

# Smart Connected Dental Handpiece

Degree programme : BSc in Micro- and Medical Technology | Specialisation : Sensor technology  
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The handpiece is a dental device that can be used for various purposes including caries removal, polishing of fillings, cosmetic dentistry, and modification of dentures. The aim of this project is to design a smart connected dental handpiece system able to track and transmit data to a web-based application.

## Introduction

Innovative and reliable products, a high-quality distribution network makes Bien-Air the number one specialist in rotary dental instruments and medical systems. Handpieces are used daily by dentists. Bien-Air wants to bring yet another innovation to the market. This will be done on a mechanical instrument by making it connected and smart. This upgrade will be developed over the CA NOVA 1:1 and CA NOVA 1:5 models in their product lineup. The challenge is ambitious because the space inside these instruments is very small; this leads to the need to miniaturize the circuit as much as possible so that it can fit inside. They are also sterilized using an autoclave, which adds the challenge of withstanding different pressures and high temperatures.

## Methods

The development of this system started from a very simple base using a breadboard and Arduino micro-controllers. To be precise, an Arduino Nano 33 BLE as the peripheral device and an Arduino Nano 33 BLE Sense as the central device. In doing so, the electric diagram of the peripheral microcontroller was modified to fit the needs of the company. This allowed the circuit prototype to be integrated into the handpiece. Programming was then done with the Arduino IDE in C language, and the communication protocol used is Bluetooth Low Energy.

## Results

Communication via Bluetooth Low Energy is fully functional; in fact, on the Serial Monitor of the Arduino IDE the desired information can be displayed. As for the hardware part, until the end of this Bachelor's thesis, the circuit will still be assembled and tested. In the short term, an autoclavable battery in the required size was not available, so it was decided to use a 3.7 V battery that will sit outside the product but will have similar specifications as the ideal battery.

## Outlook

The next step in this project is to miniaturize the circuit even more so that it can fit into the handpiece without having to change the size of the original product. To do this, it is necessary to change the type of microcontroller to, for example, an STM32 and to look for less bulky components, especially the Bluetooth module, which takes up most of the space. Then it will also be necessary to consider what is the best solution for powering the circuit; whether there is the possibility of having a custom battery manufactured for this application or whether it is better to go for another power solution.



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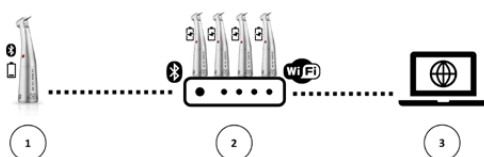


Figure 1: 1) Dental Handpiece 2) Charging & data transmitting station 3) Dental office PC with web-based application



Figure 2: Top view of the circuit realized to make the handpiece connected. Dimensions: 44 mm x 29 mm