Airbus Robotics - Tactile Nose Piece

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INTRODUCTION

- Airbus Robotics is working to automate drilling of aircraft components.
- This end effector is not robust under drilling operations of continuous cycles of loading and unloading
- A novel electromechanical nose piece will both replace the current .

Flextrack 3.0 working on a curved component

PROBLEM STATEMENT

To design and manufacture a system for Airbus Robotics which can accurately measure the angle and applied loads of the nose of an end effector, be cheaper to implement than the current solution, and continue to work under drilling operations.

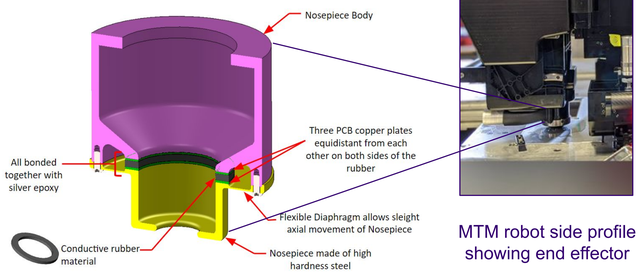
Our Problem Requirements

Primary

- Detect angles from 0 to 3 degrees with a resolution of 0.5 degrees at 20lb pre-load.

Secondary

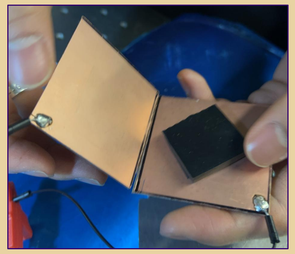
- Reliably measure 150lb drilling pre-load within 5-10lb
- Verify operability in a manufacturing environment
- Conform to gasket shaped geometry



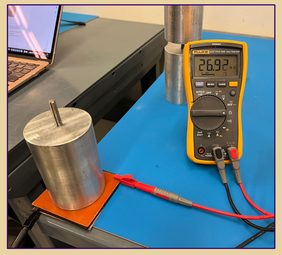
Initial Given Concept

MTM robot side profile showing end effector

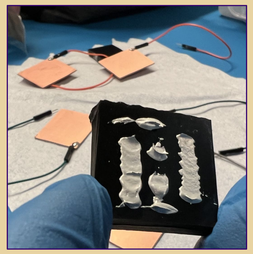
Research & Material Characterization



Initial Sensor Prototype



Initial Low Fidelity Testing



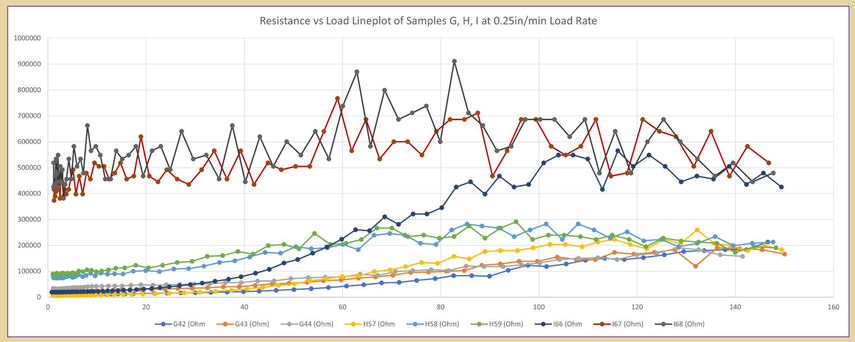
Application of Conductive Adhesive

What were the initial challenges?

- Researched an affordable, conductive elastomer with shore hardness
- Evaluated capacitance and resistance method for viability
- Eliminated Capacitance method due to time constant and manufacturing operability

Observing Resistance Response using an Oscilloscope

Circuit Diagram of Testing Microcontroller



Material Characterization Findings

- Resistance unexpectedly temporarily increased before decreasing over time
- Resistance reading more erratic at loads above 75lb
- Determined the sensor not suitable for secondary 150lb drill load measuring requirement

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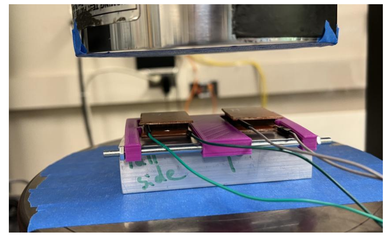
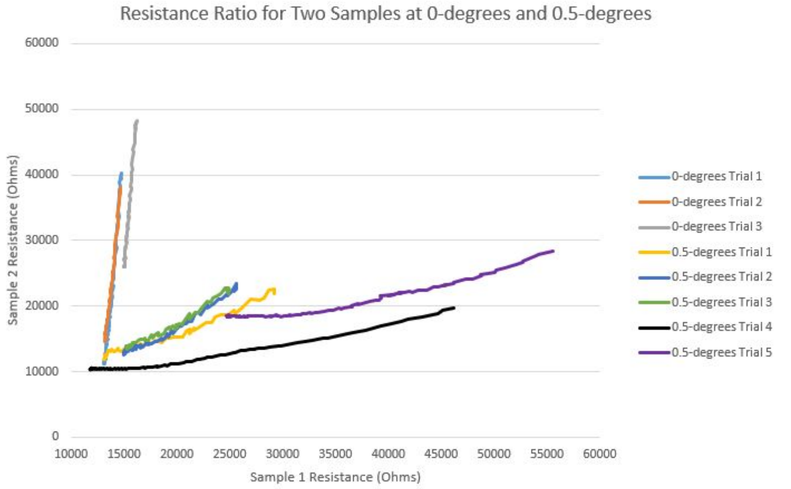
Validation Testing Results

Side View of 3 Degree Wedge Block for 2 Point Testing



3D Printed Placeholder for 2D Testing

- Tested two samples under the same loading at resolution angles
- Analyzed ratio of two resistance readings to determine if this was a viable method to predict angle



CONCLUSION & FUTURE WORK

- The concept and theory were straightforward, but the results were unpredictable and challenging to interpret.
- 2D testing shows the resistance ratios which resulted in the ability to differentiate between different angles for the sensor.
- Modify manufacturing methods to obtain equally geometric samples for 3D model testing that optimizes signaling and to then convert into a sensor prototype.

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