Smart objects for upper limb monitoring of stroke patients during rehabilitation sessions.

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Objectives

- Monitoring during rehabilitation session.
- Collect objective data of the upper limbs.
- Based on ARAT checkup protocol. [2]
- Provide visualization tools for the therapist.

Design Process

Identification

- A Cube for hand prehension
- A Jack for fingers prehension
- A watch for pendulum exercise
- A smart cup for arm coordination

Instrumented objects ecosystem

- Sensors:
  - 6 FSR (Force Sensing Resistor) for force
  - IMU (Inertial Measurement Unit) for orientation

- Monitored Information:
  - Movements of the arm
  - FMR for movements

Monitored information and sensors

- Cube for hand prehension
  - Monitored Information:
    - Force applied on the cube
    - Orientation and tremor during manipulation
  - Sensors:
    - 6 FSR (Force Sensing Resistor) for force
    - IMU (Inertial Measurement Unit) for orientation and tremor

- Smart cup for arm coordination
  - Monitored Information:
    - Force applied on the cup
  - Sensors:
    - IMU for orientation and tremor

Implementation

- Cube
- Watch
- Jack
- Smart Cup

Visualization tool

- Real-time monitoring
- Local data recording
- Easily analyze patient’s data

Conclusion & Future Work

Conclusion

✓ Design of instrumented objects for data collection during rehabilitation session.
✓ Implementation of the devices and visualization tools in progress.
✓ Recording of objective data about the patient upper limbs state.

Forthcoming Research

✓ A study is planned with patients and therapists to validate the tools
✓ Update therapists interface according to feedback
✓ Perform machine learning on the collected data to predict relapse

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References