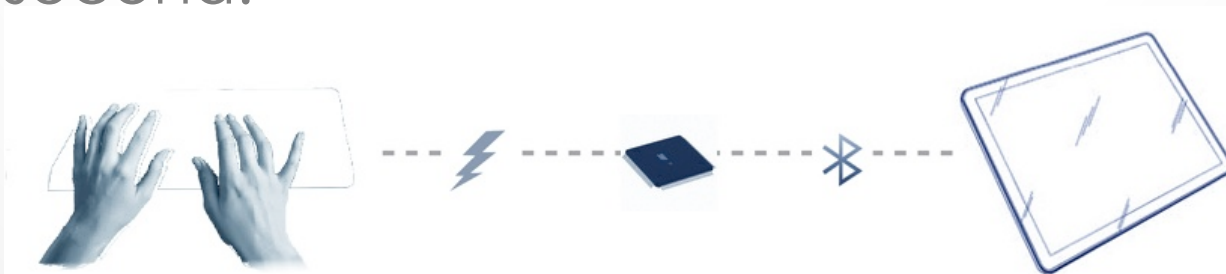
# Raw Throughput

## Procedure

1. Press random keys as fast and frequently as possible for 10 seconds
2. Count number of characters displayed on the connected device.  
Divide by time to get keys per second.

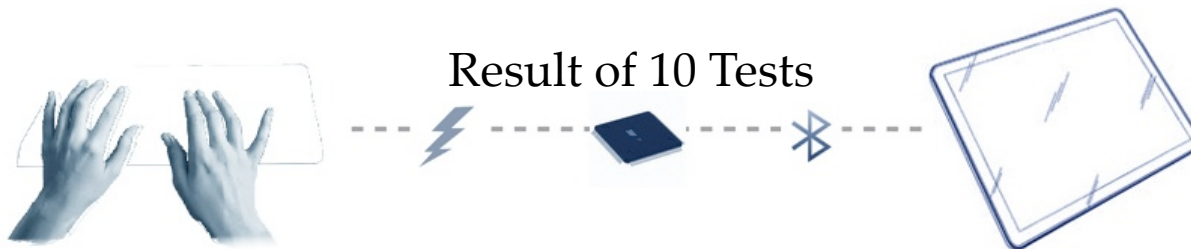
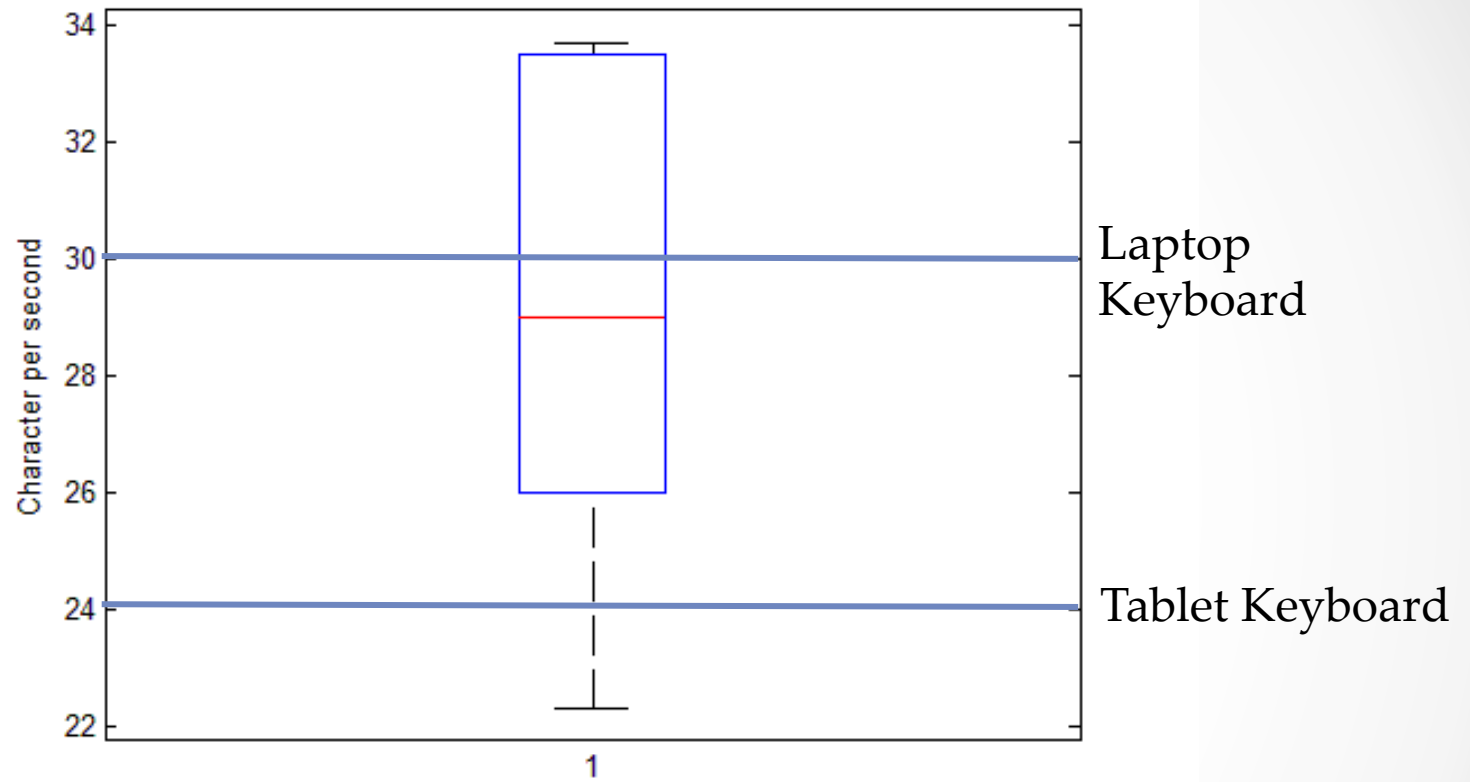
## Expectation

- Our set value for throughput can support max typing speed. Should be faster than tablet keyboard.





# Raw Throughput



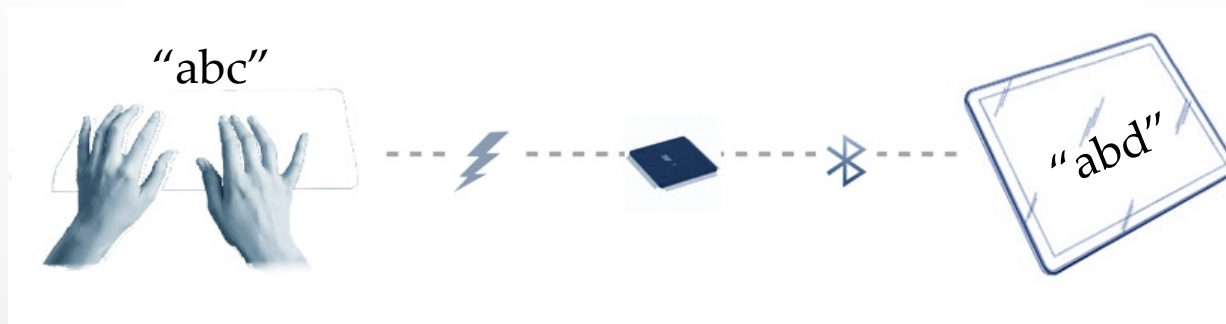
# Accuracy

## Procedure

1. Have touch-typist type a given set of characters
  - Paper keyboard layout will be given for visual reference
2. Wait until the user is done
  - Determine the number of attempts it took for the user to type the set of characters correctly
  - Do not include backspace

## Expectation

- Calibrated users should perform more accurately and consistently than novice non-calibrated users





# Accuracy

Calibrated



Knowledgeable



Novice

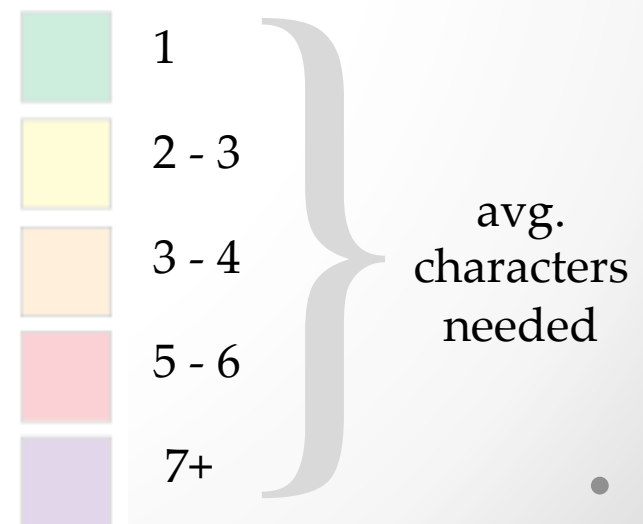


## Input Strings

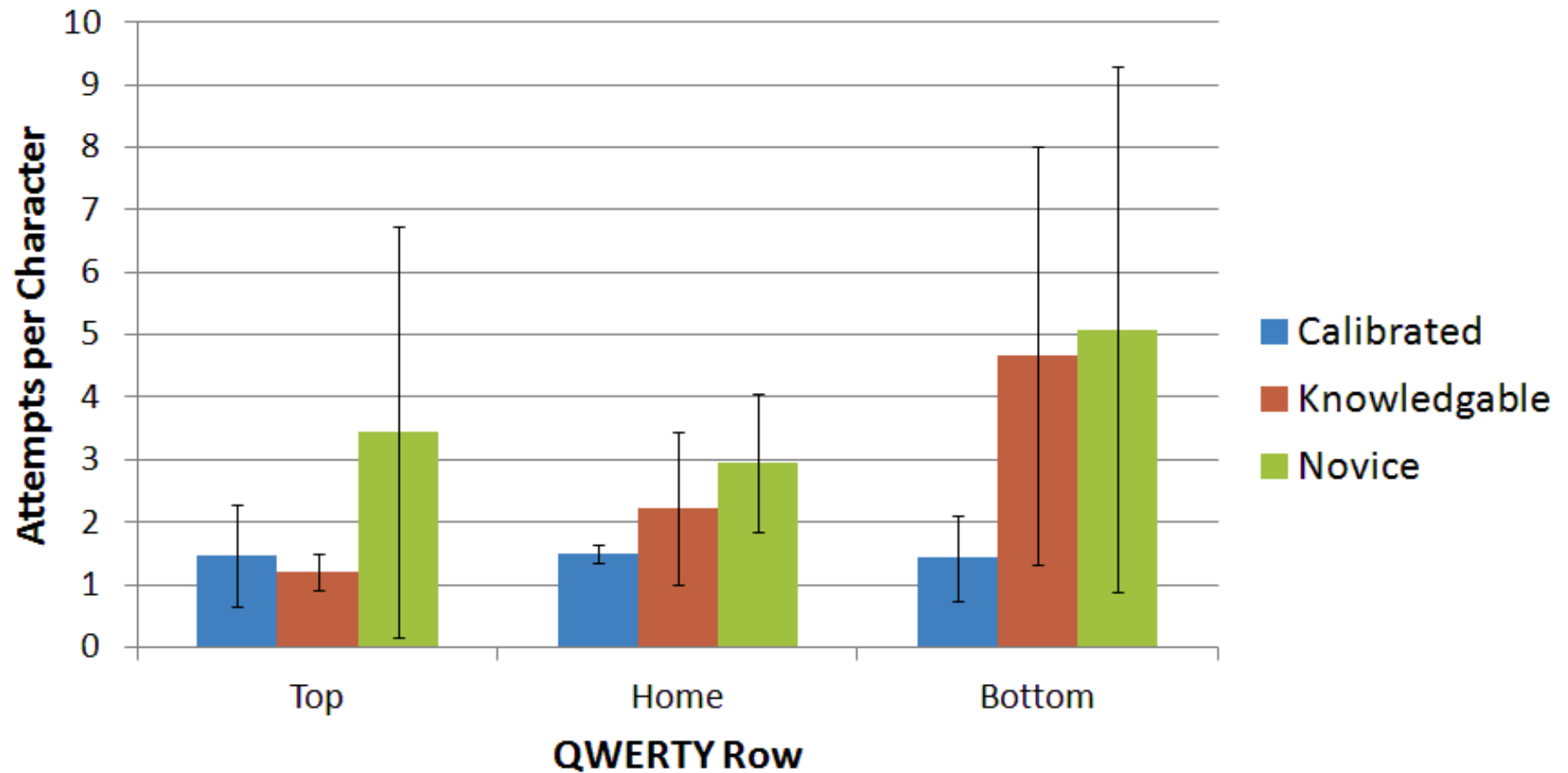
“the keyglove wearable input device”

“by putting the keys into hands instead”

“the next generation keyboard minus the board”

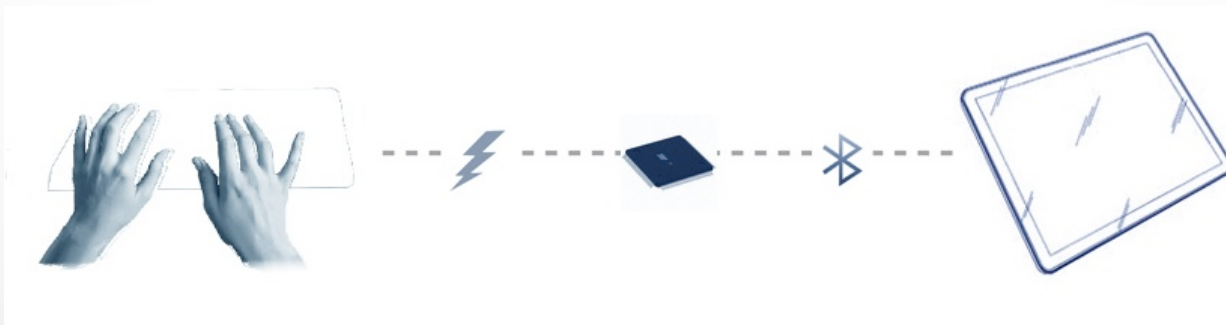


# Accuracy



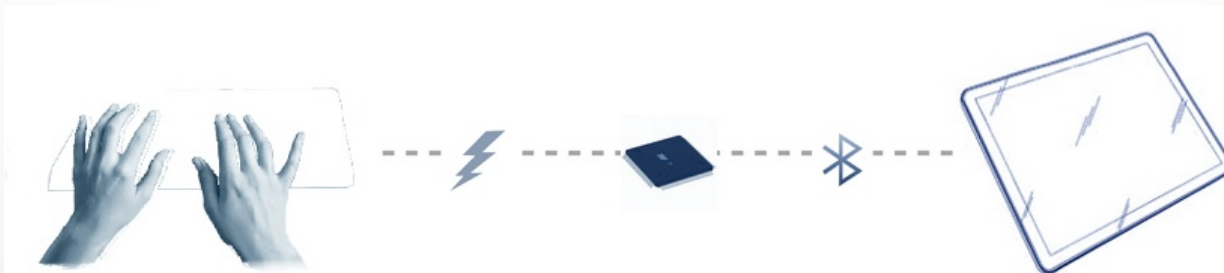
# Test Conclusions

- No human detectable latency or throughput issues.
  - To a user, as responsive as any Bluetooth keyboard
- Calibration significantly improves accuracy.
  - Implementing auto calibration routine.
- Accuracy depends on the physical location of the keys.
  - Bottom row has issues due to non-optimal button placement.
- Overall accuracy significantly improves when used with auto correct.



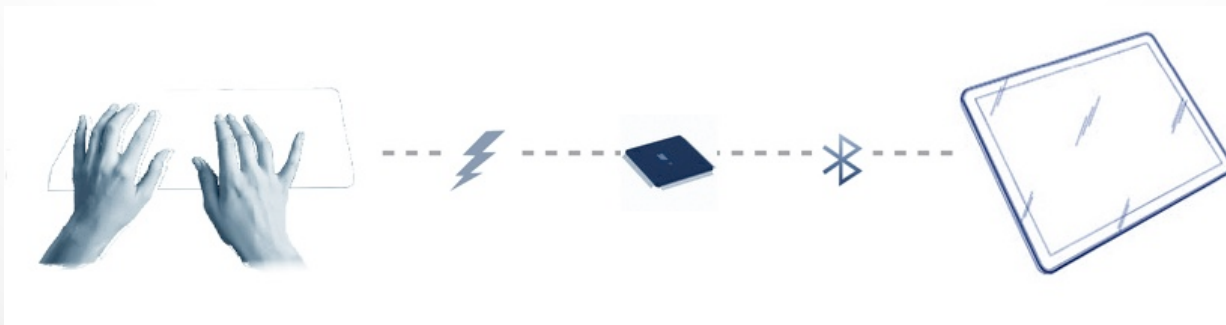
# System Performance

- Add autocorrect to gloves or as a tablet app.
  - Passing the key strokes through a tablet auto correct feature significantly boosted accuracy.
  - Applicable because the gloves experience the same errors as virtual keyboards, slight misses that result in a neighboring key being detected.
- Replace buttons with pressure sensors.
  - The presence of the buttons makes typing keys awkward, leading to higher miss rates.
  - Pressure sensors are thin, making a much easier system, to develop at the cost of physical feedback.



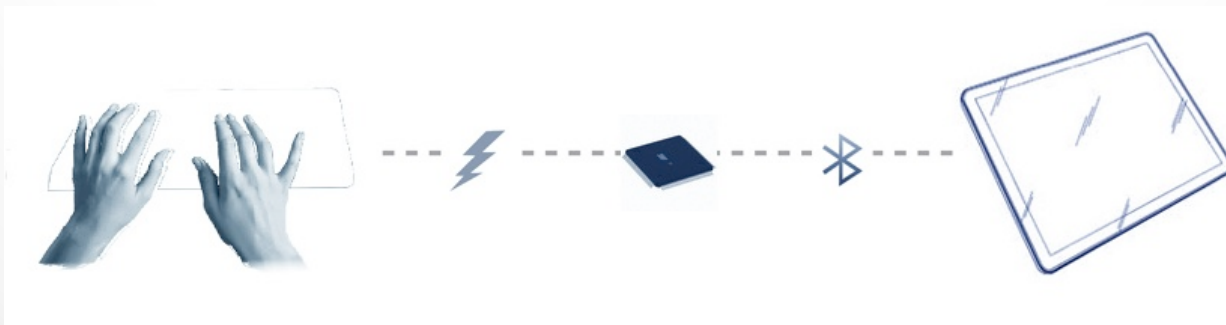
# Open Issues

- Physical construction of the gloves is poor, limited by off the shelf parts.
  - Caused durability and calibration issues
  - Gloves are bulky and require careful handling
- Gloves require strict adherence to the touch typing standard.
  - Limits target audience to a small segment of the population
- Gloves supply rich finger position data, which is mostly discarded when used as a keyboard.
  - Use this data to provide a mouse/game control mode.
- Add a battery to power the gloves.



# Conclusion

- Time management is important.
  - Set a specific goal
  - Create and assign subtasks to team members
  - Keeps work load balanced, and people accountable
- Solved the finger position data acquisition.
  - Accurate finger position data makes the keyboard possible.
- If we were starting over, find someone with experience creating wearable electronics.
  - Physical construction was a major issue with both reliability and time spent



Questions?

