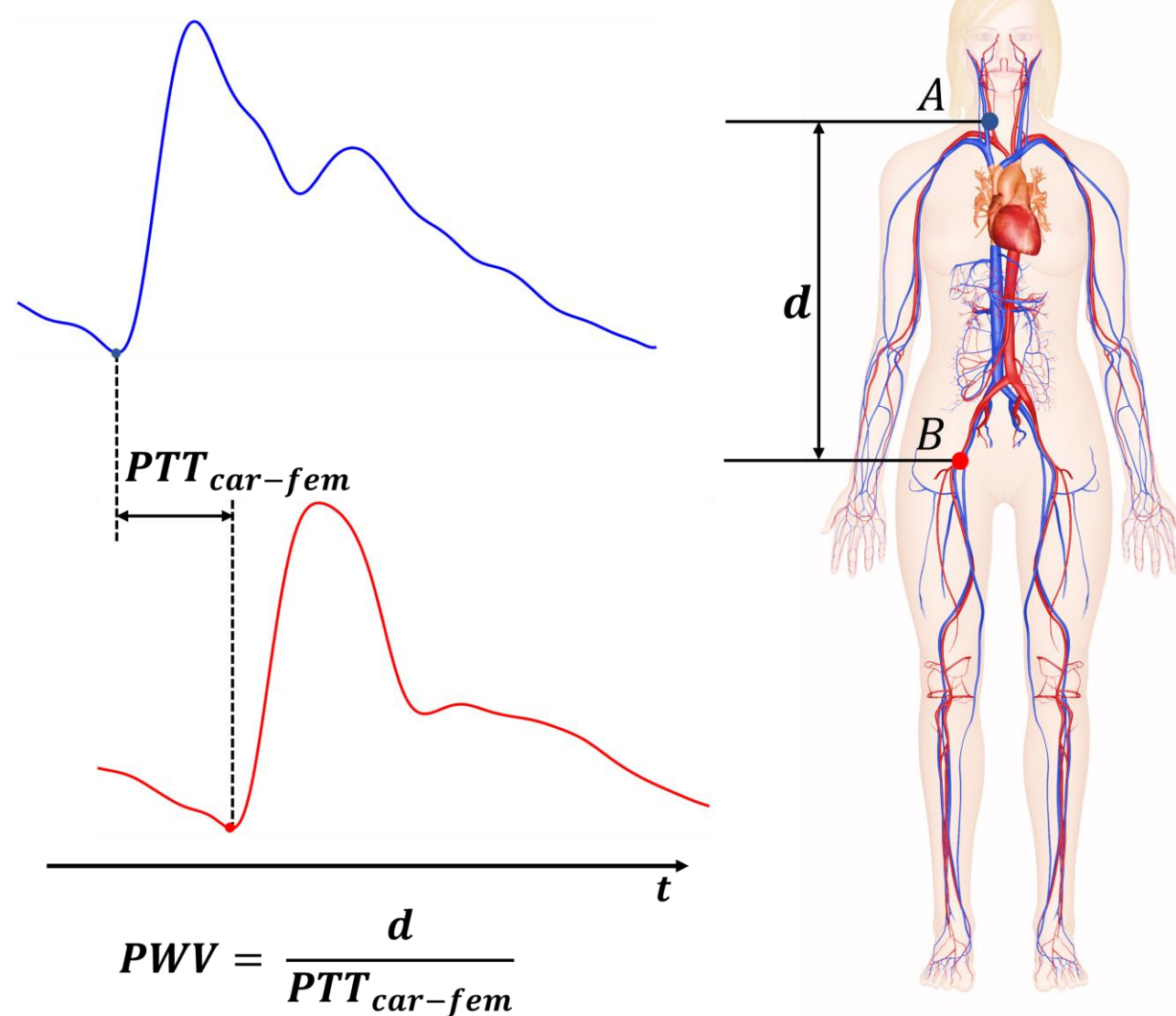


Research context and motivation

- Pulse Wave Velocity (PWV)** is the velocity at which the arterial pulse propagates through the circulatory system
- PWV is considered one of the most important clinical parameters for evaluating Cardio-Vascular risk, vascular adaptation and therapeutic efficacy. It gives information about mean arterial pressure, arterial stiffness or compliance and vasomotor tone.
- PWV estimation relies on the extraction of Δt **Pulse Transit Time (PTT)** which is the time employed by the blood pulse to propagate between two points.
- cf-PWV** is the velocity at which the arterial pulse propagates from carotid to femoral artery. Compared to other sites on the human body, It was recognized as the most reliable indicator of the stiffness of the circulatory system.



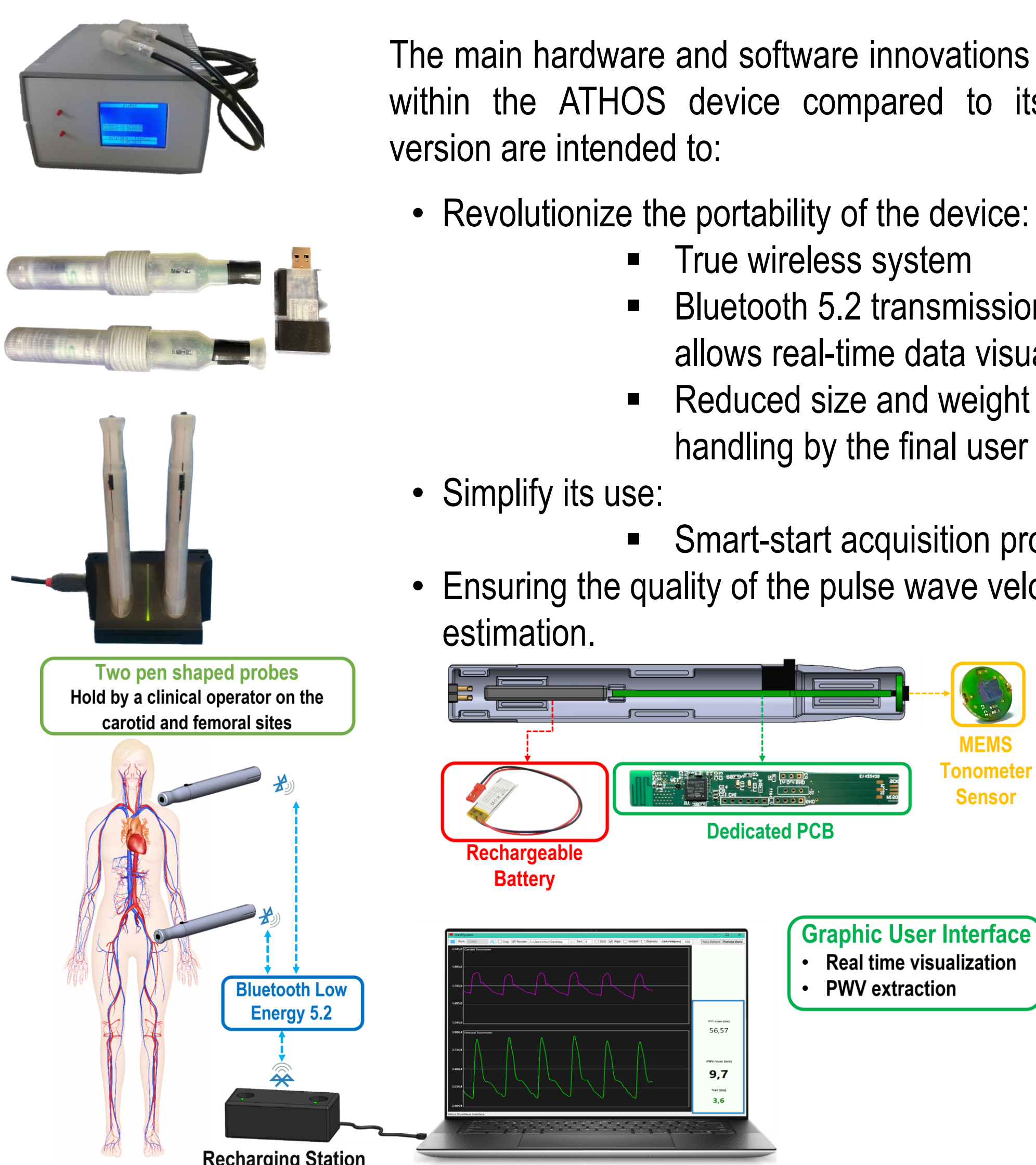
Addressed research questions/problems

- The project aims to develop a true-wireless system to perform a reliable assessment of the PWV
- Reduce the time required per each patient to perform the measurement
- Simplify the usage of the device in the clinical environment
- The opportunity to surpass present technologies' limitations and cut expenses

Novel contributions

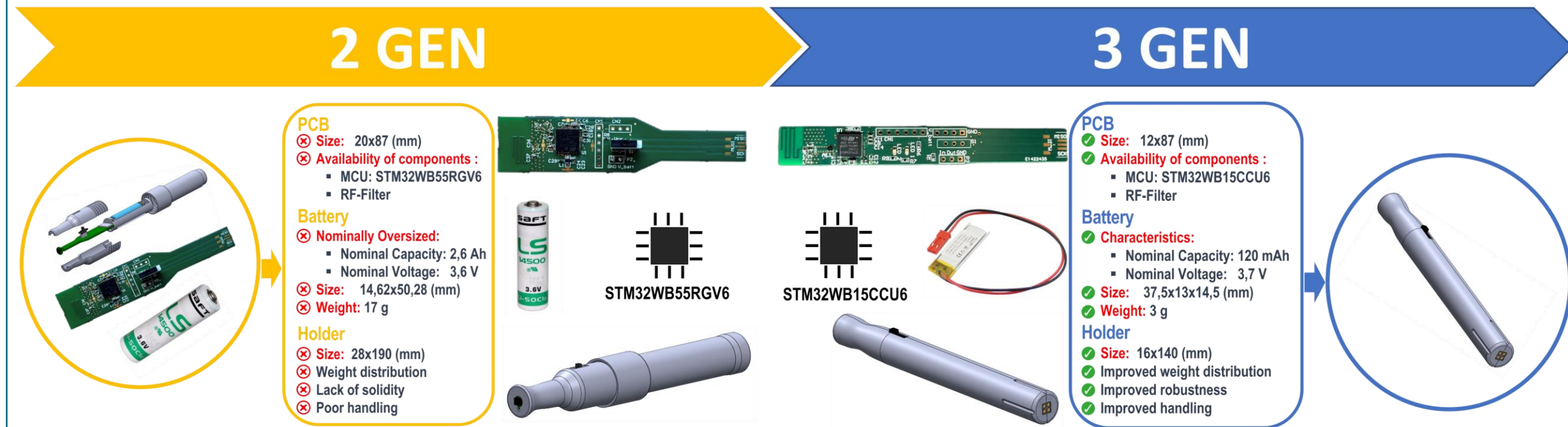
The main hardware and software innovations introduced within the ATHOS device compared to its previous version are intended to:

- Revolutionize the portability of the device:
 - True wireless system
 - Bluetooth 5.2 transmission protocol allows real-time data visualization
 - Reduced size and weight to improve handling by the final user
- Simplify its use:
 - Smart-start acquisition procedure
- Ensuring the quality of the pulse wave velocity estimation.



Adopted methodologies

Probes

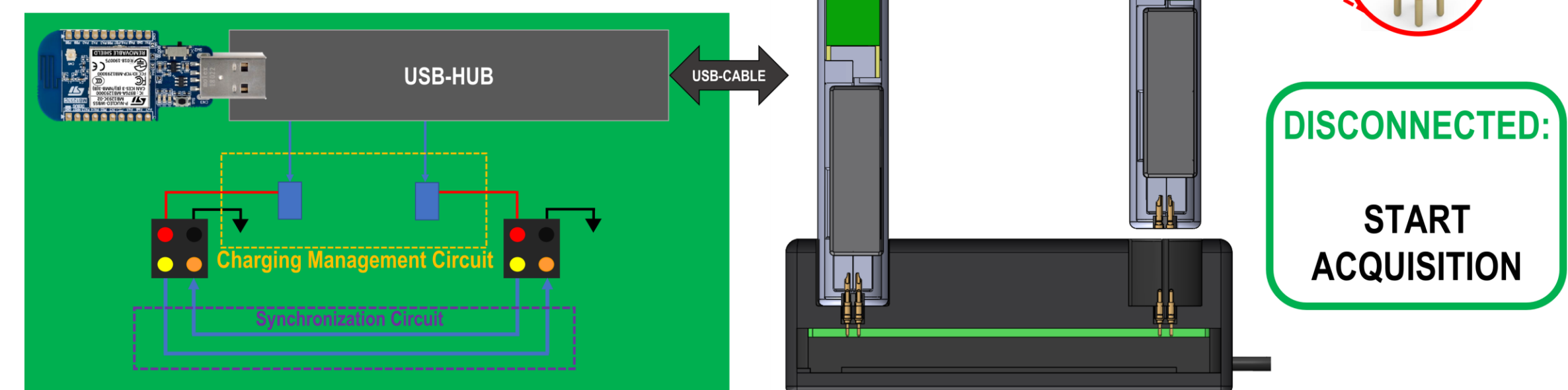


- Re-design of the PCB used in each probe
- Optimization of the MCU used by the system
- Replacement of previously used battery
- Deployment of the recharging system
- Re-design of the starting acquisition procedure

Recharging station

The recharging station is composed by three main sections:

- The charging circuit used to recharge the batteries inside the probes
- The synchronization circuit used by the system to start the acquisition when one of the two probes get disconnected by the user
- The USB-Dongle used to perform the Bluetooth connection with the probes. In particular:
 - Starts and manages the connection with the peripheral units (probes)
 - Transmits the commands given by the user through the graphic user interface
 - Manages the reception of data collected by the sensors, then, it sends them to the GUI for the real-time visualization and PWV extraction



Future work

- Validation in the clinical environment of the
- Investigation of new sensors to be used for the pulse wave velocity assessment
- Development of an operator independent designed system for PWV monitoring through wearable sensors
- Development of new algorithms to get a fully reliable estimation of the PWV.

List of attended classes

- 02QRNRV – Electromagnetic dosimetry in MRI: computational and experimental methods (5/5/2021, 5)
- 01RHCRV – Principi, materiali ed applicazioni della robotica nella biomedicina (29/6/2022, 3)
- 01DUCRV – Principles of digital image processing and technologies (22/7/2022, 5)
- 02SFURV – Programmazione scientifica avanzata in matlab (25/5/2021, 6)
- 01LEXRP – Strumenti e tecnologie per lo sviluppo del prodotto (28/6/2022, 5)
- 01DNHRV – System level low power techniques for IoT (15/7/2022, 4)
- 01RGGRV – Telemedicine and Distributed Healthcare (7/4/2022, 4)
- 01QEZR – Sviluppo e gestione di sistemi di acquisizione dati (23/9/2022, 5)
- 01RRPRV – Lean startup e lean business for innovation management (15/7/2021, 4)
- 02LWHRV – Communication (31/8/2021, 1)
- 01SHMRV – Entrepreneurial Finance (2/9/2021, 1)
- 08IXTRV – Project management (27/8/2021, 1)
- 01RISRV – Public speaking (30/8/2021, 1)
- 01SWPRV – Time management (25/8/2021, 1)

Submitted and published works

- A. Valerio, I. Buraoli, A. Sanginario, D. Leone, G. Mingrone, A. Milan, D. Demarchi, "Live Demonstration: Wireless Device for Clinical Pulse Wave Velocity Evaluations", IEEE BioCAS 2022, Taipei, 2022.