HSLU Hochschule Luzern

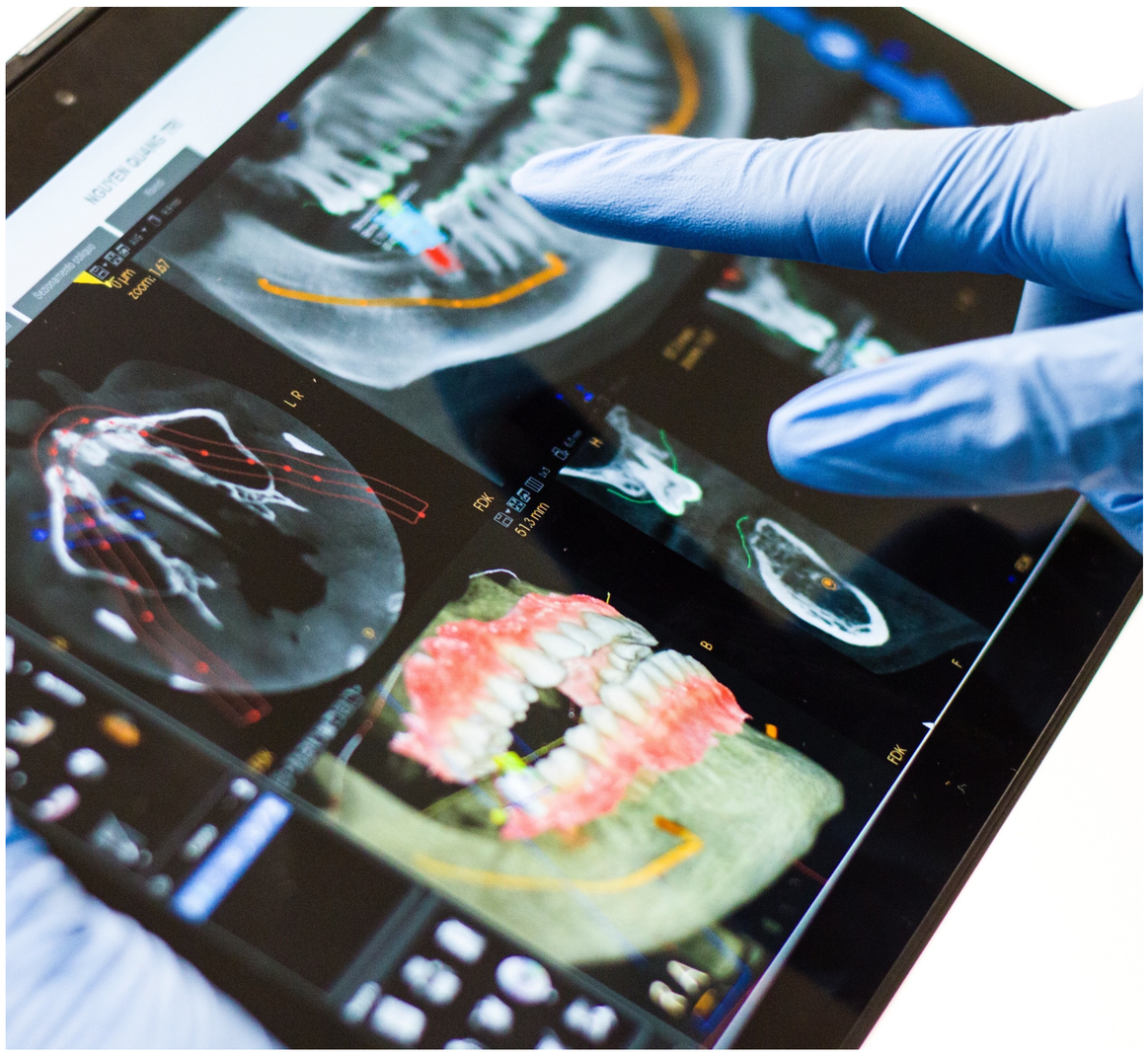
Technik & Architektur

Bachelor-Thesis Medical Engineering

Smart Dental Prosthetics

Feasibility study within the framework of combining intraoral medical devices with sensor technology

Unsplash



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Project Description

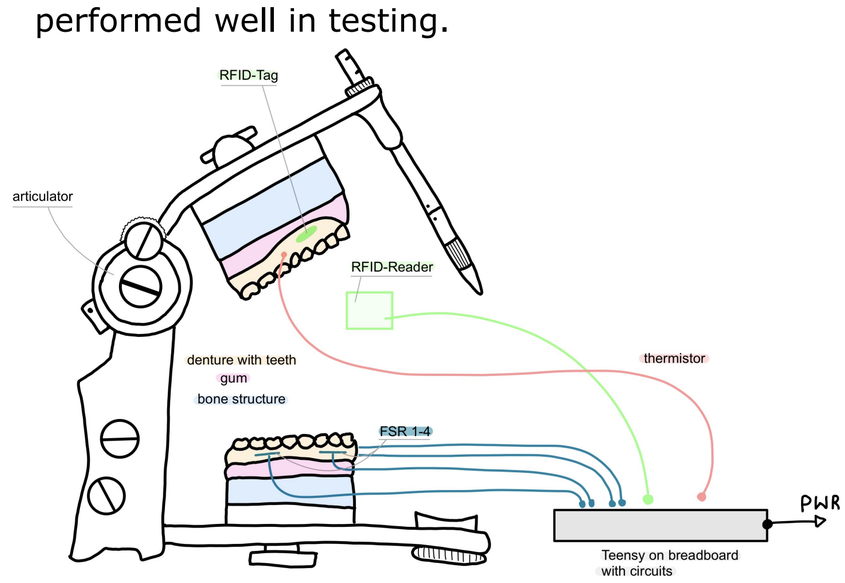
The proposed thesis aims to investigate the feasibility of combining intraoral medical devices, such as dental implants and dentures, with sensor technology. The industrial partner for this project is the Straumann Group, a leading manufacturer of dental products known for their innovation and quality. The project aims to address the use of sensors in dental products and the development of a biomedical test setup to validate these concepts. The research focuses on in-vivo sensors and tooth replacement solutions, aspiring to improve customisable treatment for patients through continuous monitoring of various parameters. The research involves laboratory work and seeks to answer several research questions, including the best sensor technology for measuring masticatory force in dentures, the optimal location for the integration of sensors, and the benefits of sensor technologies for patients. The project also intended to test several hypotheses, including the potential for faster dislocation detection using sensor technology and the feasibility of building a suitable test setup for simulating movement. Ultimately, the results of this thesis informs the development of sensor-integrated dental products that can improve patient care and treatment outcomes.

Materials and Methods

The prototype was designed to replicate a patient's gum and bone structure and have a secure fit, and had specific technical requirements including the ability to measure bite force, calibrate sensors, withstand compressive force, measure temperature, and transfer and save measurements to a computer. Additionally, the prototype was required to have a fast delivery time for all parts and be able to be assembled using a breadboard. Two prototypes were created. The final prototype was tested and evaluated using an articulator and various tests, including movement and temperature measurement and RFID labelling. The goal of these methods was to identify and address any issues or problems before going further into the research.

Results

The performance of a force-sensitive resistor (FSR) sensor, as well as thermistor and RFID sensors, was assessed in this study. The FSR was evaluated in two stages: a preliminary test to familiarise the sensors and prototype setup, followed by a more accurate test with several scenarios. When measured directly with the measurement system, the results showed that the FSR was accurate. To compare the individual sensors, zero standardisation was utilised. The FSR was tested in and under the prosthesis with results indicating that the force is not evenly distributed across all four sensors and that the in-prosthesis approach would be more practical for future research. The thermistor and RFID sensors also performed well in testing.



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