



DIGITAL SIGNAL PROCESSING

DE-44 Mechatronics

Syndicate– C

Project Proposal

**Soft Capacitive Artificial Skin: DSP Methods for High-Resolution
Tactile Sensing on Soft Robotic Surfaces**

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Abstract

This proof-of-concept project develops a flexible capacitive artificial skin for soft robotics, using silicone substrates and a 2D electrode grid to detect tactile inputs. DSP algorithms on a microcontroller enable real-time noise filtering, touch localization, and basic pressure sensitivity. Integrated haptic feedback simulates human-like sensation. The compact prototype advances DSP applications in haptics for intuitive human-robot interaction, with scalability potential.

Project Objectives

1. Fabricate flexible sensor array with signal conditioning for capacitance readout.
2. Implement DSP pipeline (filtering, interpolation) for digital signals from electrodes using mutual capacitance instead of self capacitance
3. Develop GUI for real-time visualization of touch events.

Expected Deliverables

1. **Functional Hardware Prototype:** A soft skin with embedded electronics, responsive to touches via capacitance changes and haptic output.
2. **DSP Software Suite:** Microcontroller firmware for signal processing; open-source code repository.
3. **Visualization Tool:** GUI displaying real-time touch maps (e.g., dots on grid for location/pressure).
4. **Validation Report:** Empirical results, demonstration video, and scalability recommendations.