Open Source Hardware Whisker Sensor

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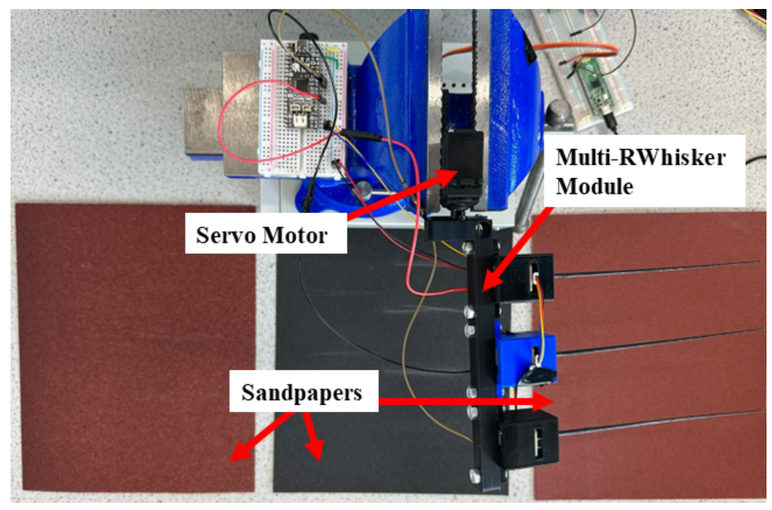
Background

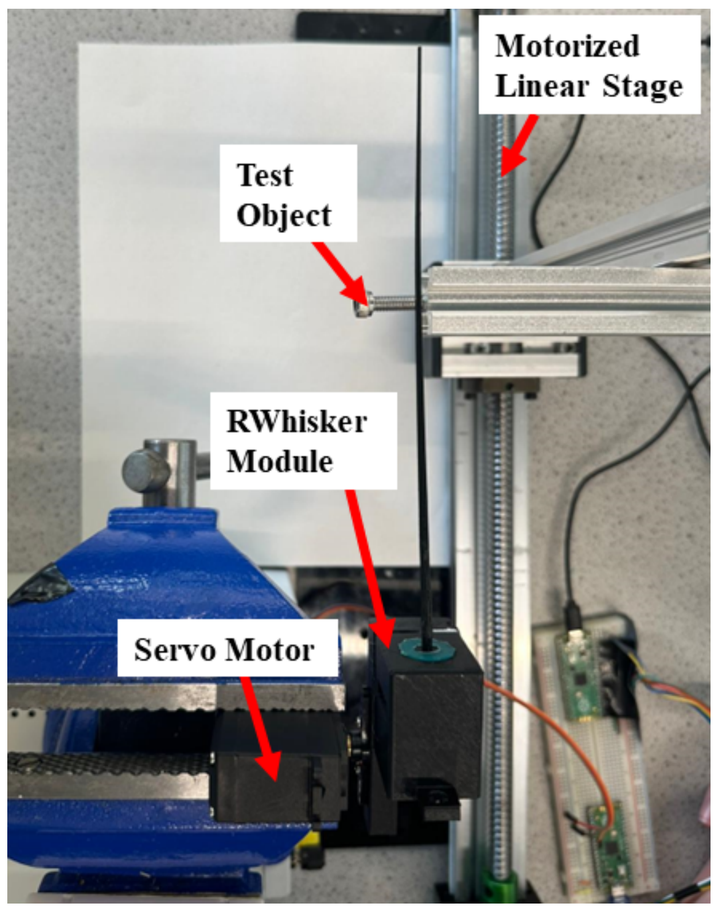
Robotic whisker sensors have been investigated in many studies but have been challenging to replicate across labs. This work provides an open-source, affordable robotic whisker sensor, inspired by the design of the whiskers developed in CrunchBot and SCRATCHbot systems [1, 2].

Repository

Experimental Setup

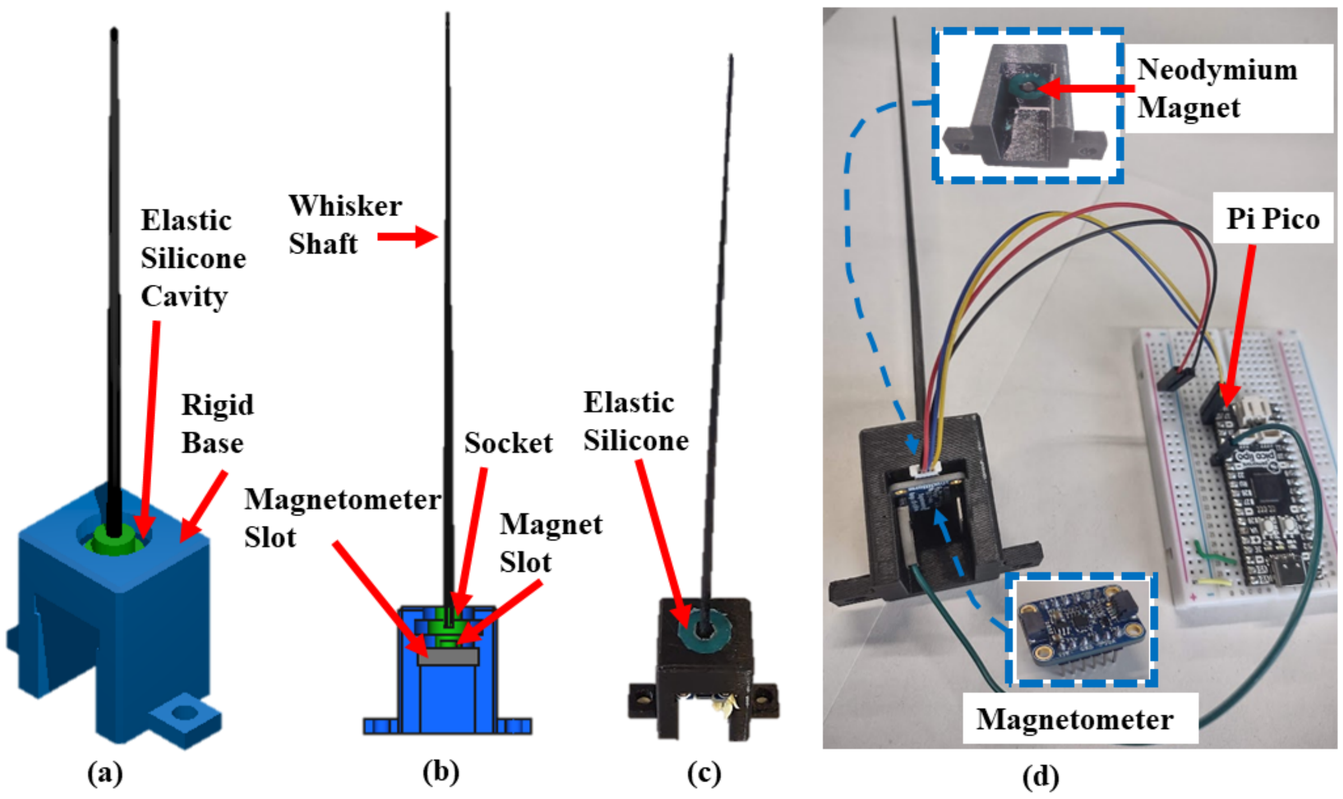


Texture classification experiment



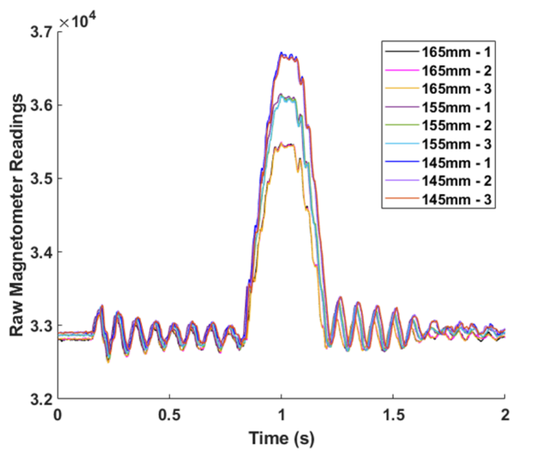
Radial distance estimation experiment

Whisker Design



RWhisker Design overview: (a) RWhisker isometric CAD view, (b) Frontal cross-section view, (c) RWhisker prototype showing the elastic silicone bearing, and (d) The RWhisker prototype connected to a Raspberry Pi Pico, along with a closer view of the magnetometer and neodymium magnet.

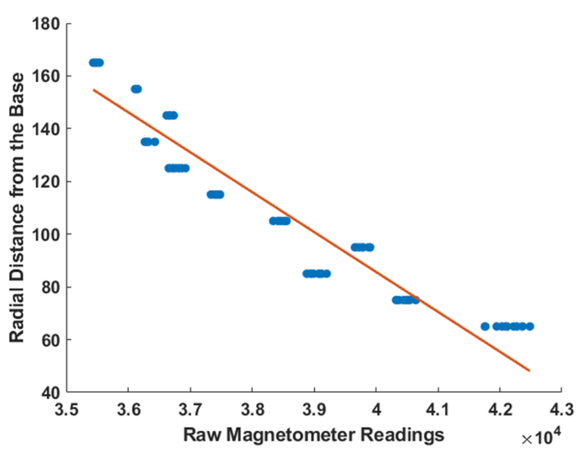
Characterisation Results



(a)

D	165	155	145	135	125	115	105	95	85	75	65
E	6.5	7.2	7.7	9.4	19.6	6.3	11.9	11.4	21.6	11.9	47.2

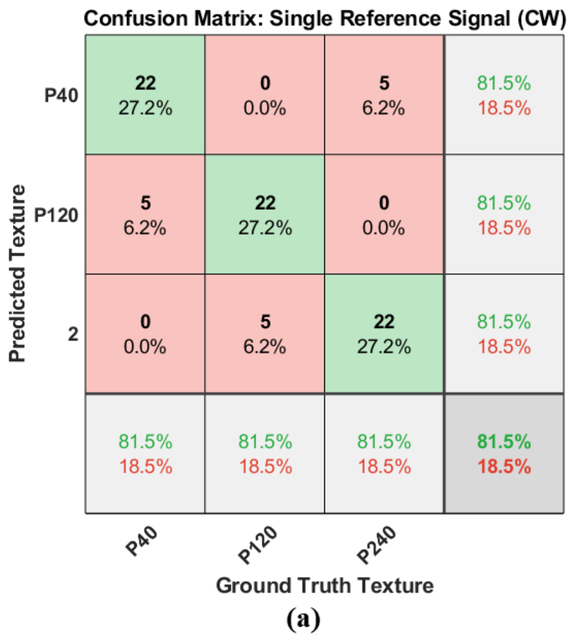
(b)



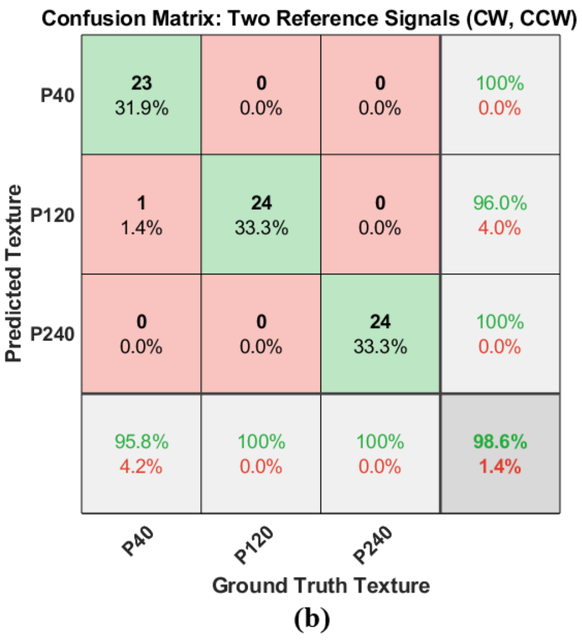
(c)

D	165	155	145	135	125	115	105	95	85	75	65
E	11.1	10.7	8.9	6.3	9.5	9.8	3.5	6.1	15.4	3.6	11.2

(d)



(a)



(b)

(a) Raw magnetometer response for three samples of three radial distances and (b) the average absolute mean error where the first experimental run is compared to the remaining nine. (c) Linear regression model to predict the radial distance (mm) from raw magnetometer readings and (d) the average absolute mean error between the regression line and data.

(a) Confusion matrix for the spectral template classifier that uses the first clockwise (CW) signal as a reference. (b) Confusion matrix for the classifier that uses two separate reference signals, a signal for the CW whisking and a different one for the counter-clockwise (CCW) whisking.

References

[1] C. Fox, M. Evans, N. Lepora, M. Pearson, A. Ham, and T. Prescott, "Crunchbot: a mobile whiskered robot platform," in *TAROS*, 2011.
[2] M. Pearson, B. Mitchinson, J. Welsby, T. Pipe, and T. Prescott, "Scratchbot: Active tactile sensing in a whiskered mobile robot," in *SAB*, 2010.