ROS 2-based Mechatronic Platform for Automated FSR Sensor Calibration

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Abstract. *Force Sensing Resistors (FSRs) used in instrumented shoe insoles require individual calibration. Their pressure–resistance characteristic is logarithmic, differs between sensors of the same type, and drifts over time due to hysteresis and creep. A single insole array carries between 4 and 16 sensors, which makes manual calibration of every sensor slow and prone to human error.*

This work presents an automated calibration station currently under development. The positioning subsystem is based on an existing X–Y platform running GRBL firmware. It was extended with an additional Z axis, which presses the calibration probe onto the sensor under test. The Z axis and the FSR readout are handled by an independent ESP32-based module. The force applied by the probe is measured by a load cell with an HX711 amplifier, which gives the reference value for every calibration point.

The ongoing work is the integration of these two parts into a single automated process using ROS2. The GRBL positioning platform and the ESP32 module are each wrapped as a ROS2 node, so that motion commands and sensor readings are exchanged over a common communication layer. This makes the full calibration cycle coordinated from one place: traversal to each sensor position, controlled force application along the Z axis, and synchronous recording of the sensor response. The node-based structure keeps motion control separate from data acquisition and allows the station to be adapted to insoles with different sensor layouts.

The intended outcome is a repeatable procedure that produces a calibration curve for every sensor of a complete insole without manual intervention. Testing of positioning repeatability, force accuracy and curve reproducibility will follow once the pipeline runs end to end.

Keywords. ROS2, calibration, FSR, mechatronics, automation, robotic systems

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