Haptic Embed, a tool for exploring tactile functions

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Abstract. The Haptic Embed is a microcontroller-based measuring device designed to simplify and digitize physiotherapeutic assessments, specifically the Petrie test – an essential tool for evaluating individual pain tolerance in patients. Based on this test, it will be determined whether the patient underestimates, accurately estimates, or overestimates tactile sensations. At its core is the ESP32 microcontroller unit, connected to a touch strip in the form of a membrane potentiometer. It is powered by a built-in Li-Ion battery with USB Type-C charging capability. The device can be used independently or in conjunction with a desktop application. Communication with the desktop application is wireless via Bluetooth, enabling detailed visualization and archiving of patient measurements. Haptic Embed features intuitive control via a built-in display with a capacitive touch layer. It offers two main operational modes: calibration using three points and real-time deviation measurement. The measured deviation is presented both graphically and numerically, and it is color-coded based on patient evaluation criteria. The device achieves finger position accuracy up to 0.3 mm, facilitating precise measurements. Additionally, it includes functionality to detect improper touch minimizing errors during measurements or calibration. Moreover, this device can be enhanced by adding another touch strip, enabling the device to measure each finger independently. Furthermore, with this setup, it is possible to calculate the patient's tilt angle, allowing for a more comprehensive investigation of the patient's touch sensitivity. In conclusion, Haptic Embed holds the potential to significantly optimize physiotherapeutic procedures and propel healthcare technology toward a future characterized by enhanced efficiency, intuitive operation, and error-free performance.

Keywords. tactile functions, digital healthcare, Petrie test, microcontroller, membrane potentiometer.

Acknowledgments

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