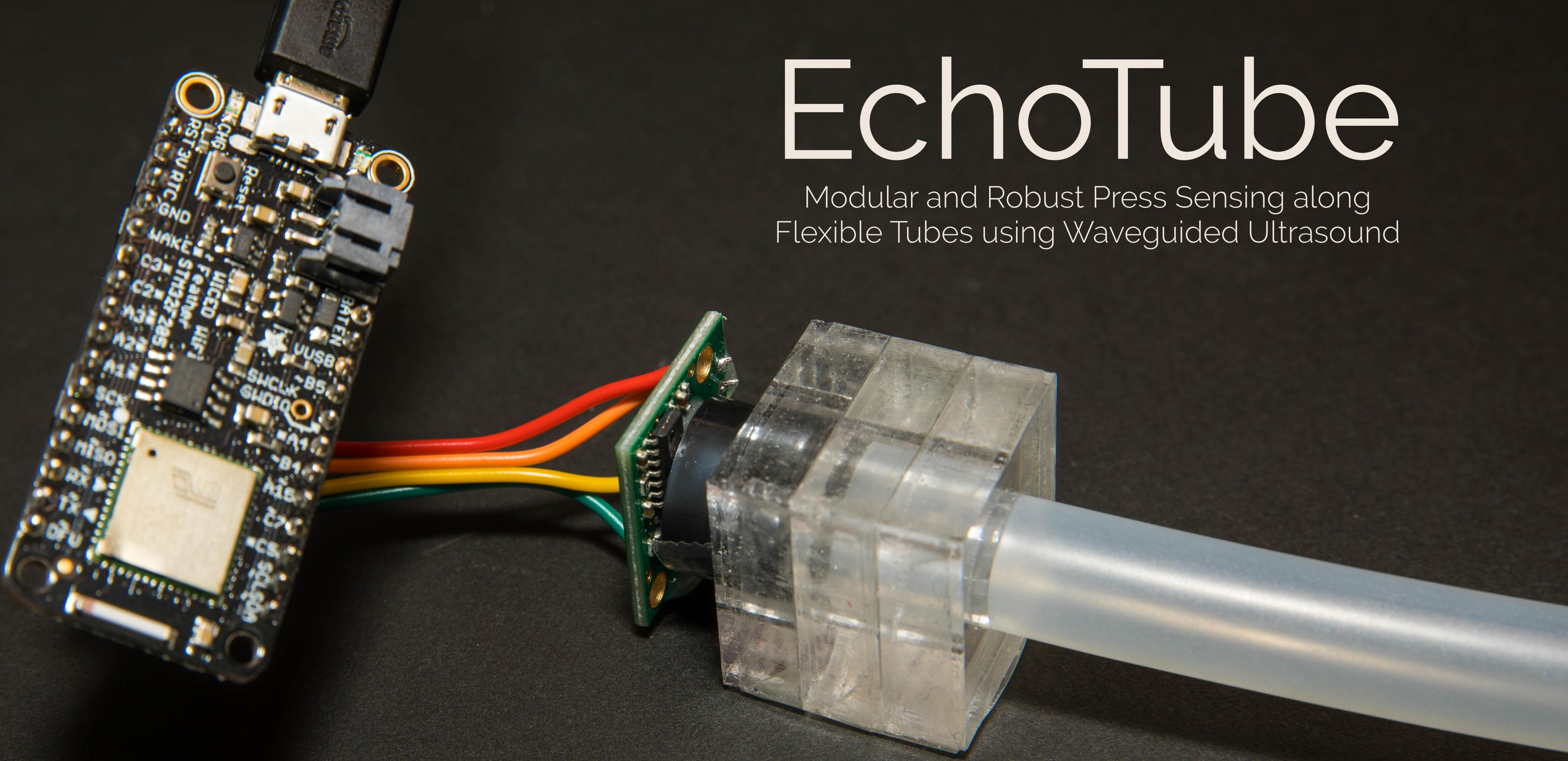


# EchoTube

Modular and Robust Press Sensing along  
Flexible Tubes using Waveguided Ultrasound



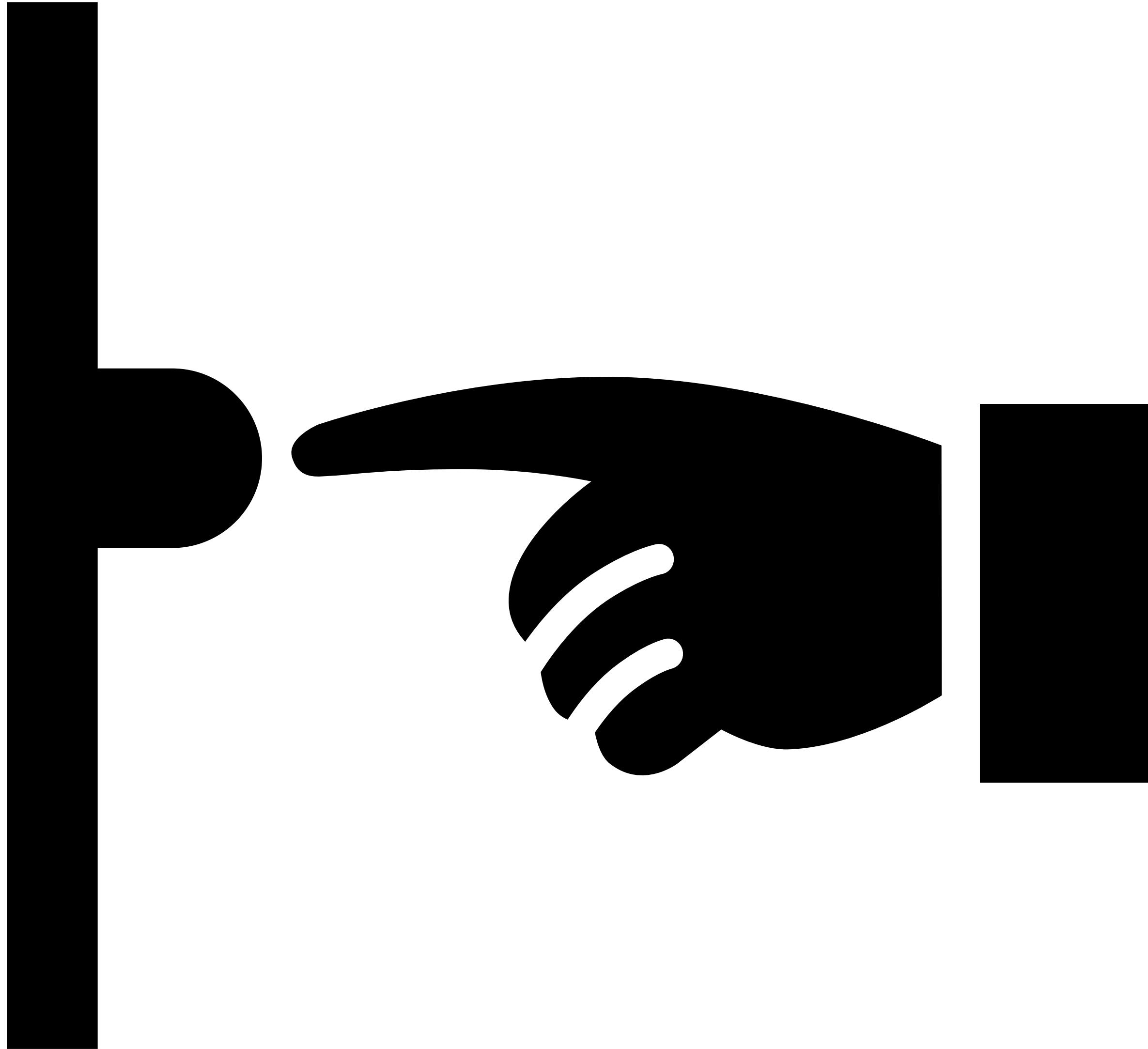
**Carlos Tejada**  
Sebastian Boring

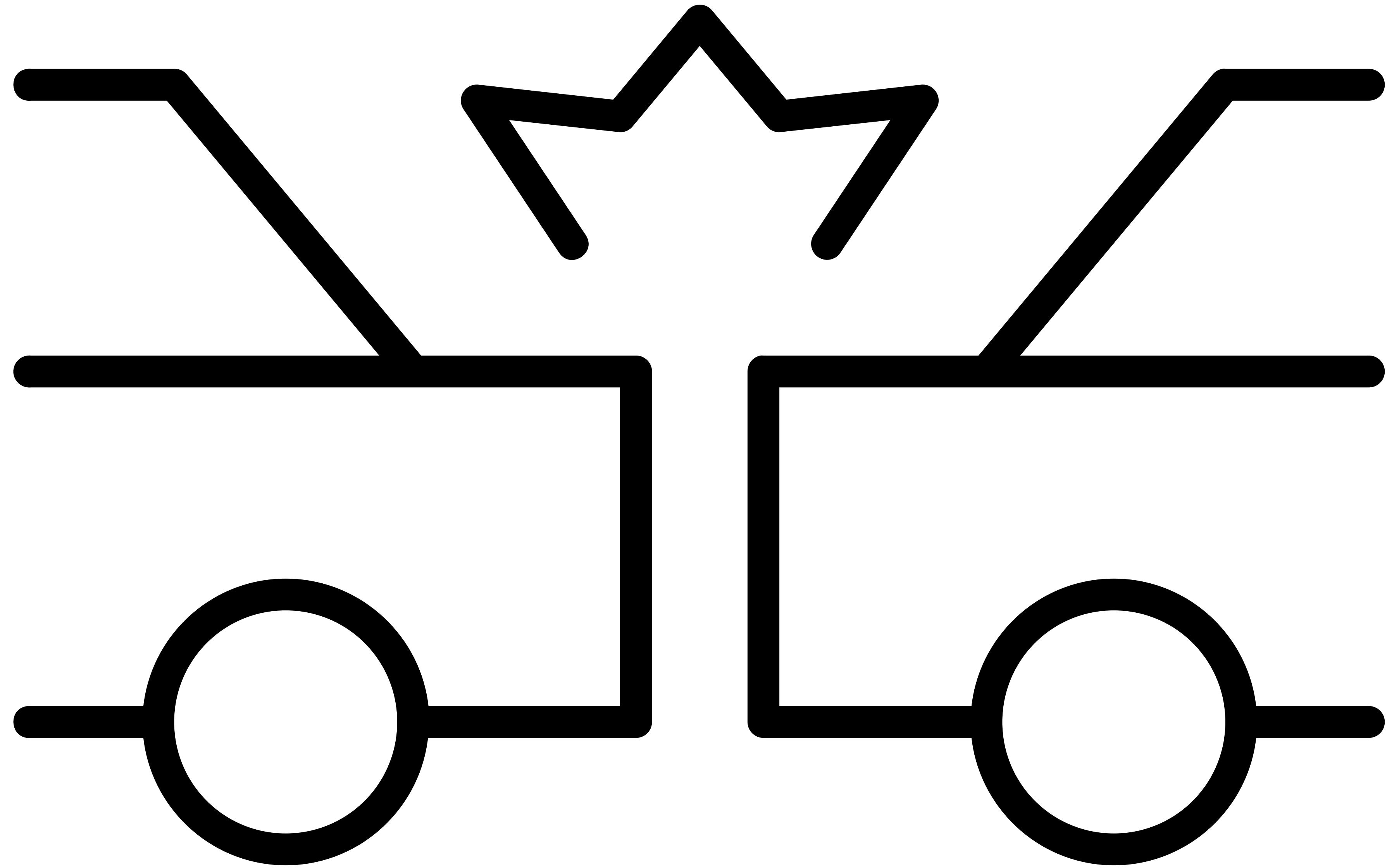
Jess McIntosh  
Daniel Ashbrook

Klæs Bergen  
Azier Marzo

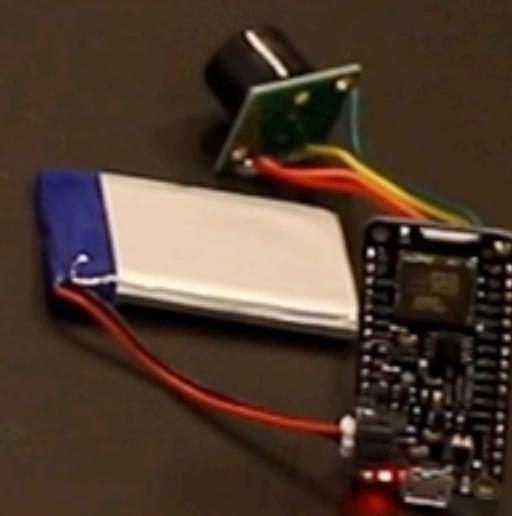




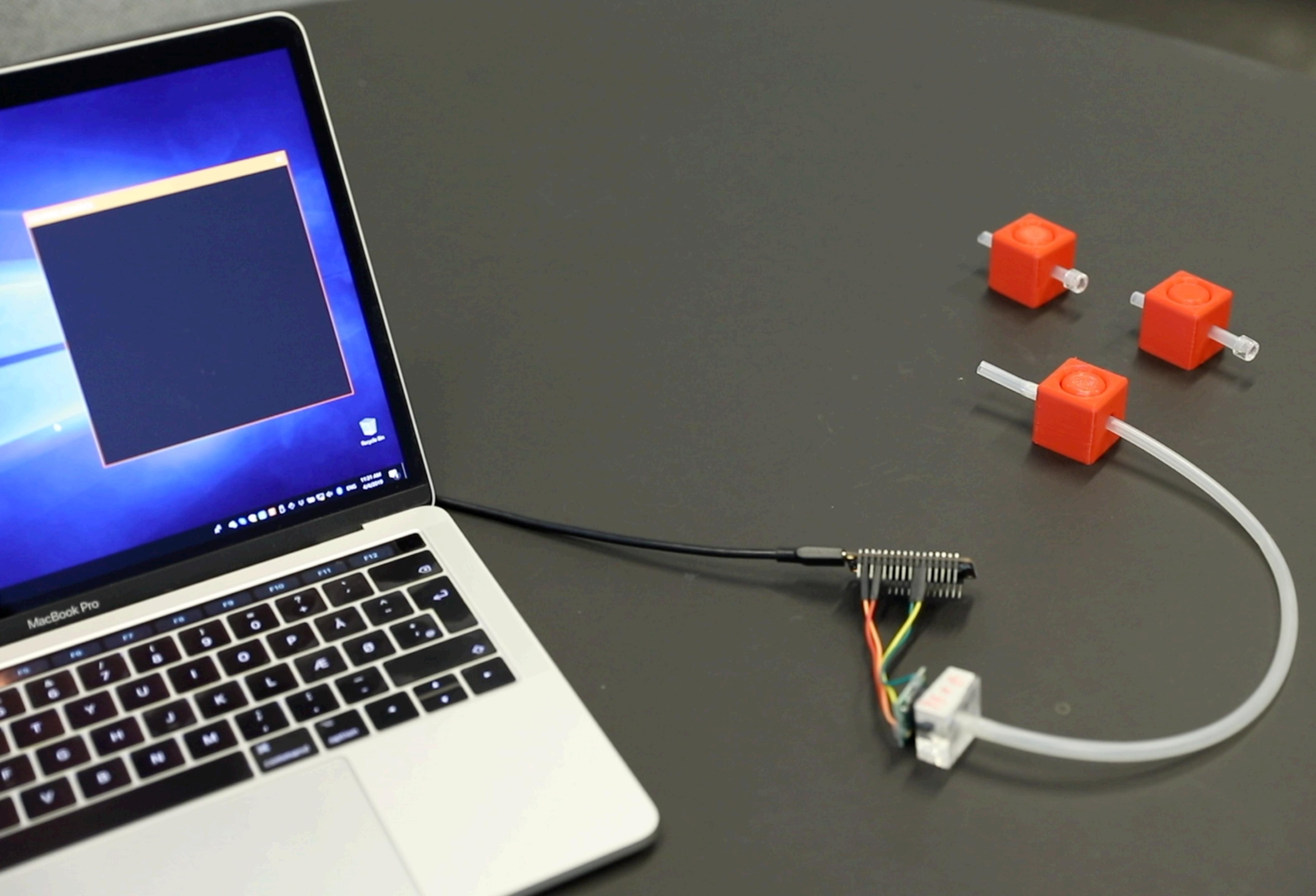
















# Previous Work

# Previous Work

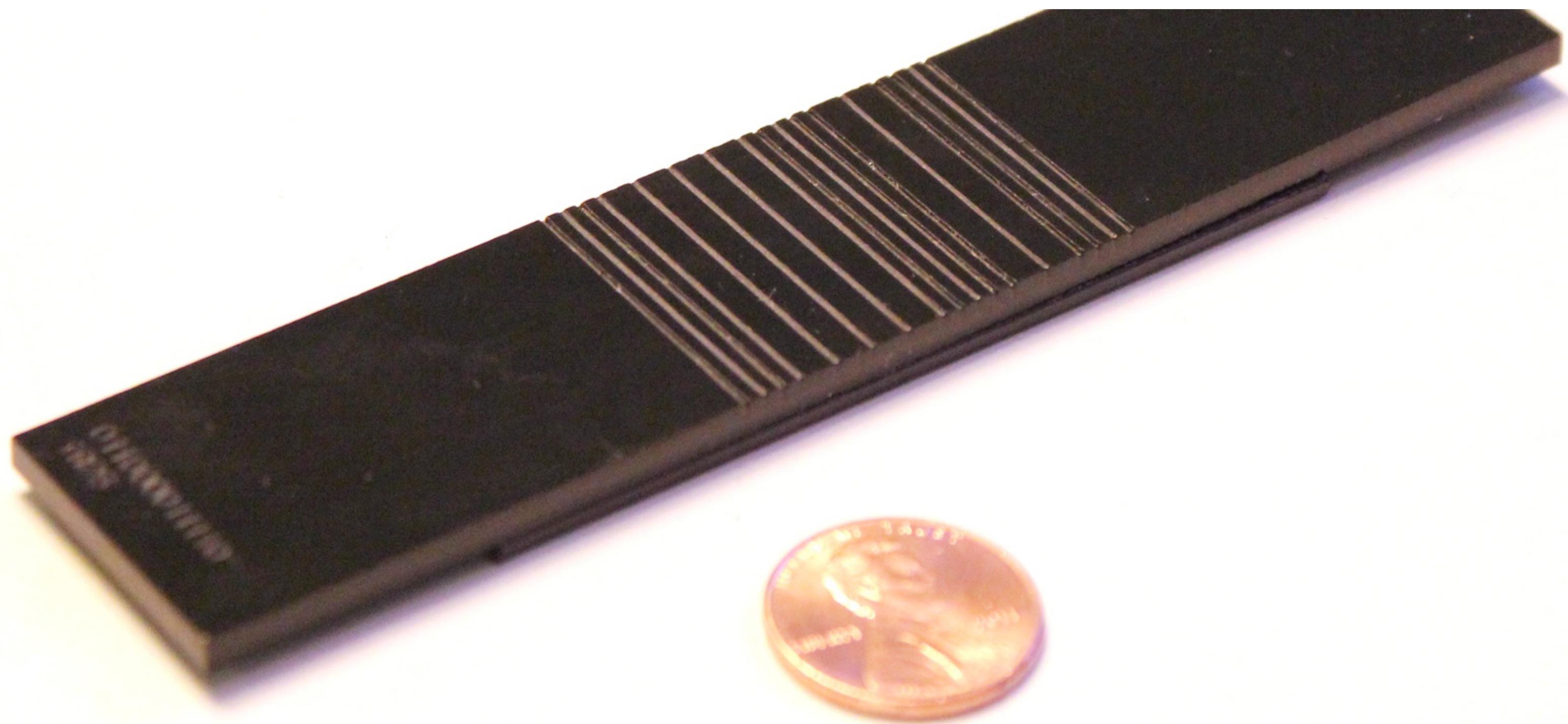
Passive Acoustic Sensing

# Passive Acoustic Techniques



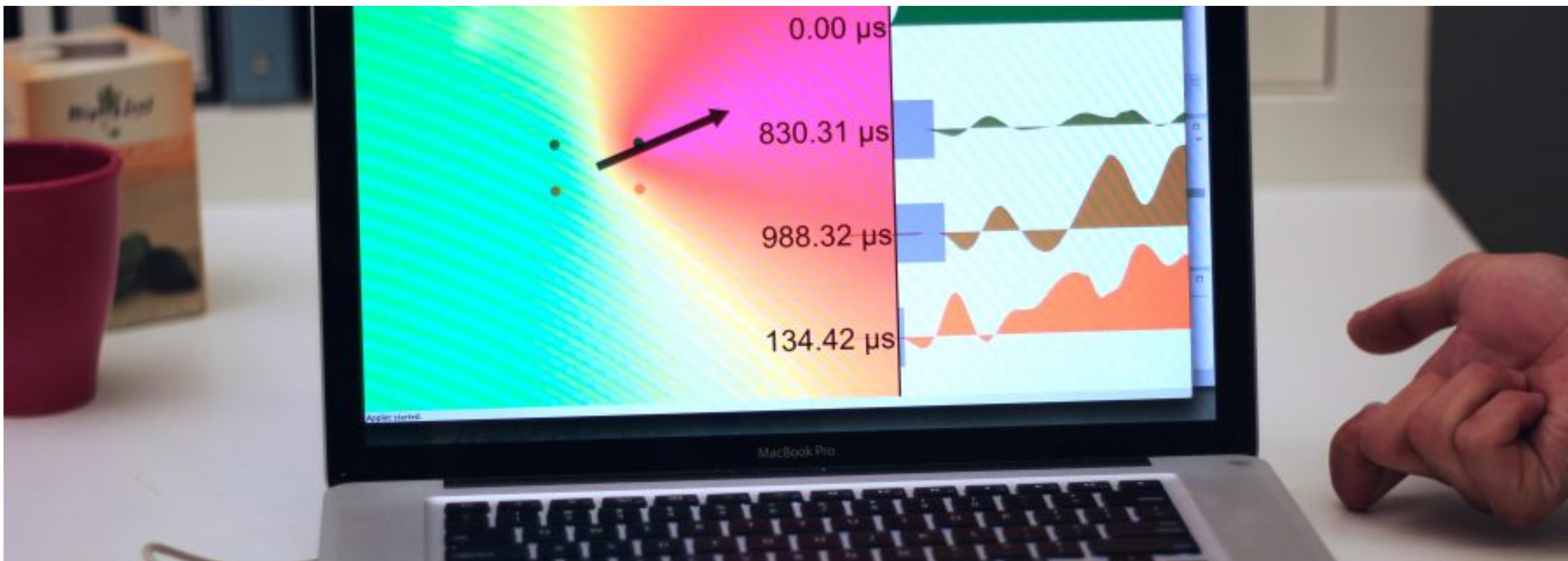
Scratch Input: Harrison et al.  
UIST '08

# Passive Acoustic Techniques



Acoustic Barcodes: Xiao et al.  
UIST '12

# Passive Acoustic Techniques



Toffee: Xiao et al.  
MobileHCI '14

# Previous Work

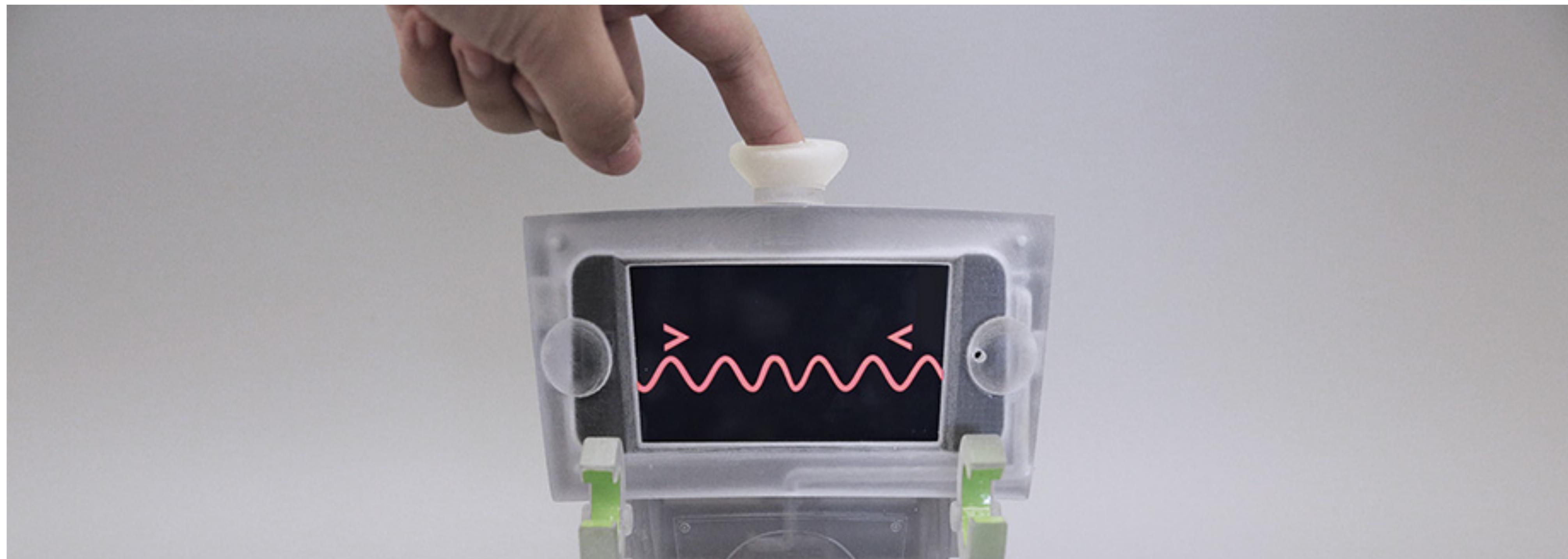
Active Acoustic Sensing

# Active Acoustic Techniques



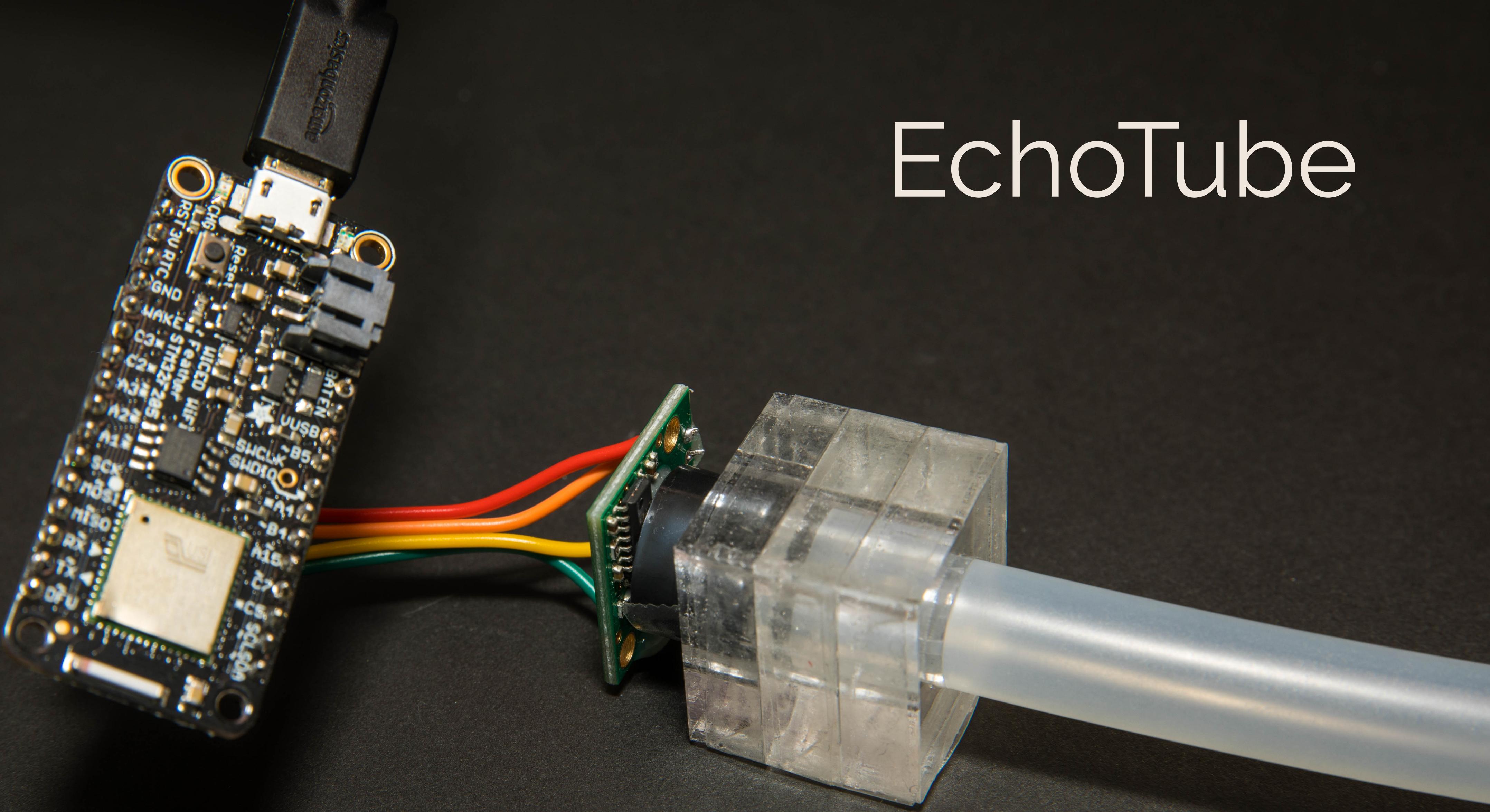
Touch & Activate: Ono et al.  
UIST '13

# Active Acoustic Techniques



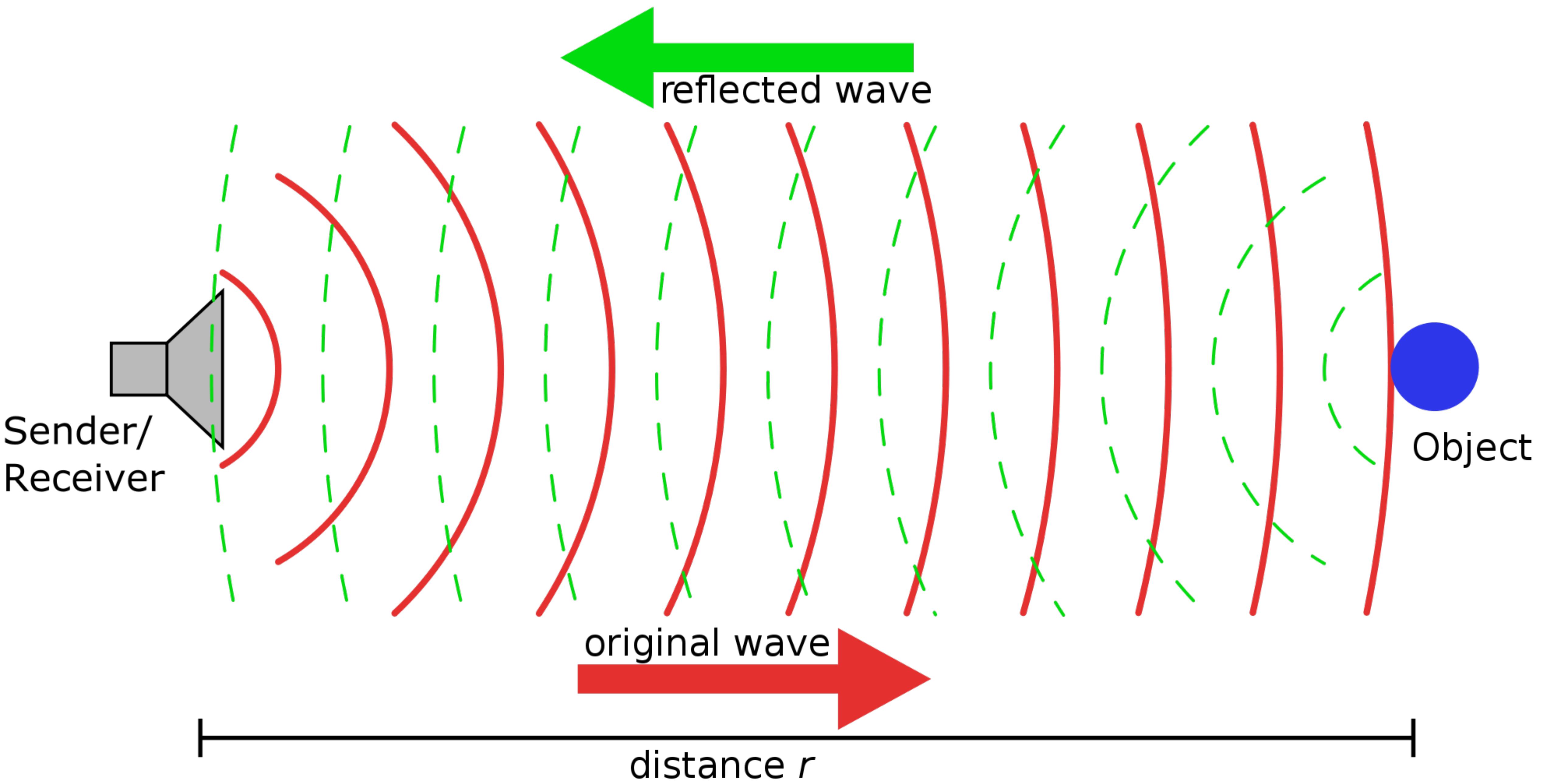
Acoustuments: Laput et al.  
CHI '15

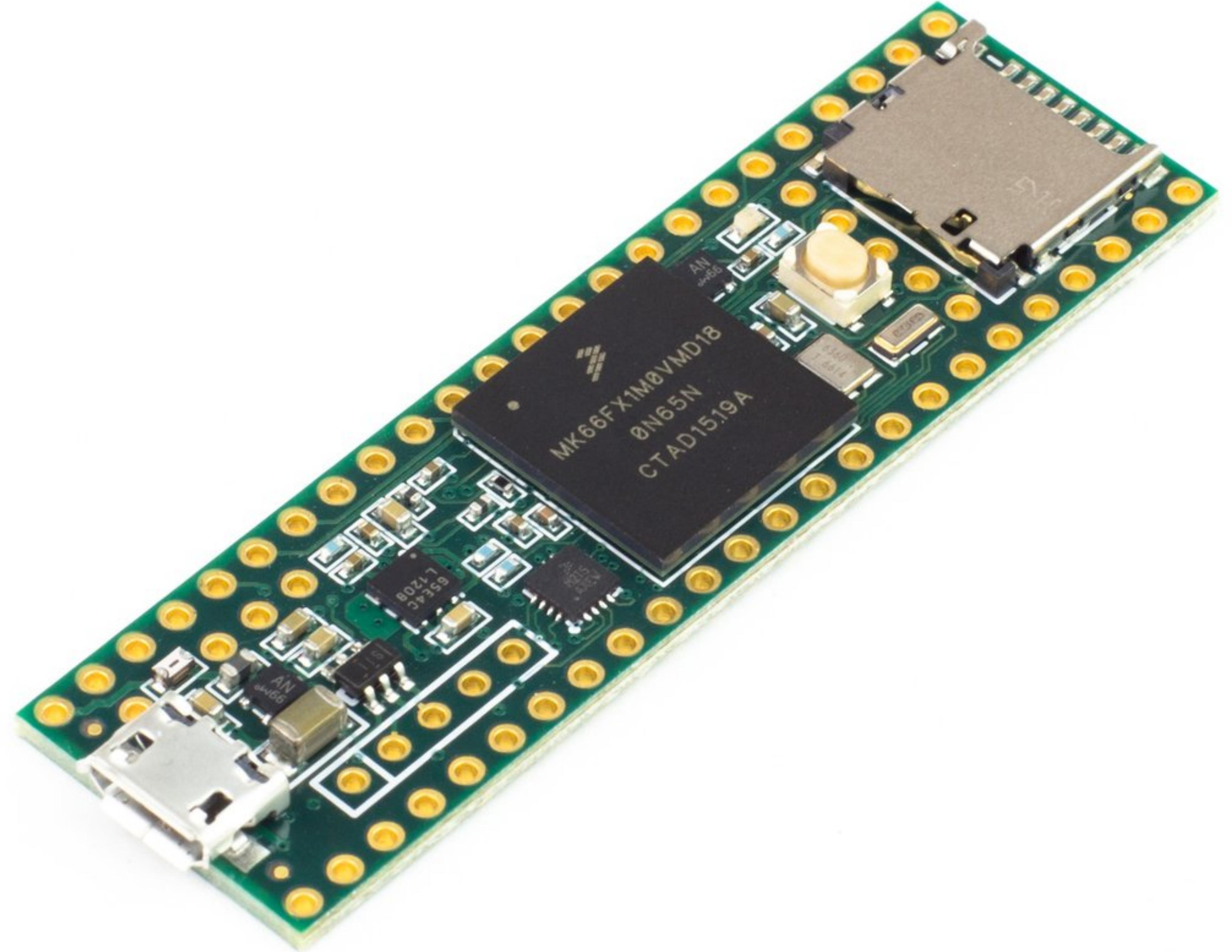
# EchoTube

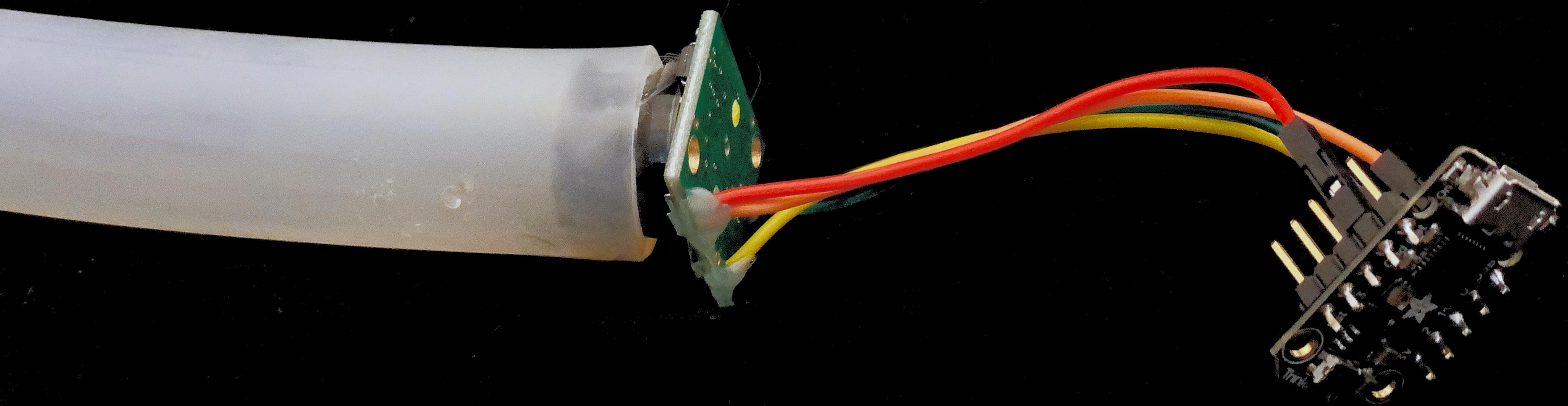


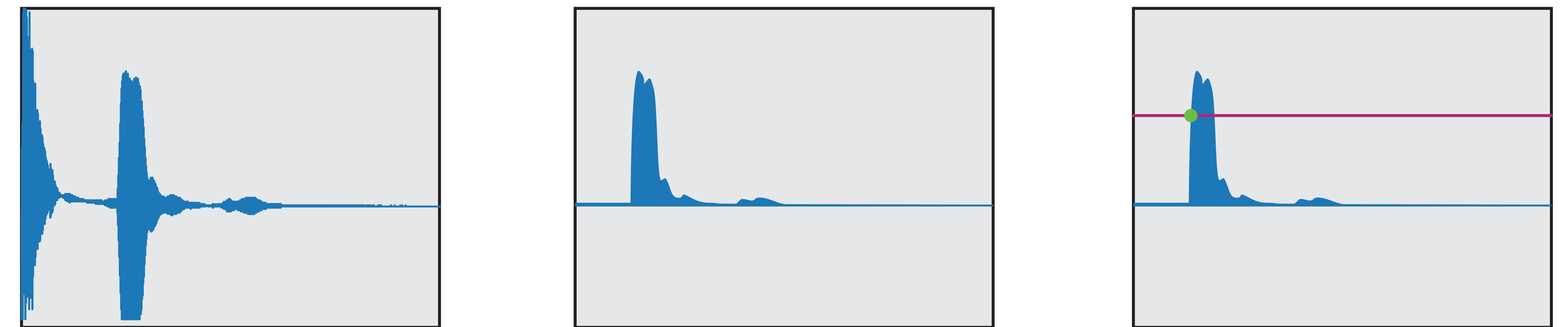
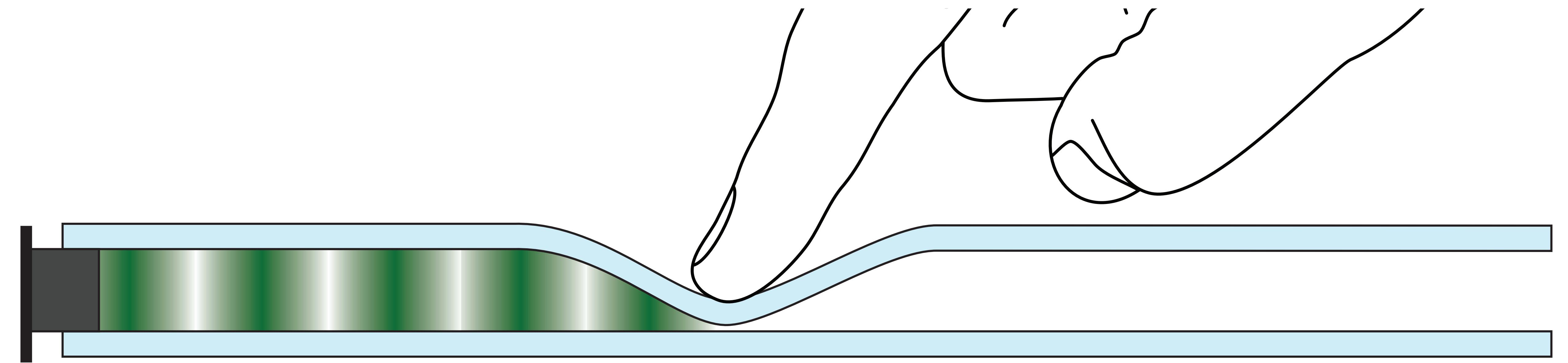








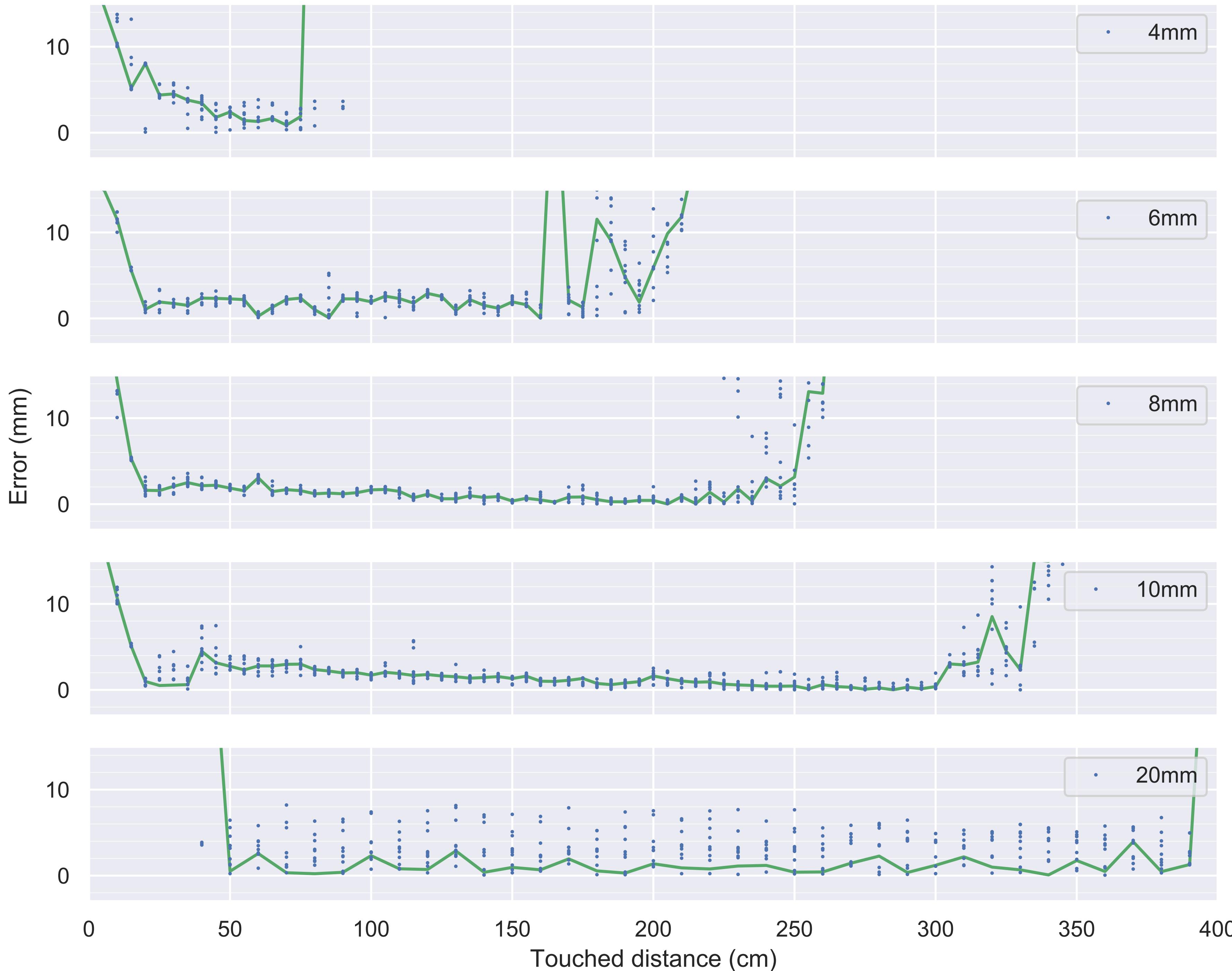




# Performance Testing

# Single Press Accuracy





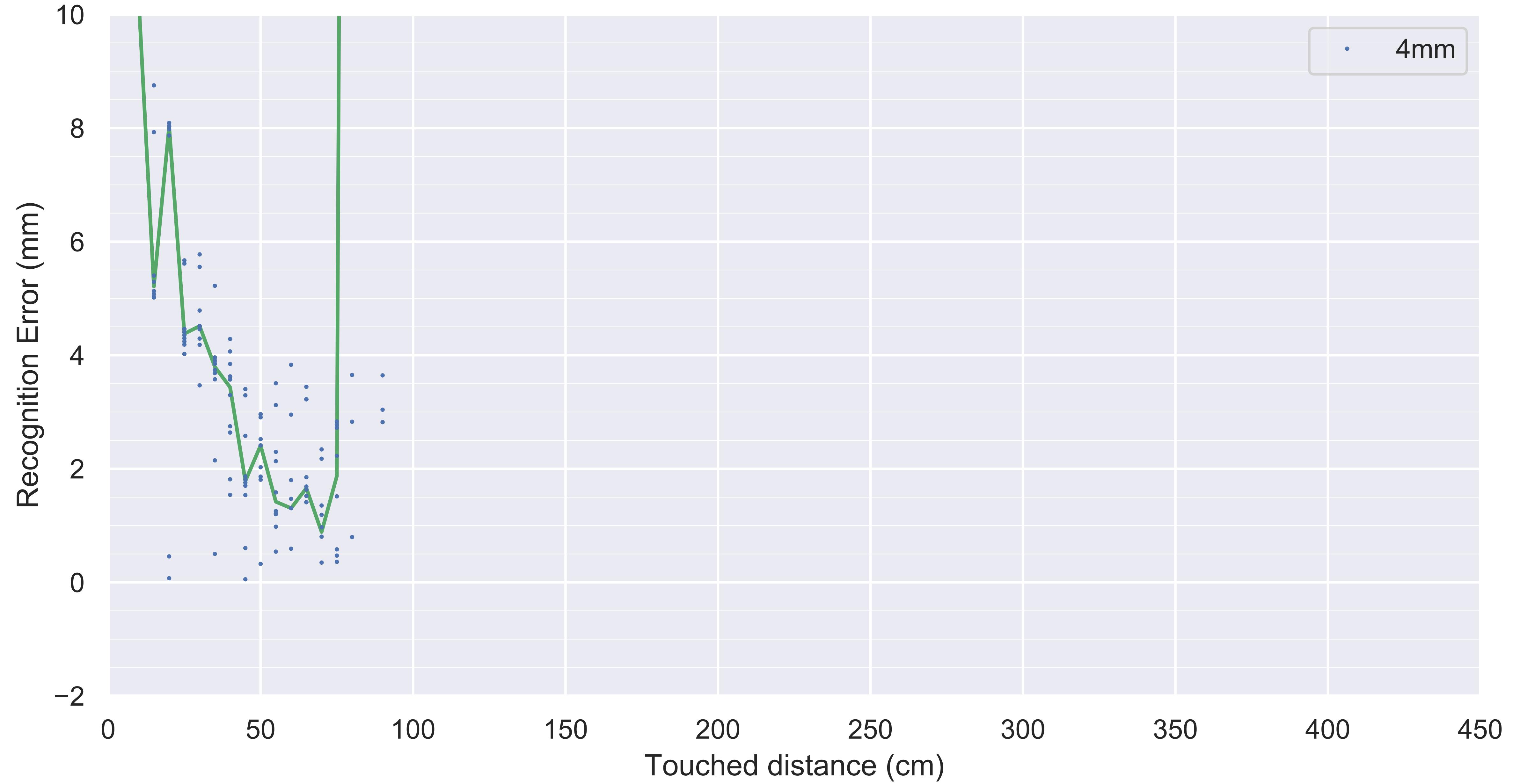
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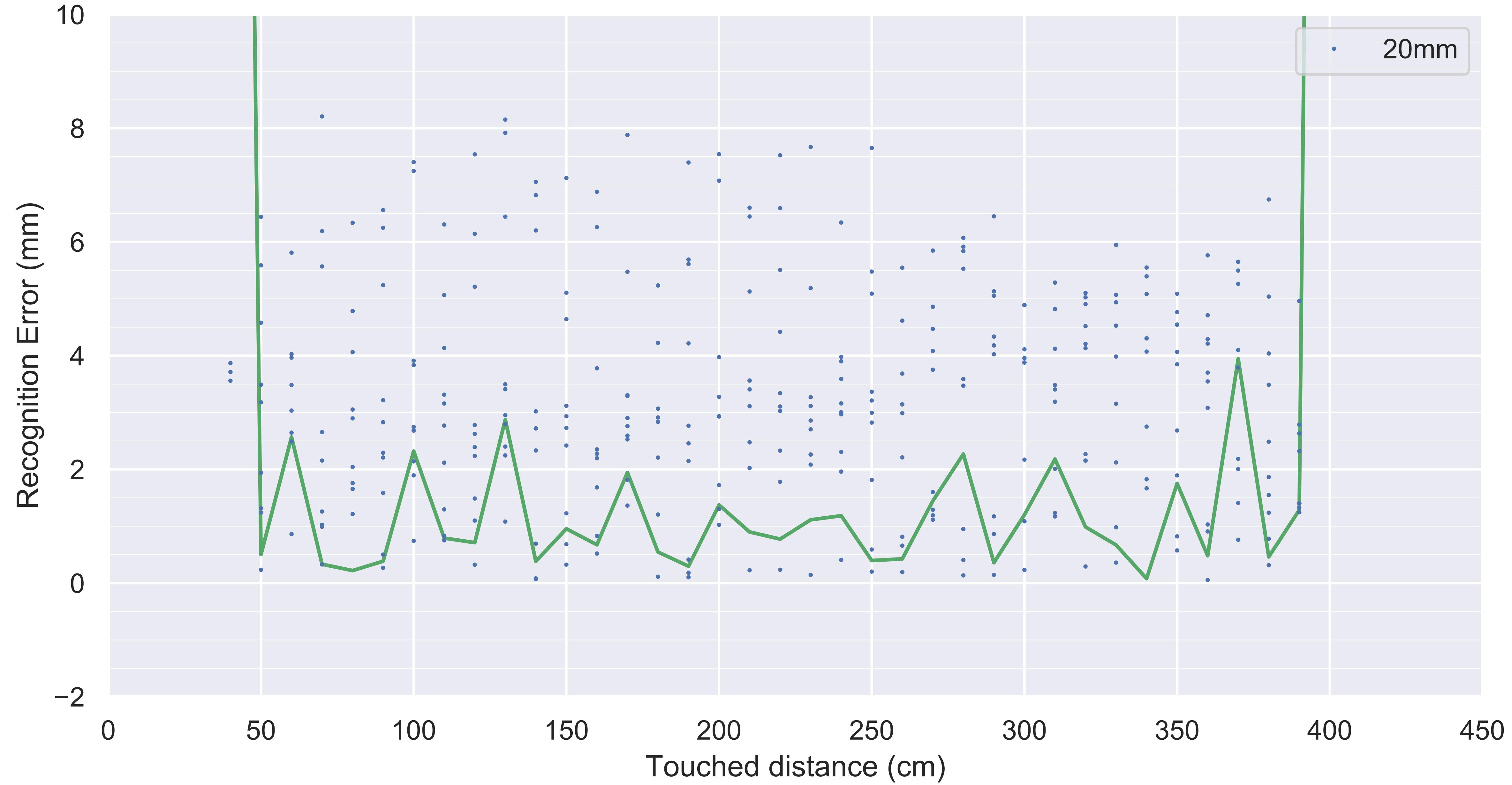
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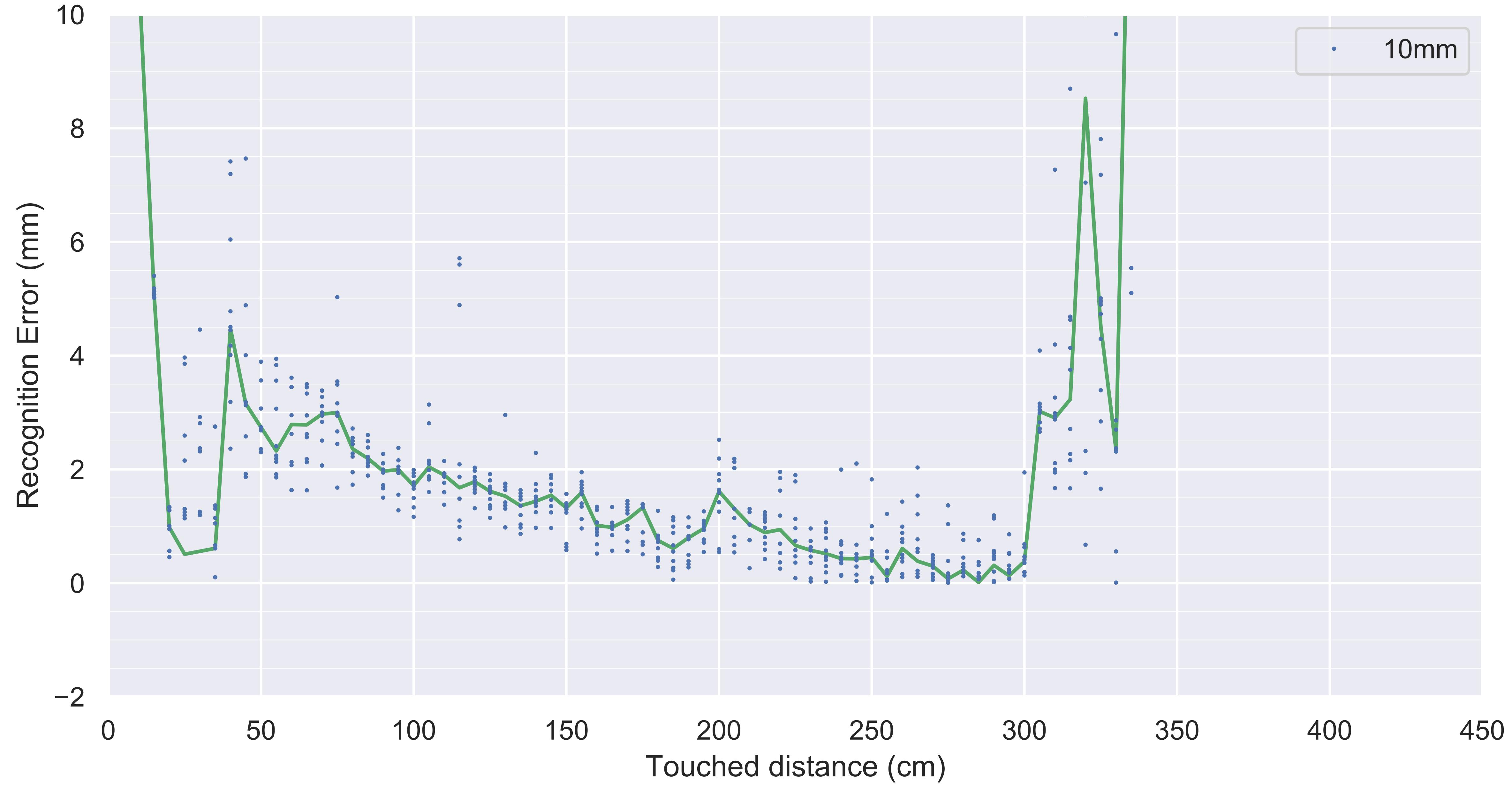
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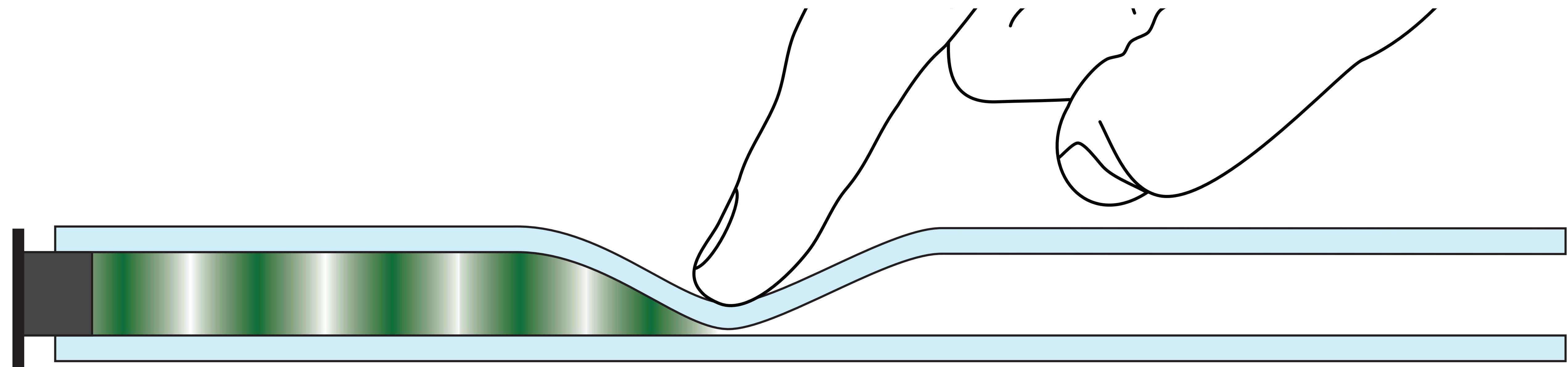
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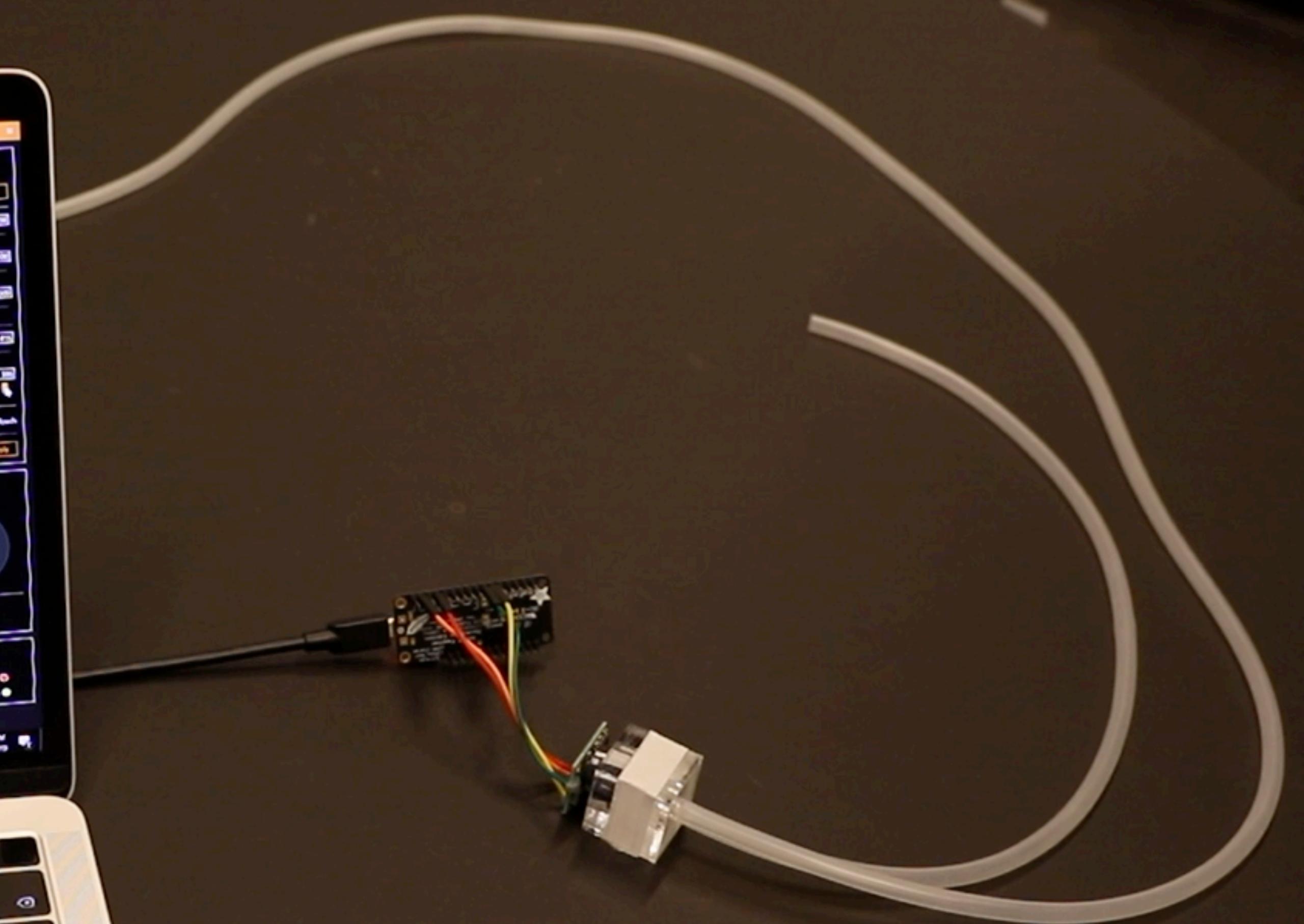




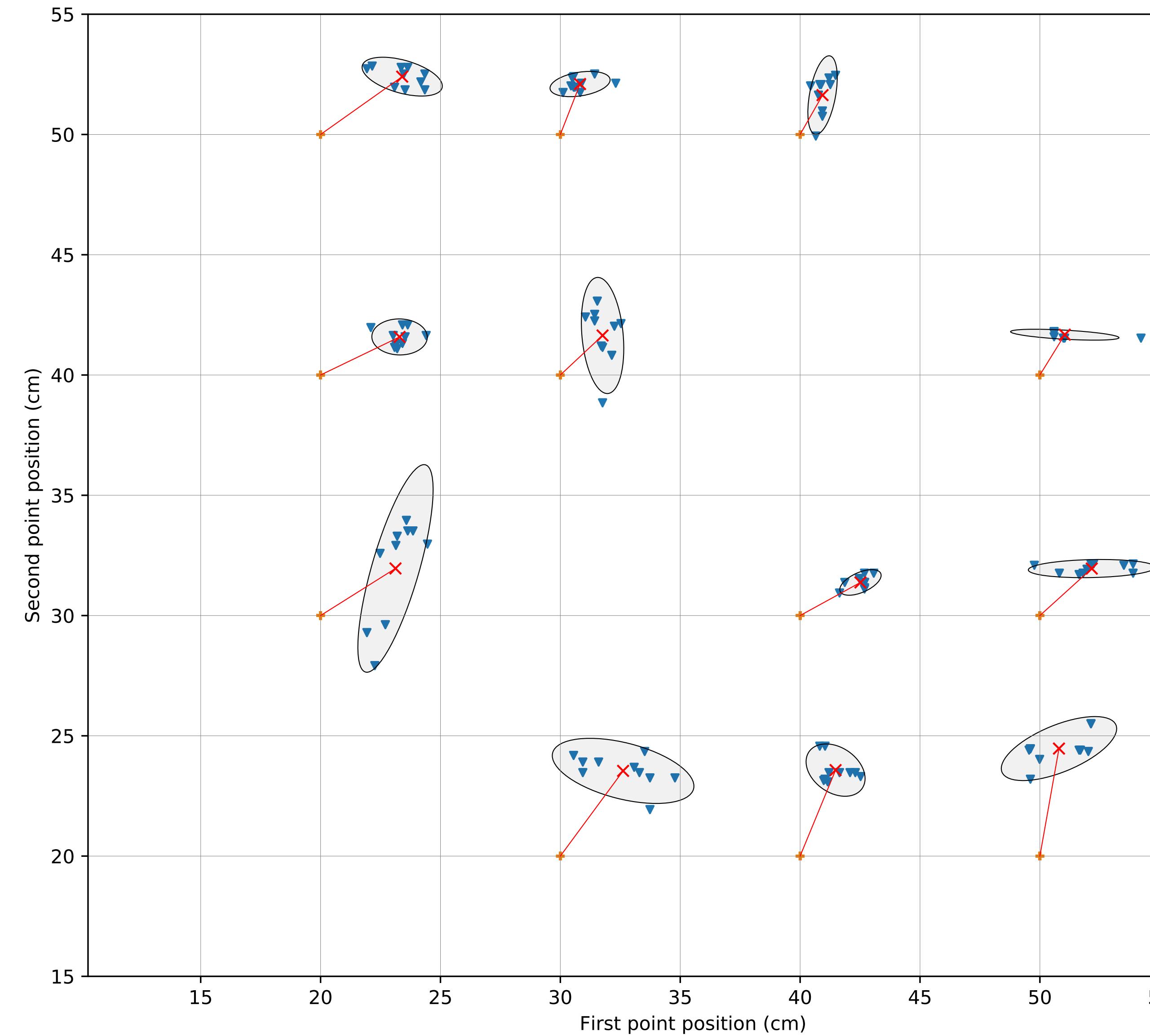
# Dual Touch



# Dual Touch



# Dual Touch Accuracies



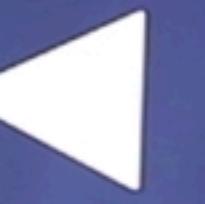
# Repetition Rate

# Applications

BIKES TODAY

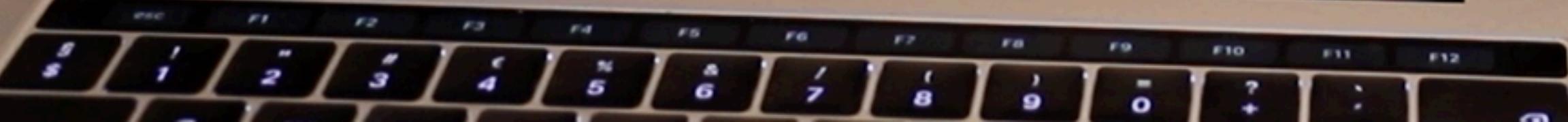
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LAST BIKE

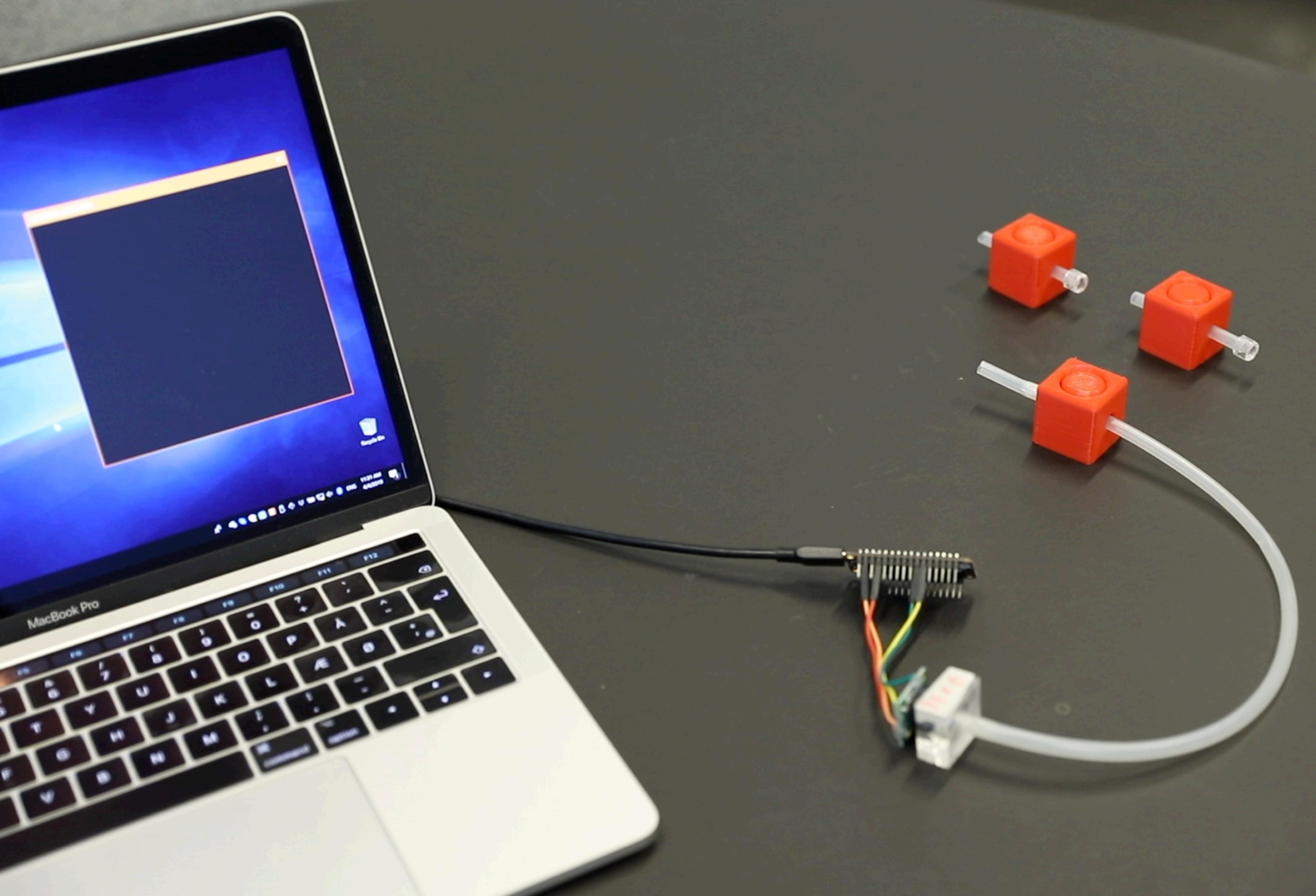


6.5 KM/H

MacBook Pro





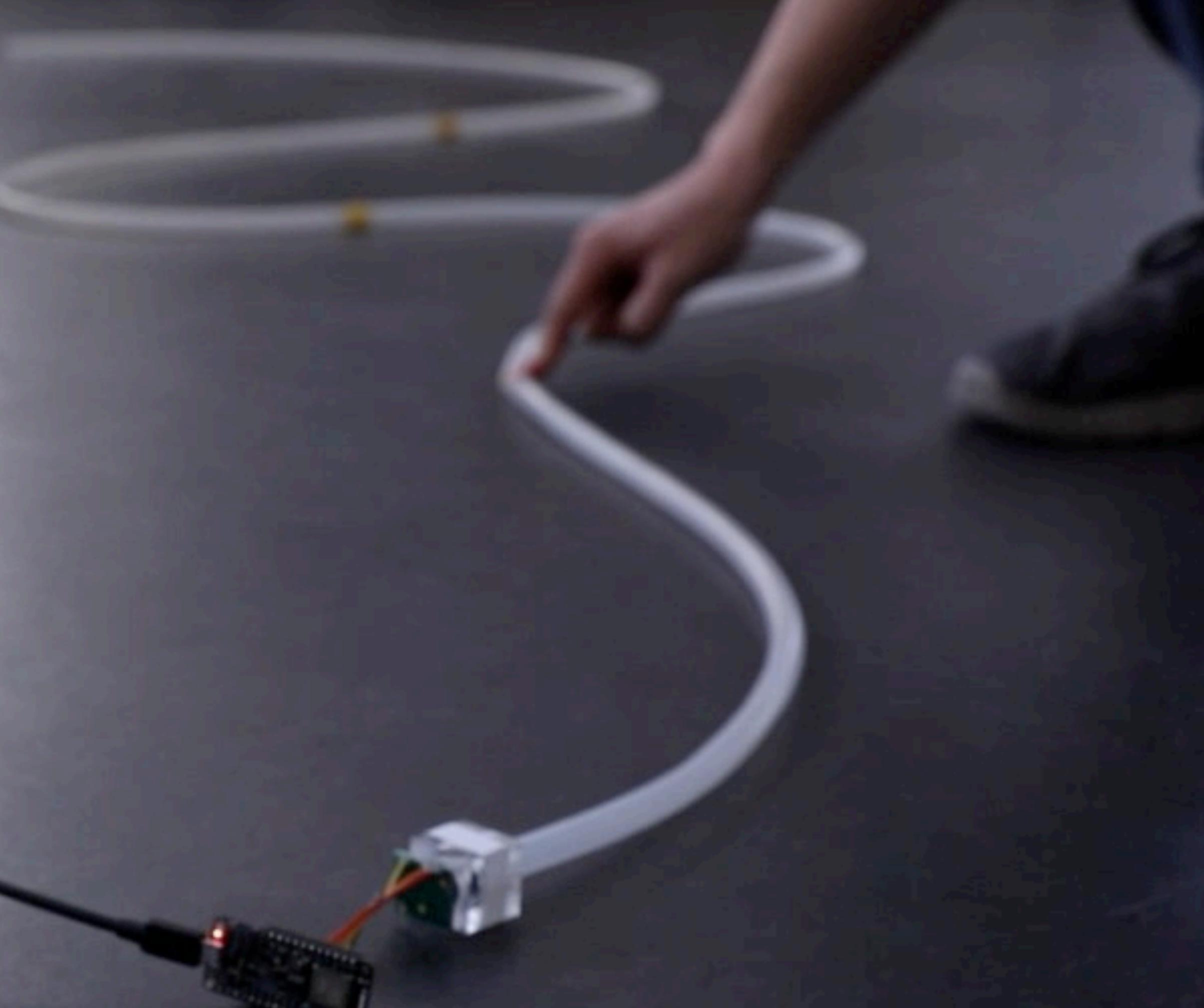


# Limitations



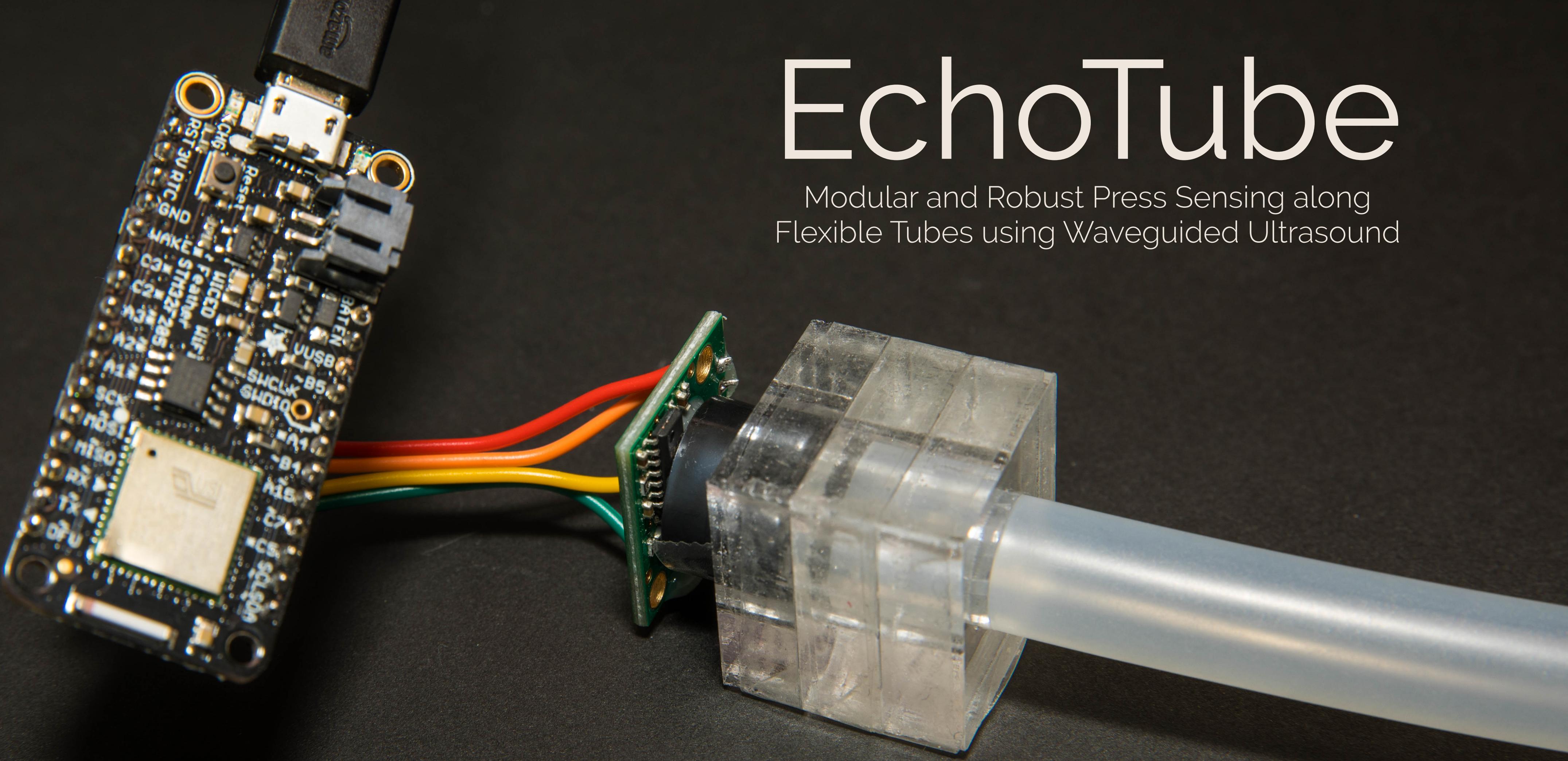


# Conclusions



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