Real Time *C. elegans* Tracking Package with Spatial Targeting for Mechanical Stimulation

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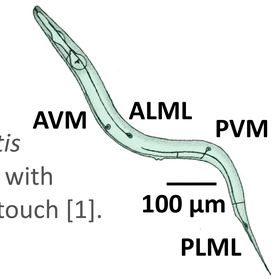
INTRODUCTION

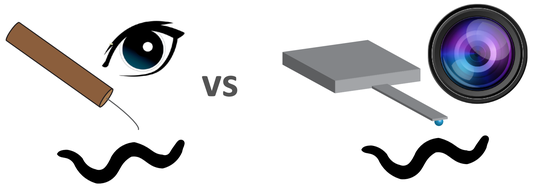
The Sense of Touch

The nematode *Caenorhabditis elegans* is a model organism with which to study the sense of touch [1].



AIM

Spatial Tracking Increases Target Precision

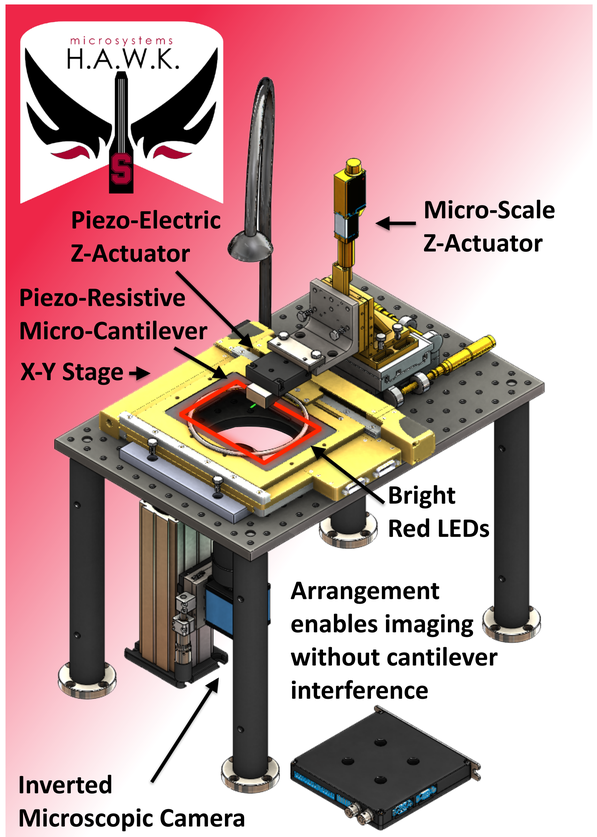


Eyebrow Hair [2]
Manual Tracking
Width ≅ 100 µm
Force > 100 µN

Self-Sensing Cantilever [3]
Automatic Tracking
Width ≅ 30 µm
10 nN < Force < 10 µN

THE RIG

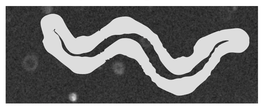
Highly Automated Worm Kicker (H.A.W.K)



TRACKING

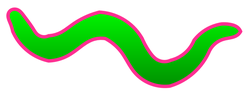
Adapted from [4]

1. Snap Image



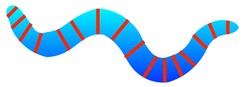
2. Smooth & Threshold

3. Find the Largest Contour



4. Find the Sharpest Points [5]

5. Minimizing Segment Length

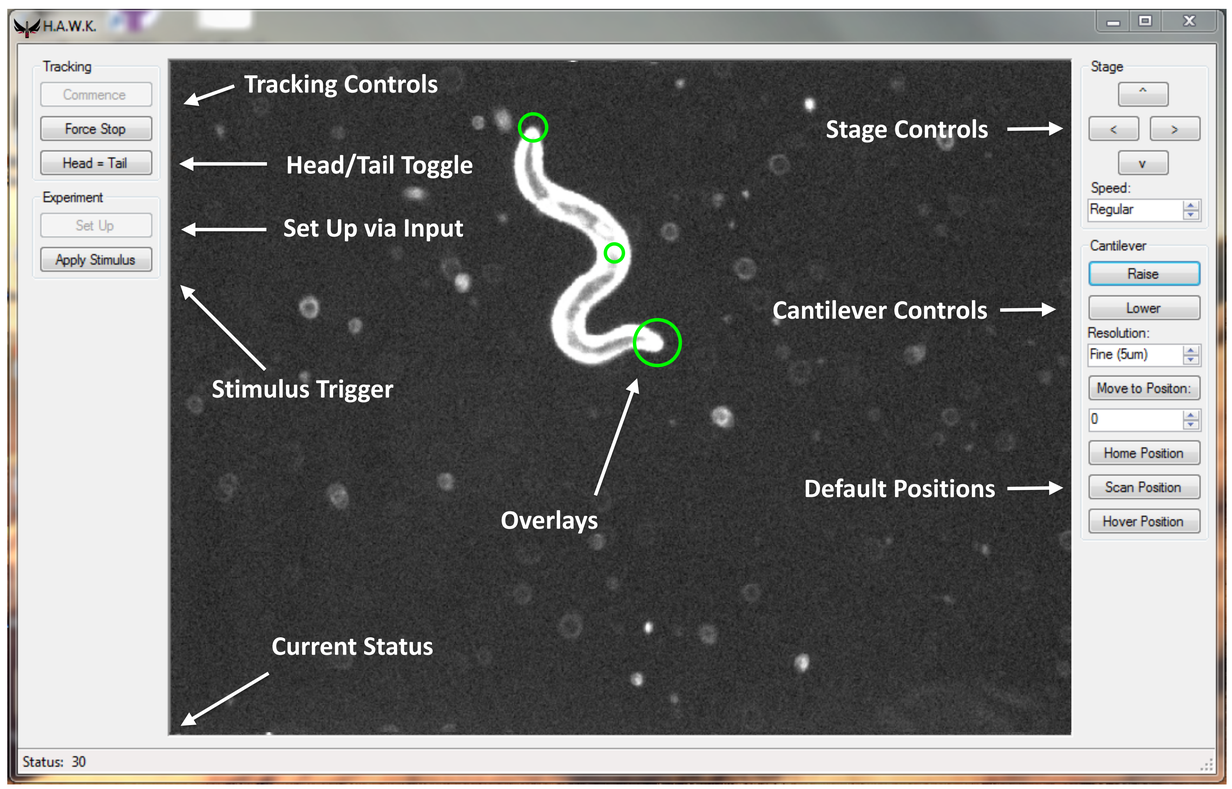


6. Connect Midpoints and Interpolate

7. Move Target to Cantilever

INTERFACE

Main GUI (Display and Controls)



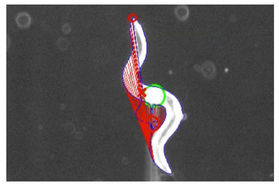
STRENGTHS & LIMITATIONS

Timing Data from 1886 frames

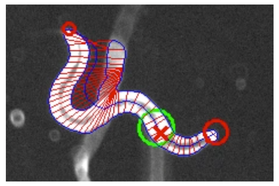
Waiting for Stage :	43.7 ms	
Image Acquisition :	18.4 ms	
Worm Finding :	4.19 ms	
Stage Movement :	1.20 ms	
Total for Single Frame:	**68.0 ms**	≅ 15 fps

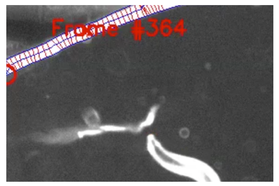
Limitations

Erroneous sharp point

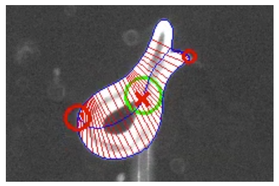


Large debris on pad





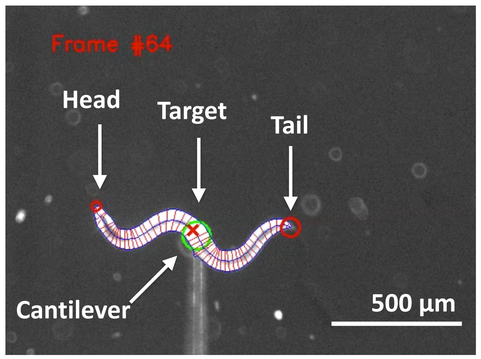
Worm approaches edge



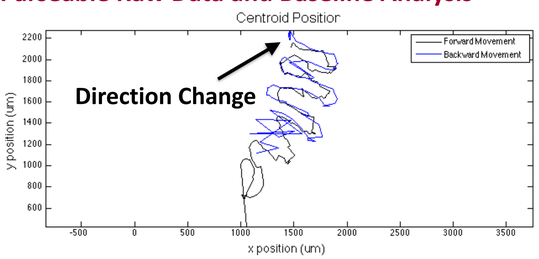
Worm curls into a ball

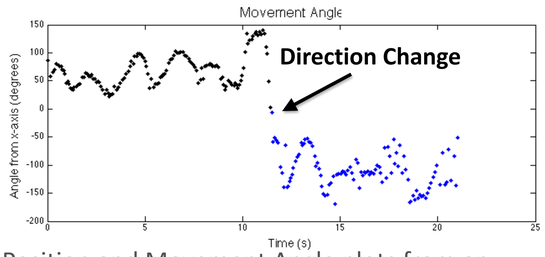
DATA OUTPUT

Overlaid Video



Parseable Raw Data and Baseline Analysis





Position and Movement Angle plots from an experiment show stimulus response behavior.

CONCLUSION

The H.A.W.K. enables the application of a mechanical stimulus profile with spatial targeting and is a large step towards improving researchers' capability to collect quantitative data in studies developing our understanding of the sense of touch.

FUTURE WORK

Planned Experiments

1. Test robustness on mutants with different body morphologies
2. Test force and displacement sensitivities versus location along the body

REFERENCES

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