XR for Improving Cardiac Electrophysiology Procedure

Nisal Udawatta
School of Engineering and Computer Science
Victoria University of Wellington
nisal.udawatta@vuw.ac.nz

Supervisors: Dr Craig Anslow and Dr Brian Robinson

Problem

Cather ablation is the best available therapy to cure a life-threatening pathology called arrhythmia. Although this minimally invasive procedure is much beneficial for patients, this is challenging to perform and even more challenging to master the required skills. Each of the scenarios has its own challenges.

Scenario 1: Intraoperative
(An electrophysiologist conducts the procedure with the help of an operator)
- Lack of 3Dness in 2D screens
- Distant screen positions
- Thinking interruptions due to operator assisted visualization manipulation
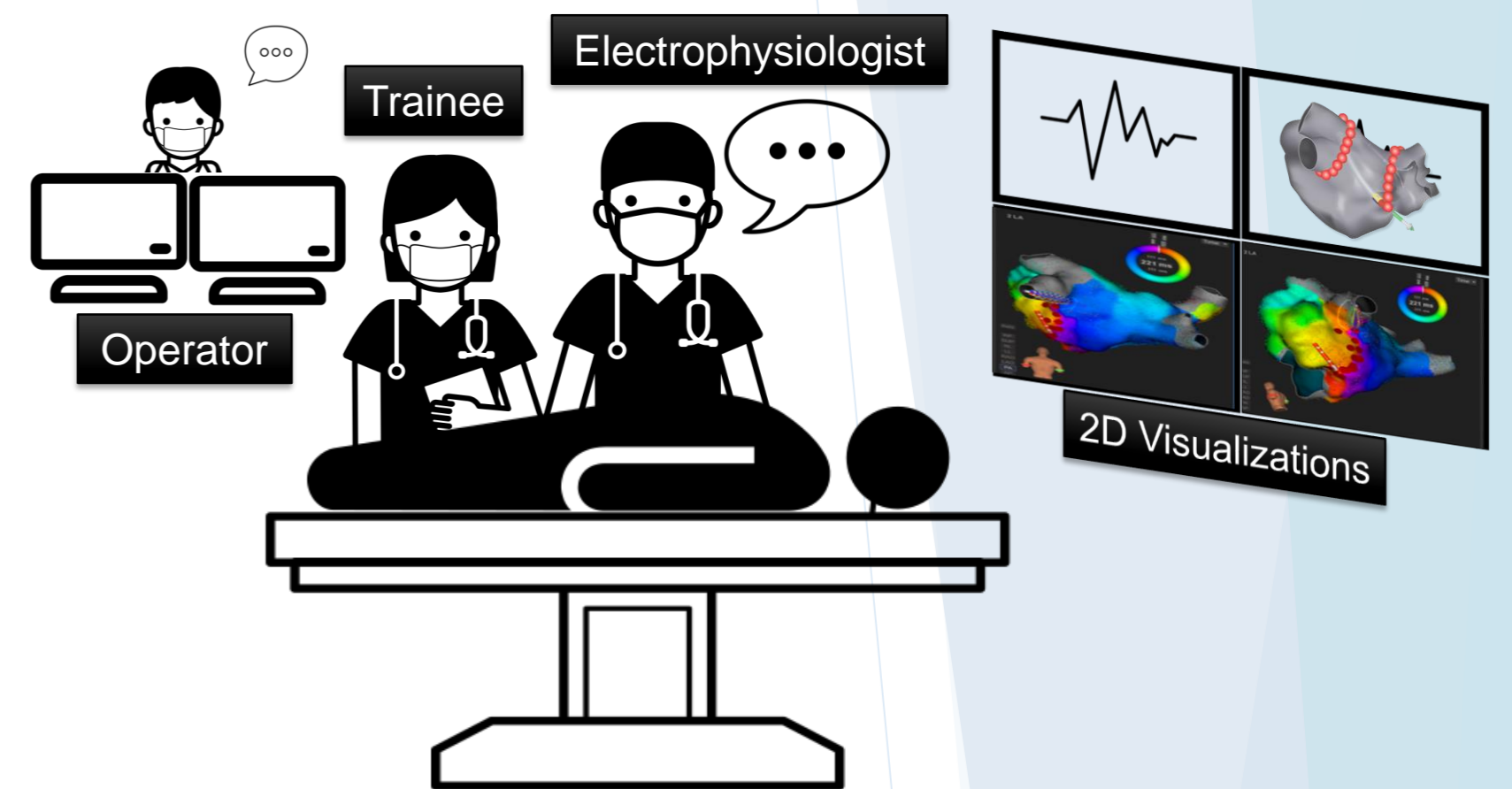
Scenario 2: Procedure Training
(A trainee fellow involved in clinical training supervised by an electrophysiologist)
- Reduced training time
- Increased procedure time
- Mentorship disparities
- Patient risks

We aim to solve these problems by developing an **Extended Reality (XR)** (combination of **Augmented Reality - AR** and **Virtual Reality -VR**) software. XR is increasingly used in medical/surgical HCI research contexts to improve immersive visualization and interaction. Compared to the current medical simulation technologies XR provides portable low-cost immersive solutions.

Design

We will develop XR software solutions for both of the scenarios.

Scenario 1: Intraoperative Guidance System (AR)

AR-based guidance for the electrophysiologists during the procedure.

- Visualize 3D models in 3D
- Convenient positionings
- Self interactions
- No thinking interruptions
- AR technology see-thoroughness allows the user to see the real operating room.
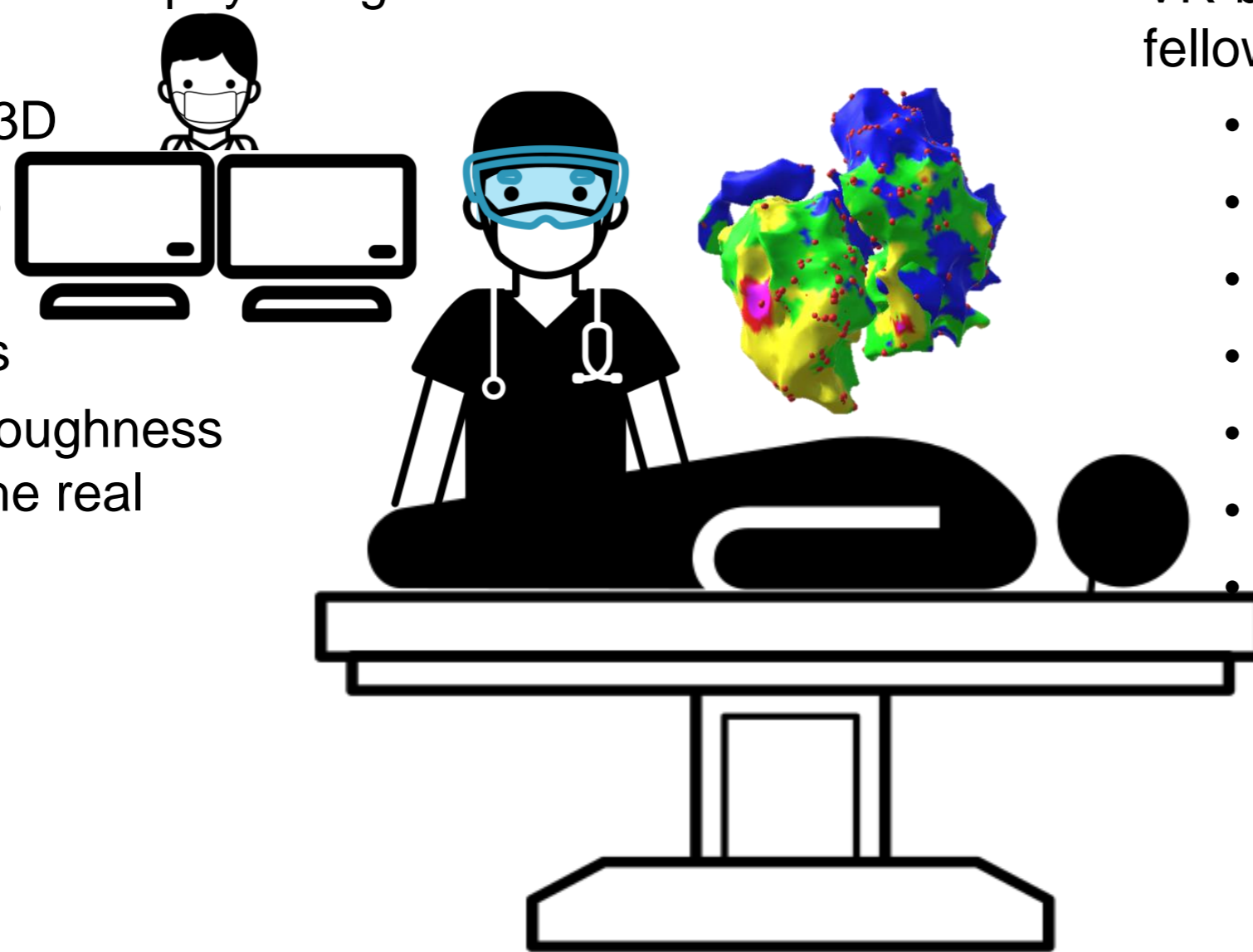
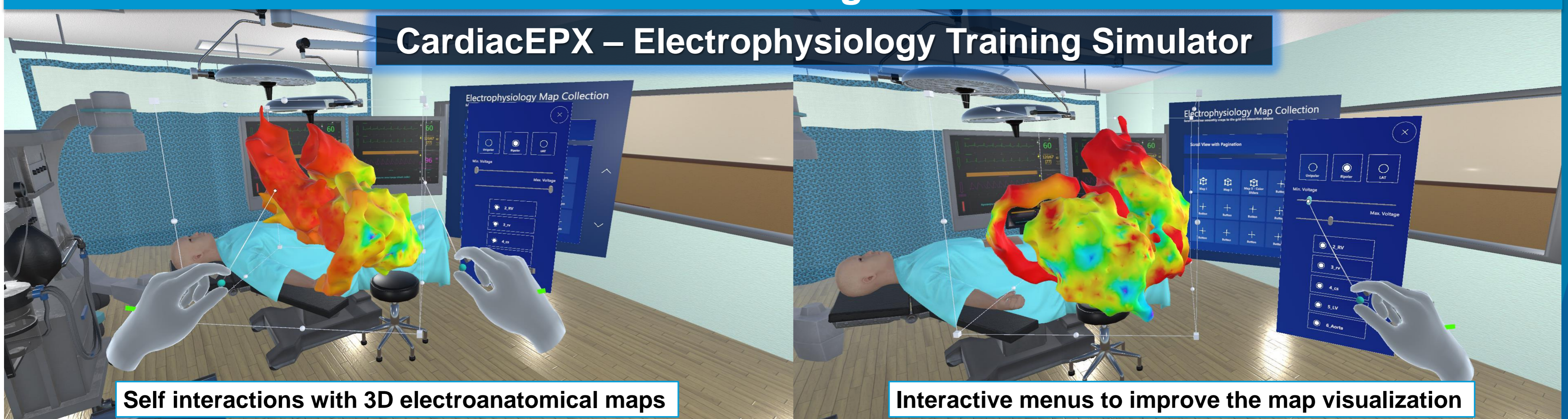**Scenario 2: Procedure Training Simulator (VR)**

VR-based training simulation for electrophysiology fellows to master skills.

- Immersive environment
- Training with actual tools
- Risk-free environment
- No time limitations
- Personalized training
- Repeatable tasks
- Wide content learning
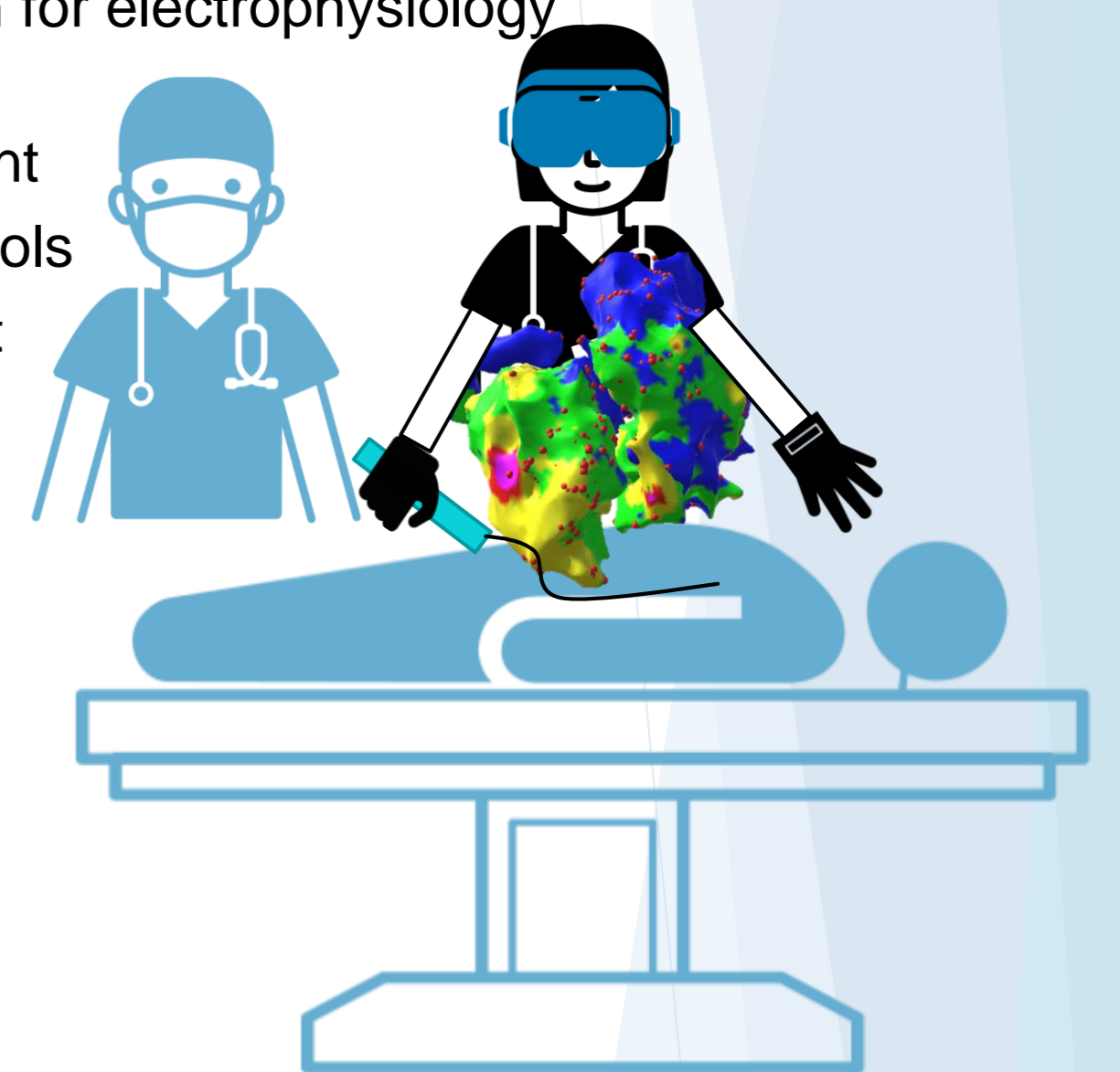
Current Progress

CardiacEPX – Electrophysiology Training Simulator

Self interactions with 3D electroanatomical maps

Interactive menus to improve the map visualization

- **XR software development – "CardiacEPX – Electrophysiology Training Simulator"**
  - ✓ VR technology
  - ✓ Immersive operating room environment
  - ✓ Visualize 3D electroanatomical maps (Carto3) in 3D VR space
  - ✓ Self-interactions to 3D maps
  - ✓ Interactive menus to improve the visibility of the heart's electrophysiology

- **Interviews with Electrophysiologists** - Semi-structured interviews were conducted with seven electrophysiologists (approximately 20 Electrophysiologists in NZ)
  - Most of the participants (06 out of 07) think the **procedure training simulator** will add more value to the field of cardiac electrophysiology.

In summary, the research aims to design and develop an extended reality software solution to improve the cardiac catheter ablation procedure.