Monitoring the Surgical Team: Approaches and Challenges

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Introduction

- **Situation awareness (SA)** is an **essential construct in the operating room (OR)** that impacts decision-making and medical outcomes: **poor SA can lead to medical errors**.
- **Existing methods** to assess SA rely on questionnaires and 'freeze-probe' techniques: **not suitable during a surgery and unreliable**.

Goals

Develop an intelligent **real-time** system to:

- **Automatically assess SA, stress, and mental workload**.
- **Suggest useful interventions and recommendations** for maintaining and restoring SA, decreasing stress and mental workload.

First study - Plan

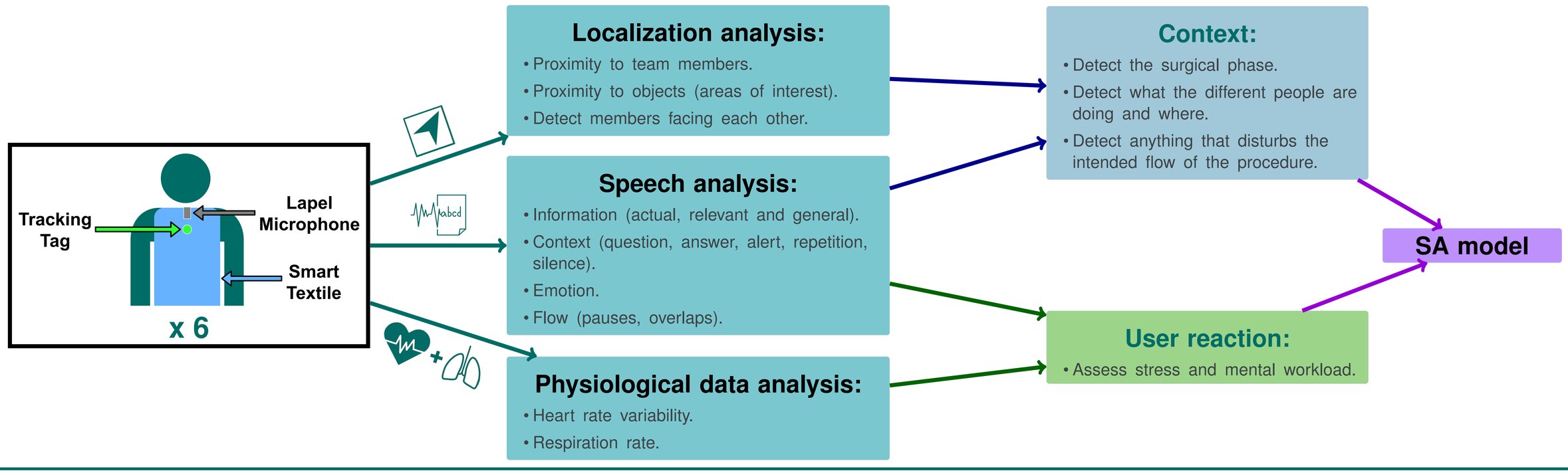
Context: Liver Transplantation

- **Long**, **difficult**, and **stressful** surgery.
- Requires a lot of **cognitive skills**: e.g., choose appropriate technique and pace for dissection, assess appearance of the liver, decide what to do if the patient is unstable.

Surgical Team

- **Surgeons**, **anesthesiologists**, and **nurses collaborate actively** to perform the surgery.
- **Responsibilities** and **knowledge** of the situation are **shared** among team members.

Overview of the setup



Collection platform: Microsoft Platform for Situated Intelligence.

Challenges

- Many constraints to develop a non-invasive and comfortable setup.
- Difficult to collect multimodal data in real time.
- Very complex to build a reliable model (e.g., extract appropriate features, use suitable multimodal machine-learning techniques).

Baseline:

- Physiological data of at least the 30 min before the surgery.
- Questionnaires about daily details (e.g., quality and duration of sleep, amount of caffeine consumed, time of last meal).

Benchmark:

- Workload (NASA-TLX), stress (STAI-6) and SA (SART) right after the surgery.
- Self-confrontation and/or expert's rating.

Additional approaches for future studies

Approach	Advantages	Challenges
Eye tracking	Gold standard for cognitive load	Adapt to surgical loupes
IMU	Assess posture and gestures	Use them without interfering with surgical gestures
GSR/EDA	Gold standard for stress	Designed to be worn on the hands/wrists which is incompatible with open surgery

Conclusion

Many remaining technical challenges to:

- **Advance understanding of team SA in surgery**.
- Provide real-time **feedback** and **suggestions**.

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