DIAMOND

DC12

PhD Enrolment: University College Dublin
Duration: 36 Months
Specific Deliverable: SD3.1, SD4.1
Time Input: [WP4 40% WP5 60%]

Secondments:
Host: UNIBO, Federica Zonzini, (M13-M18), 6 months training in on-chip computing and sensor fusion driven optimisation to enhance developed solutions.
DC12S3: Host: ST, (M31-M33), TBD, 3 months on-chip hardware training.

Development of intelligent surgical micro-drills

Context

Low-power, rapid sensing to create effective devices for monitoring linked to analytics will be addressed for the biomedical sector through design and test of next generation micro-drills, which are extensively used by neurosurgeons, paving a new "design & test" pathway and eventual standardization.

Objectives (Ob):

Ob1: Develop micro-drills with intelligent feedback and control of force and torques to significantly reduce vibrational trauma to sensitive structures such as cochlea via development of nonlinear dynamics models and establishing their stability regimes.
Ob2: Implement a sensory-guided system to detect and adapt to different tissue types and states in real time, enabling precise control over drill penetration depth and avoid unintended damage to delicate membranes and tissues.
Ob3: Develop a micro-drill system with customizable grip options and adjustable control to accommodate a range of hand sizes, grip strengths, and other user preferences among

surgeons, improving ease of use, reduce surgeon fatigue, and support precision in long procedures, especially for variations in surgeon ergonomics (e.g. gender variability, individual hand dimensions).
Ob4: Develop a micro-drill system with adjustable drill sizes and customizable penetration depths or diverse cochlear anatomies and surgical needs, enabling surgeons to tailor drilling process to individual patient needs, improving precision and reducing risks in complex procedures.

Expected Results (R):

Design, testing and application framework for next generation micro drills.
R1. Experimental demonstration of light-weight sensors with on-chip dynamics measurements of micro-drills.
R2. Integratinng sensor data in feedback loop with on-chip computing platform, adjust the drill speed, force, and torque based on real-time feedback and optimizing performance while preventing damage to sensitive tissues.
R3. Demonstrate developed system for neurosurgery scenarios.
R4. Extend microdrills capabilities with safer surgical outcomes, preserving delicate tissues and minimizing complications associated with traditional drilling.

Contributions for Recruited Researchers over 36 months

Living Allowance: €1960707.04
Mobility Allowance: €25560
Family Allowance: (where relevant) €17820

This position and related financial contributions is subject to the commencement of the project and agreement signed.

For more information, please contact Dr Aasifa Rounak or Assoc Prof. Vikram Pakrashi.

To apply, interested candidates should send a copy of their CV and a covering letter aligning to the project, with a short section on how you will approach the problem to Assoc Prof. Vikram Pakrashi by 25th December 2025.
You can also provide references, exam results/transcripts and/or any sample work, but this is optional.