ISTITUTO
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Scuola Superiore
Sant'Anna

Data collection and processing for a multimodal Learning Analytic System

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SEVENTH FRAMEWORK
PROGRAMME

Scuola Superiore Sant'Anna, Pisa
TeCiP Institute
PERCRO Lab

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Practice-based Experimental Learning Analytics Research and Support

A EUROPEAN PROJECT LOOKING AT HOW TEACHER, LEARNERS AND TECHNOLOGIES CAN SUPPORT ONE ANOTHER IN HANDS-ON LEARNING OF SCIENCE, TECHNOLOGY, ENGINEERING AND MATH.

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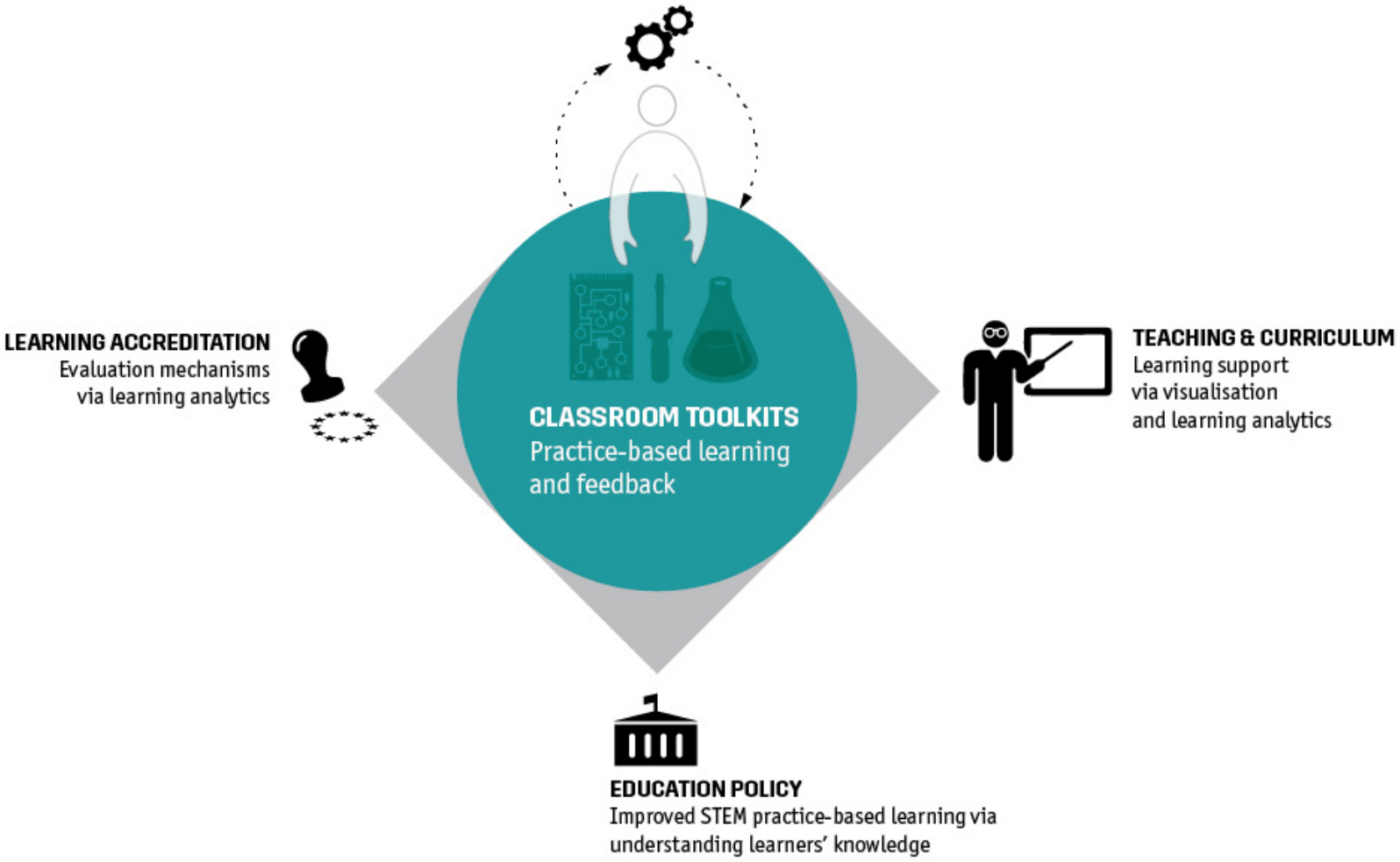
PERCRO Perceptual Robotics Laboratory

PELARS

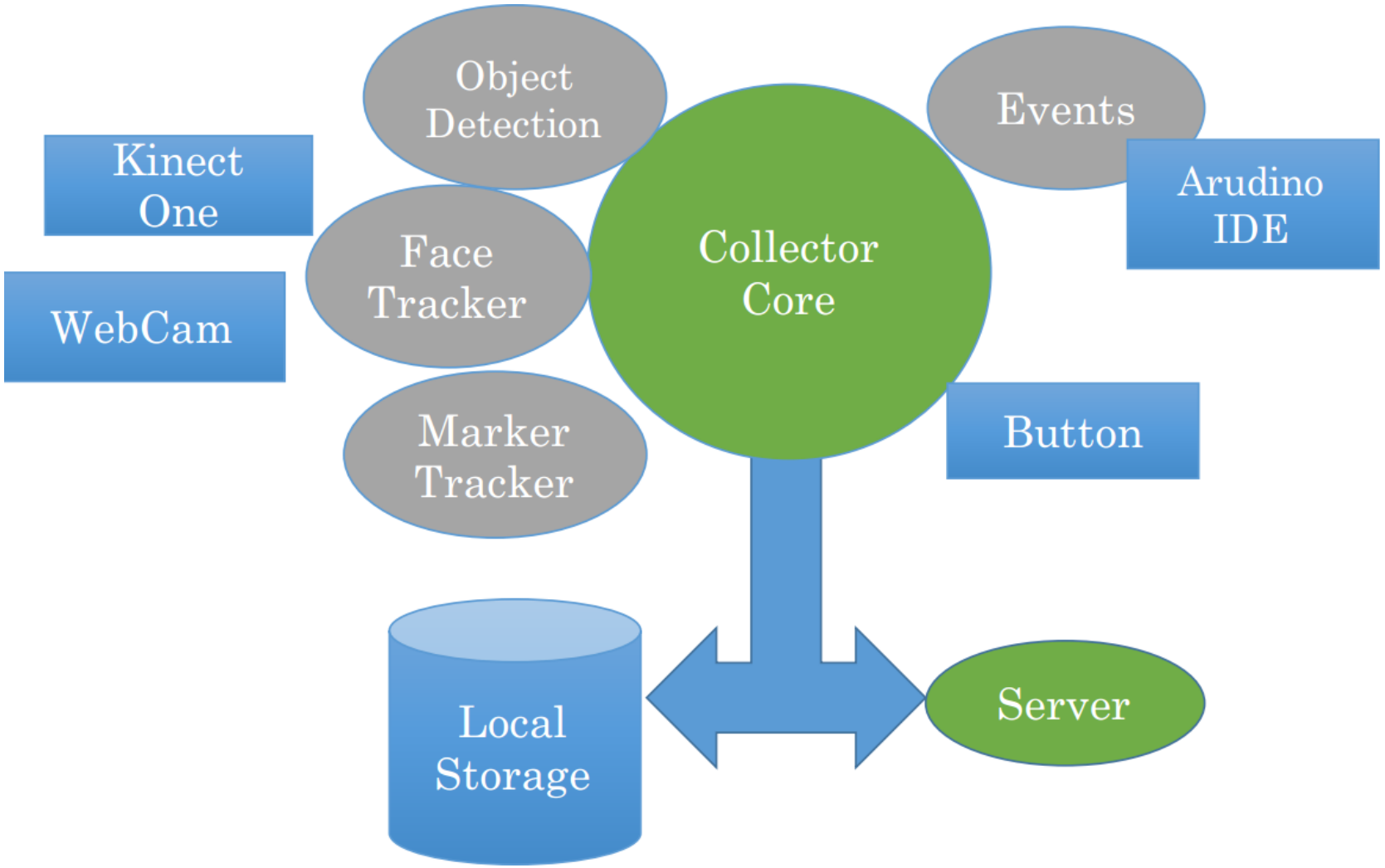


Introduction

The system is designed to:

- Acquire raw data from a set of sensors.
- Send data to a remote server.
- Process remotely data to produce learning traces.
- Produce visualizations for the different stakeholders (Teachers, Students, Reseachers)

Overview



Overview

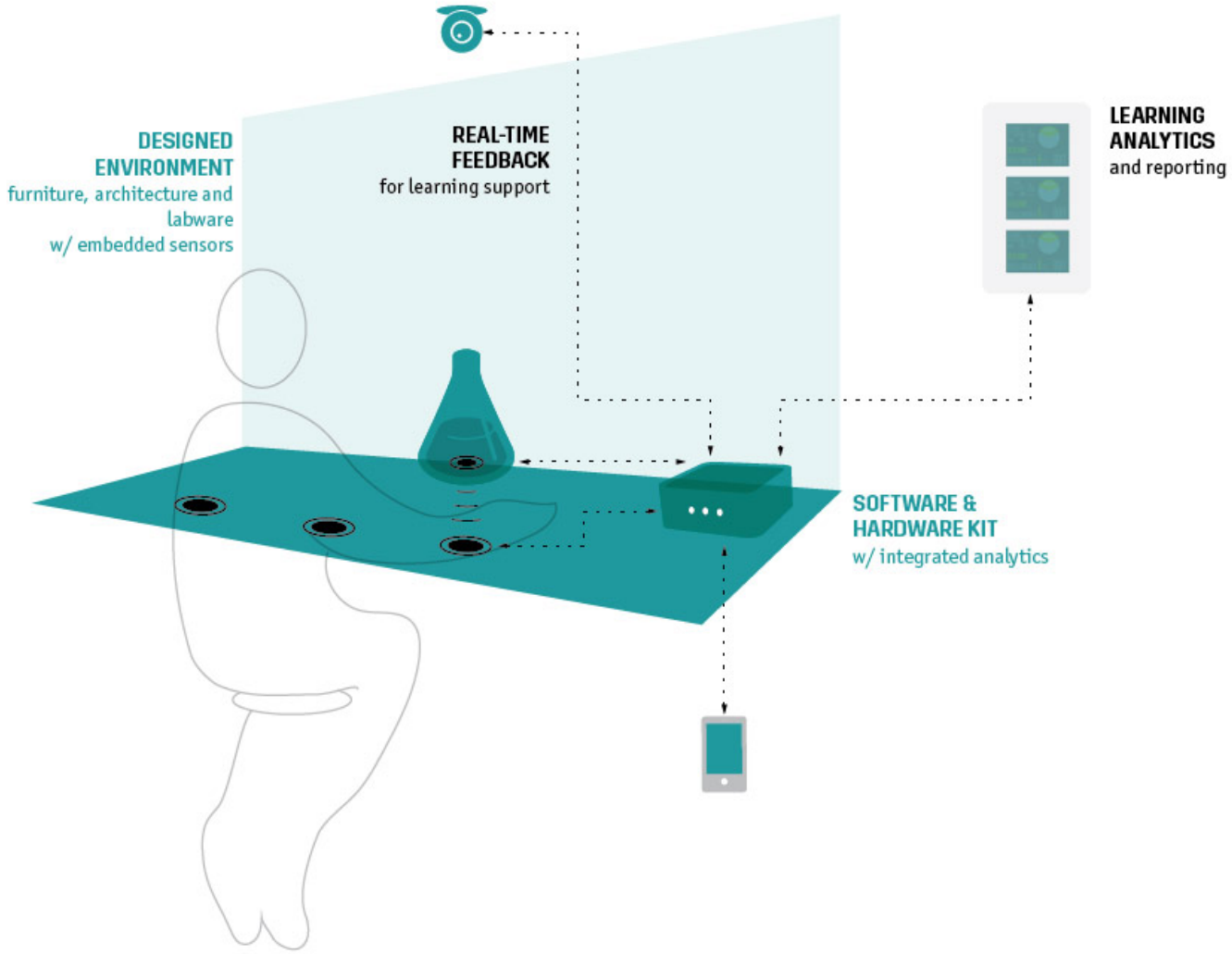
- One central server
- Multiple clients
  - Single computing machine
  - Multiple sensors
  - Mobile app

Scalable architecture

Client

- Standalone C++ executable running under Linux.
- Distributed as opensource project on github.
- Runs inside a Docker virtual machine.
- Works online and offline.

Client

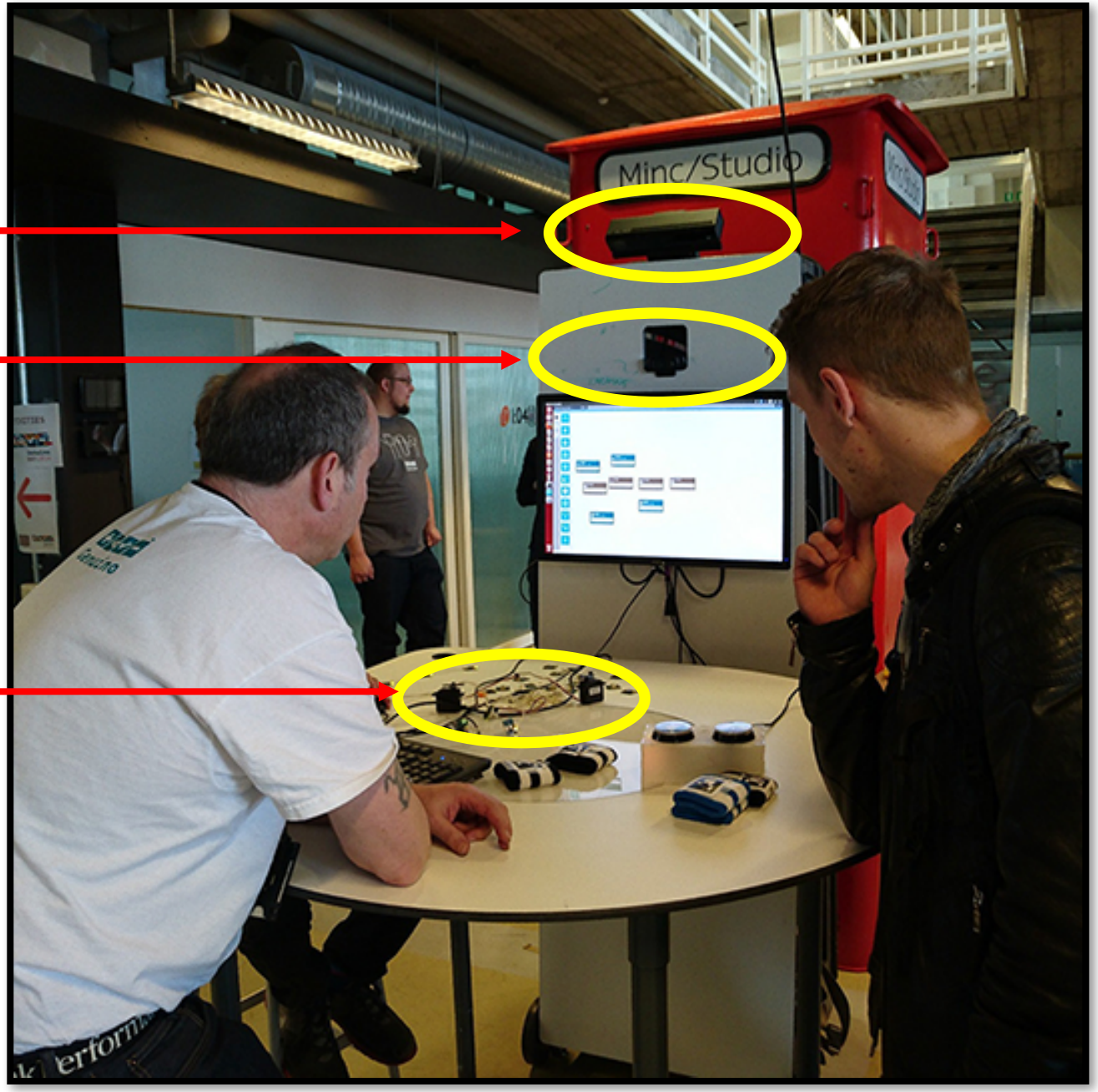


Client

C920

Kinect2

Arduino kit



Client

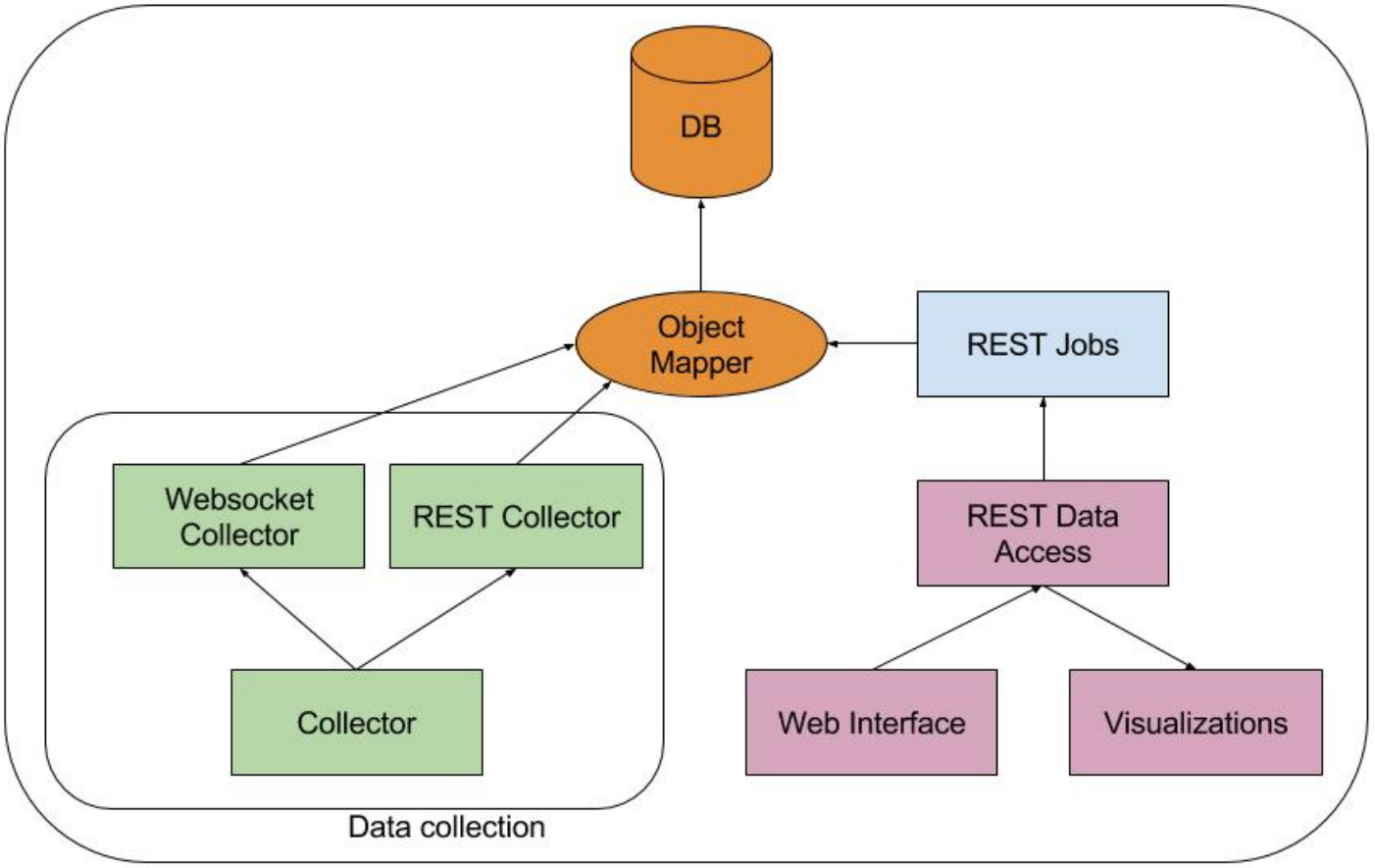
Low level data acquisition :

- Hand tracking using Aruco markers.
- Face detection using openCV gpu detector.
- Audio power level recording.
- Arduino ide log.
- Sentiment button interaction.
- Particle.io events.
- Video recording from kinect2 and webcam.
- Object recognition.

Server

- Coded mainly in Java and javascript.
- Two separate collector endpoints:
  - Websocket for data streams
  - Servlets for single requests
- Mysql database for persistence.
- Hibernate object mapper.

Server

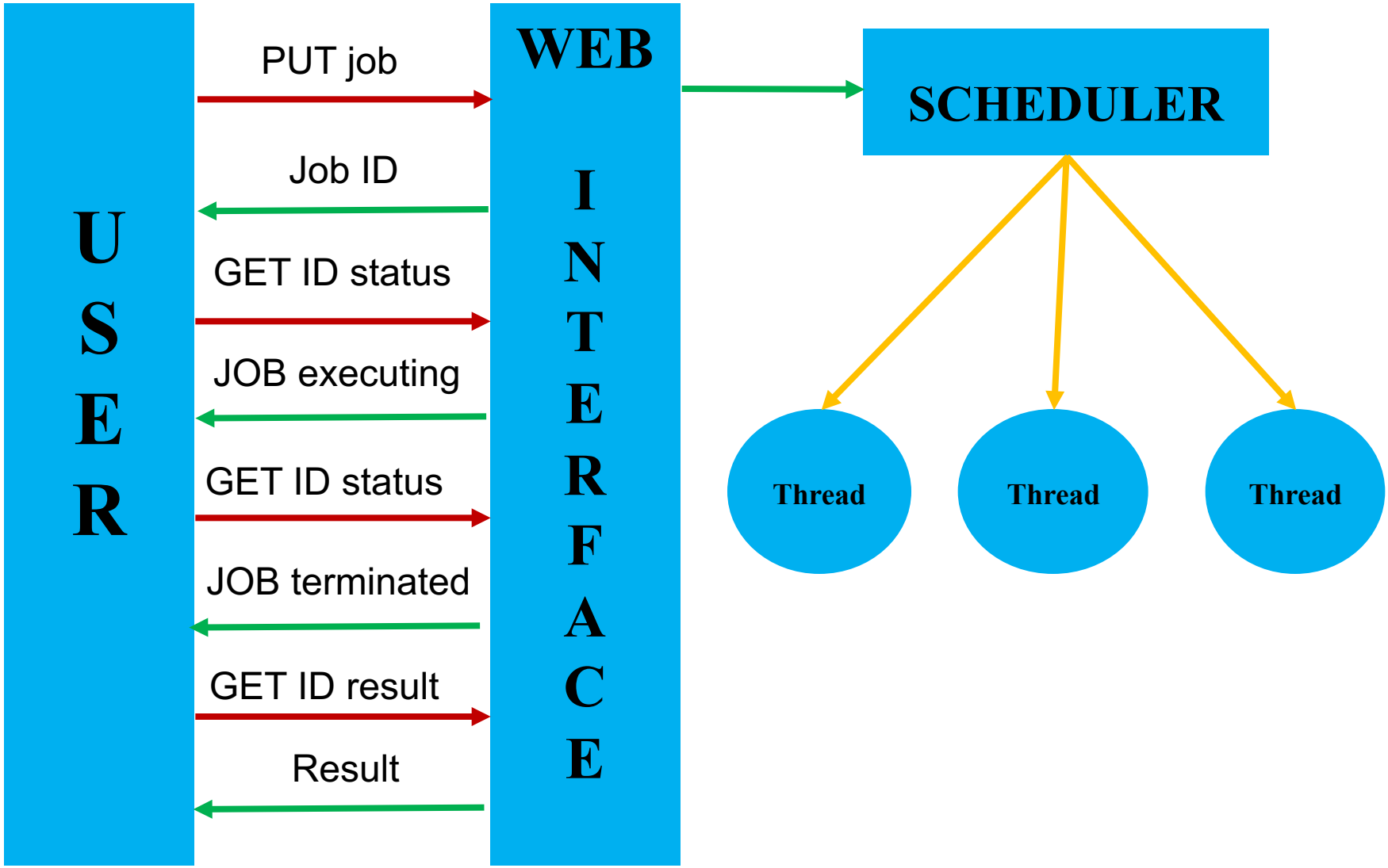


Server web interface

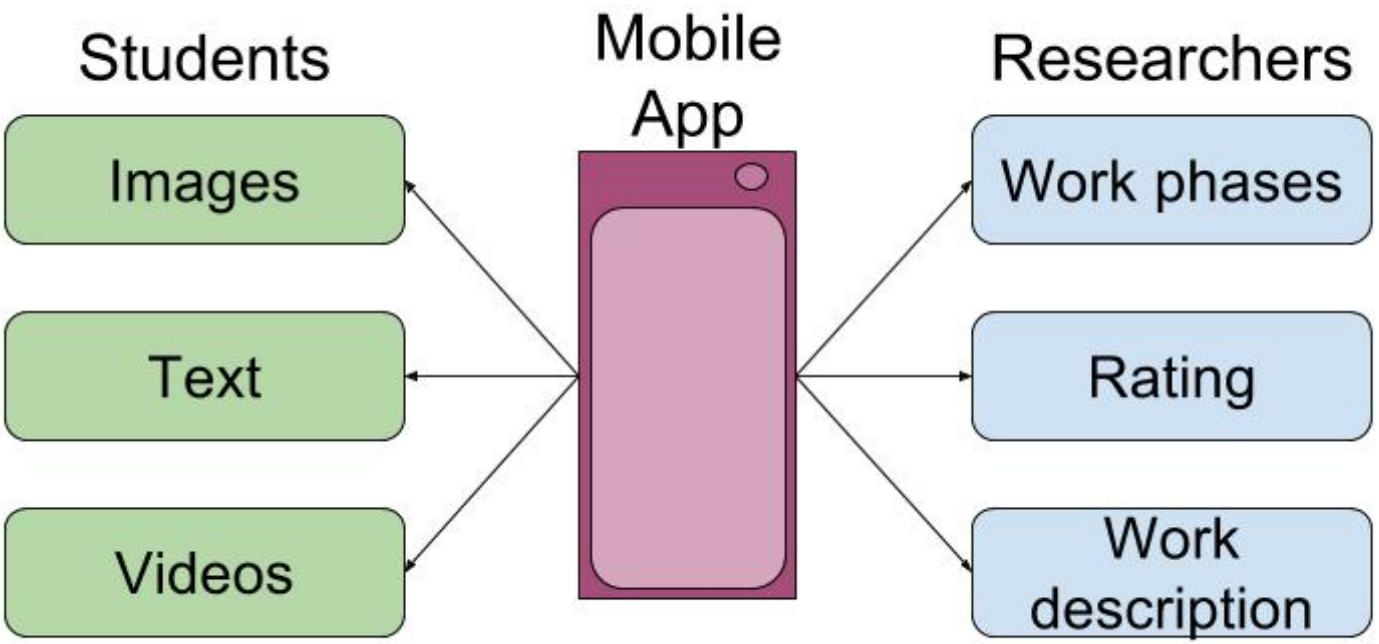
The server supports

- REST operations on the db data
  PUT/GET/DELETE based on User Acess Control
- Batch jobs
  - Single valued and Data streams
- Computation of learning analytics
- Produces dynamic visualizations

Jobs



Mobile app

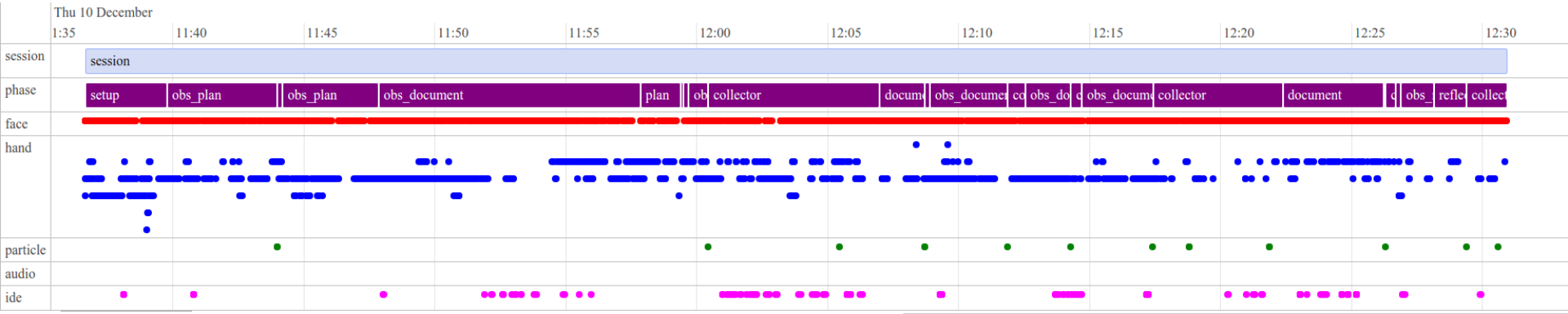


Visualization

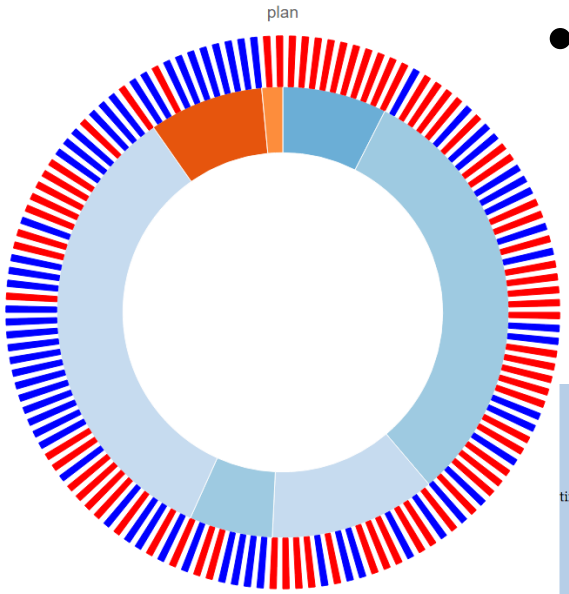
Support for different visualizations based on stakeholders

- Data timeline
- 3D data visualization
- Storyboard
- Piechart
- ...

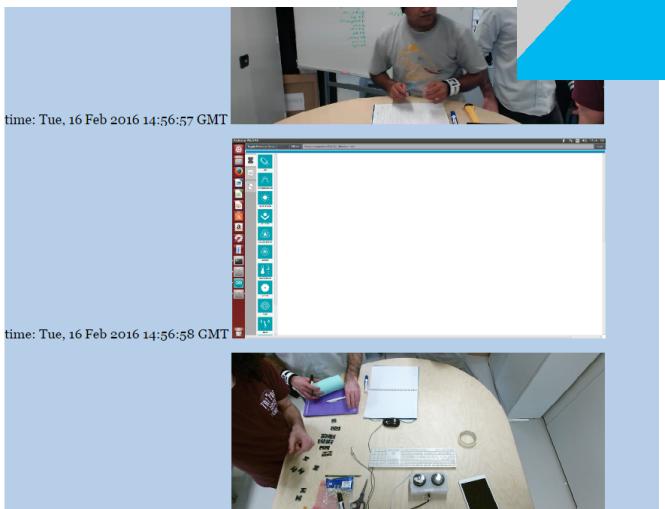
Visualization

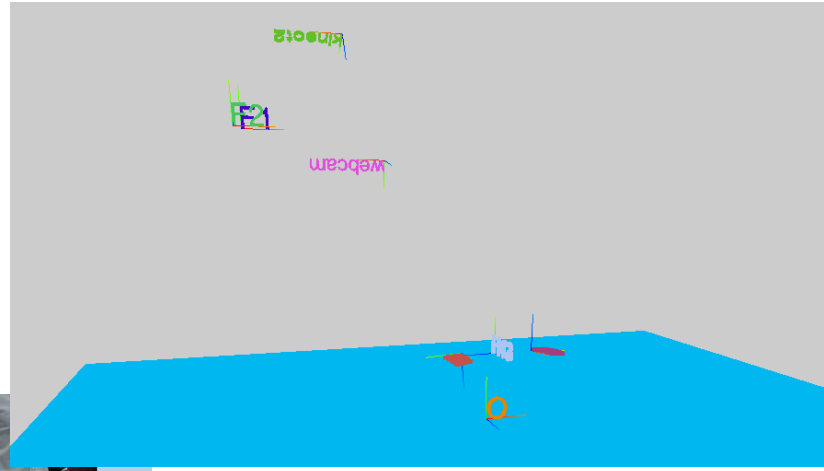


- Timeline



- Piechart





- 3D viewer

- Storyboard

Results

- 33 trials
- 83 students
- 6 different locations
- 36 hours of recording
- 58 min average session length
- 15GB of collected data

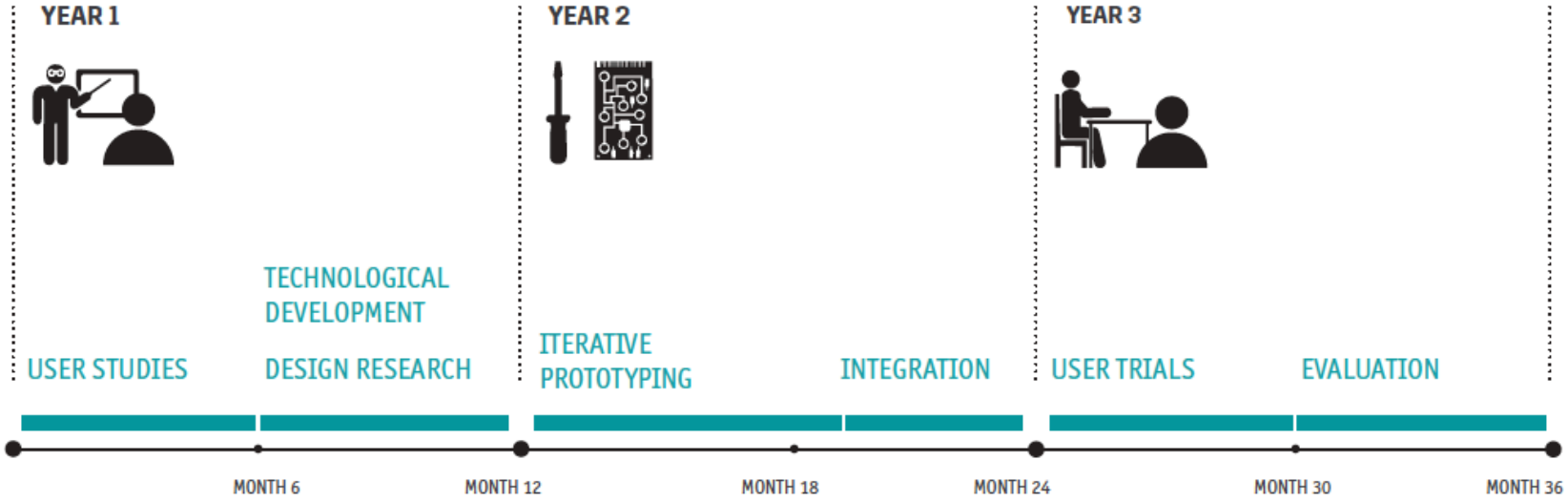
Technical Challenges

- Distribution and installation
- Integrate all data sources
- Offline vs Online system state
- Quick bug fixes
- Computer science experts vs learning experts
- Data timing and integrity

Research Challenges

- Extract “Analytics” from unstructured sessions
- Identify patterns of behavior
- Identify groupwork

Future work



- Extract new learning analytics after trials
- Create and evaluate visualizations
- Debug system

Thank you!

Questions?