CAT-SL - An open source global approach for Sign Language teaching

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About CAT-SL

- According to the European Union of Deaf, more than 750.000 deaf SL users live in EU, while only 12.000 interpreters are registered.

- In Greece and Portugal more than 60% of the deaf children have extremely limited reading and writing skills.

- Therefore, the educators need to receive appropriate training in Sign Languages, the native languages of the Deaf, so that they are able to communicate with them and to teach them how to develop linguistically.

- However, it is hard for Higher Education Institutes to find and employ as tutors experts in Sign Language, so many educators are not adequately trained as students to face the challenges of communicating with deaf children in the classroom.

About CAT-SL

- **CAT-SL** (Computer Assisted Teaching of Sign Languages using Computer Vision and Machine Learning) is a 3-year project co-funded by the Erasmus+ programme of the European Union, started in 2020 and it involves 5 partners across Europe.

- CAT-SL aims to give appropriate training in sign languages to teachers, so that they will be able to communicate effectively with their students.

CAT-SL Partners

- **Coordinator**: University of Patras, Greece

- **Partner**: Insituto Superior de Engenharia do Porto, Portugal

- **Partner**: Hellenic Mediterranean University, Crete, Greece

- **Partner**: Cyprus University of Technology , Limassol, Cyprus

- **Partner**: Royal Dutch Kentalis, Netherlands

CAT-SL Objectives

- To develop an innovative and affordable system/service for interactive SL teaching for students in Special Education/Pedagogical departments and primary school education. The system will be based on computer-vision, machine-learning, linguistic technology, and avatars.

- To set up the CAT-SL infrastructure in four Higher Education Institutes (one for every partner), and one primary education one, based on open standards; to enable its practical use by teachers and students.

- To develop curricula and guides for teaching SL using the CAT-SL system for at least two multilingual courses, in Greece, Cyprus, Portugal and Netherlands; to support the social inclusion of the deaf children.

- To actively disseminate the project results through the promotion of workshops with stakeholders in the EU to raise awareness on the main challenges faced by the Deaf.

CAT-SL Target groups

- The students of Special Education university departments, aiming to learn how to use and teach SLs to deaf children.

- The primary school pupils who aim to learn how to use the SLs.

- The course administrators, who may be university professors teaching SLs in Special Education departments, as well as educators in public or private organizations involved in SL teaching or Deaf education.

- The teachers, who may be university professors or educators, as in the previous case.

- The system administrators, who will be able to set up and maintain the system.

CAT-SL Outputs

Intellectual Output 1

A research study will be developed which will extensively analyze the:

- requirements to incorporate specific teaching curricula based on practices followed in four countries and at EU level.

- requirements on capturing user body motion and level of detail (e.g., hand/body/head motion, facial expressions etc.). The morphological, syntactic and semantic rules of the SLs will be extensively considered and encoded.

- requirements on how to display feedback to the users, e.g., how should the avatar visualize the body motion, how should it highlight errors, how should it evaluate the students.

- incorporation of serious games to offer a more playful environment, especially for the younger users.

- investigation of the challenges in the above process as well the challenges for the teacher - student communication.

CAT-SL Outputs

Intellectual Output 2

- The CAT-SL Automated Sign Language Teaching System for European SLs will be developed here.

- A server-based learning service will be developed. The same system will be available as stand-alone as well. The development will be based on the analysis given in O1.

- One-by-one the user requirements will be mapped to design requirements. Then the design requirements will be mapped to software modules. The software modules will be integrated into a system to offer an educational service for learning SLs.

- The user will be able to access the service by connecting a depth sensor or a color web camera.

CAT-SL Outputs

Intellectual Output 3

- The Sign Language Learning Curricula will be developed here.

- We will develop interactive material two cover at least two SL courses in three different languages: Greek (including Cypriot dialect), Portugese and Dutch.

- The development will be based on the analysis given in O1.

- The user will be able to access the material by connecting to the CAT-SL platform based on Moodle. The learning curricula will include theoretical background and practical exercises in the form of serious games. Lessons can consist of concepts, types of words or signs. Such as: finger spelling: A to Z and numbers, signs: People, Objects, Places, etc, communication scenarios (greetings, friendly conversation, hotel, train station, doctor, bank etc.).
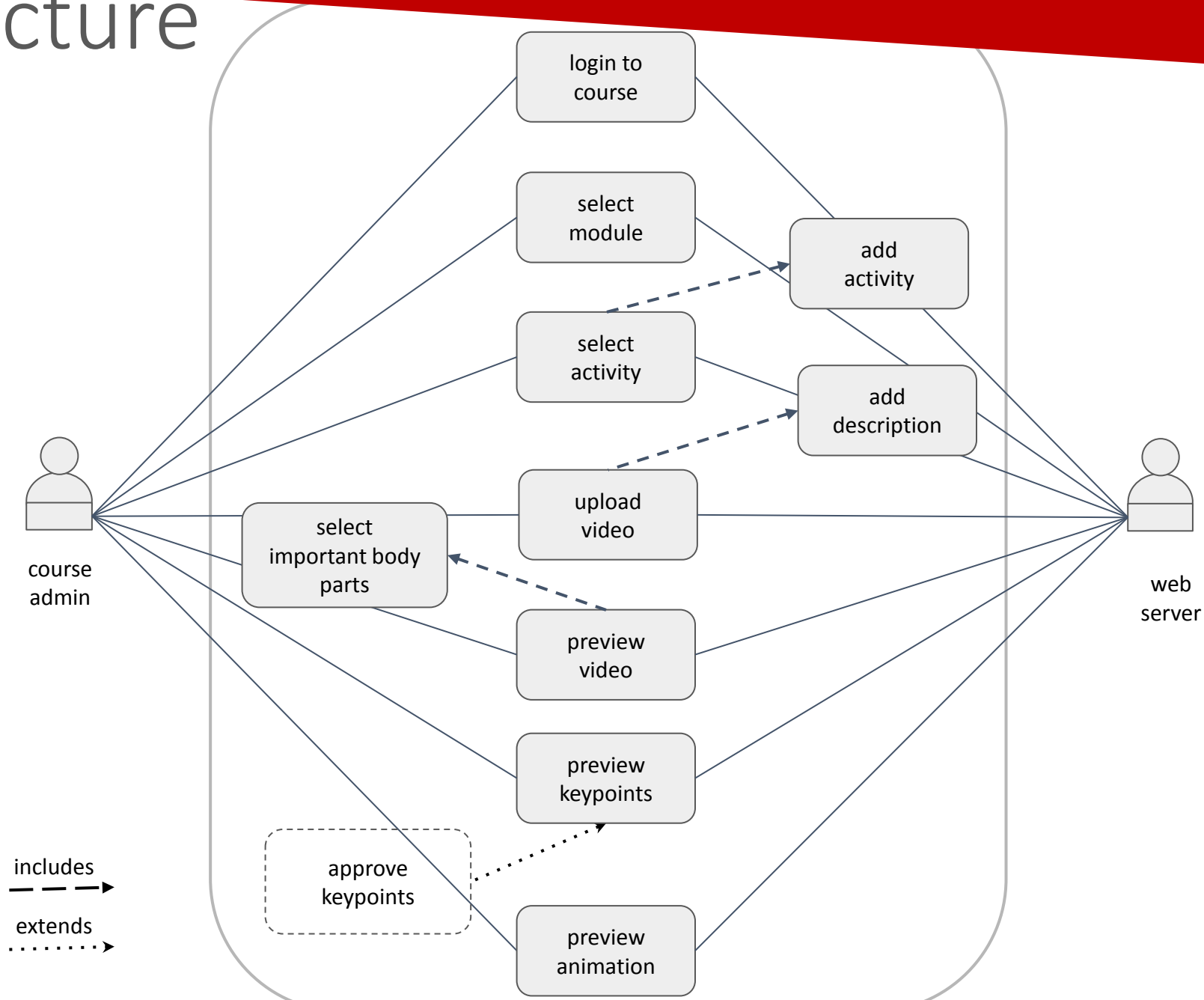
CAT-SL Outputs

Intellectual Output 4

- The teaching guide for the CAT-SL Automated Sign Language Teaching System will be developed here. The guide will be available in four languages (English, Greek, Dutch, Portuguese) and will be a document also referring to videos.

Architecture

Course Administrator

login to course

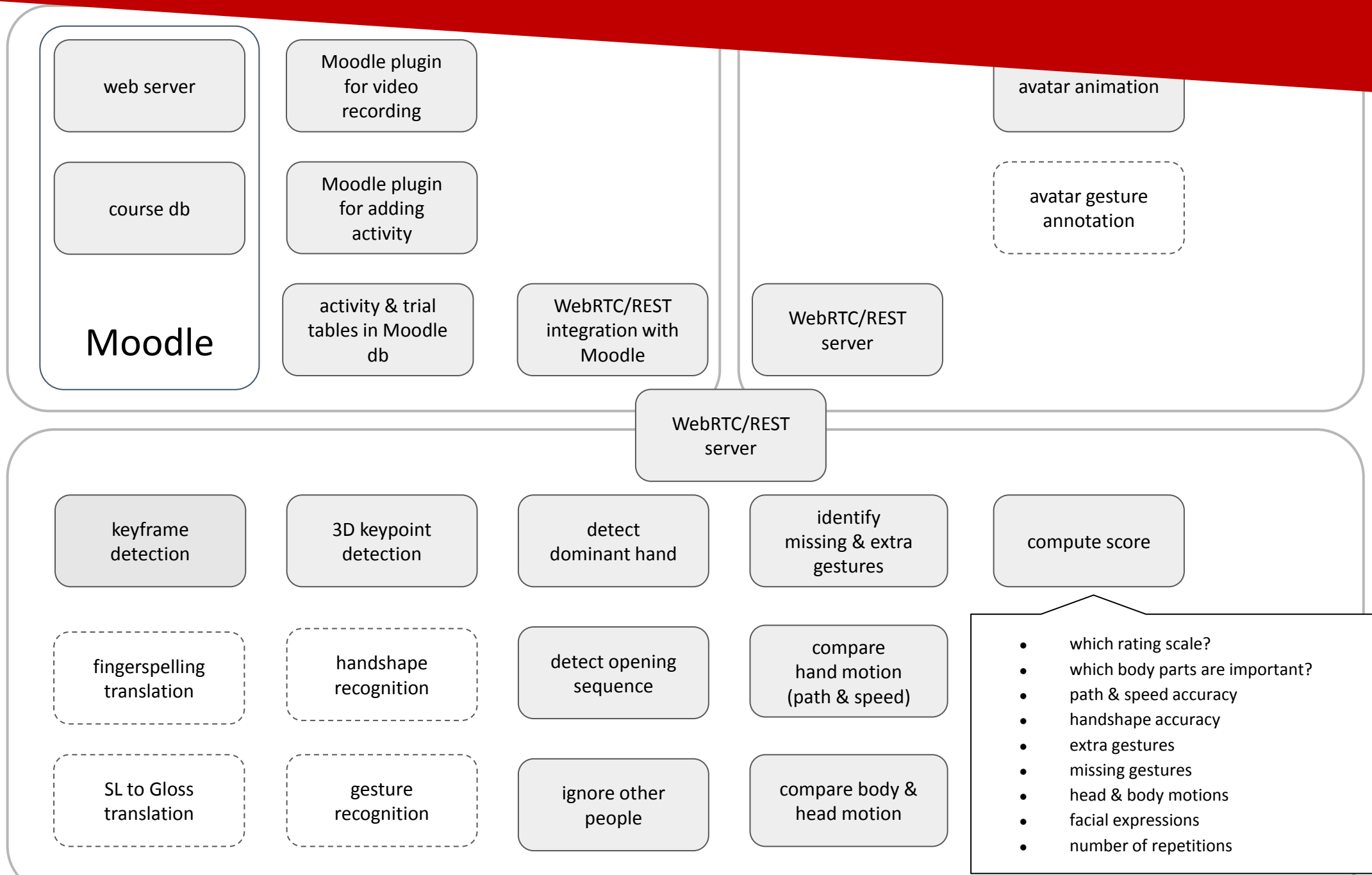select module

select activity

upload video

add activity

add description

select important body parts

preview video

preview keypoints

approve keypoints

preview animation

course admin

web server

includes

extends

Architecture

Teacher
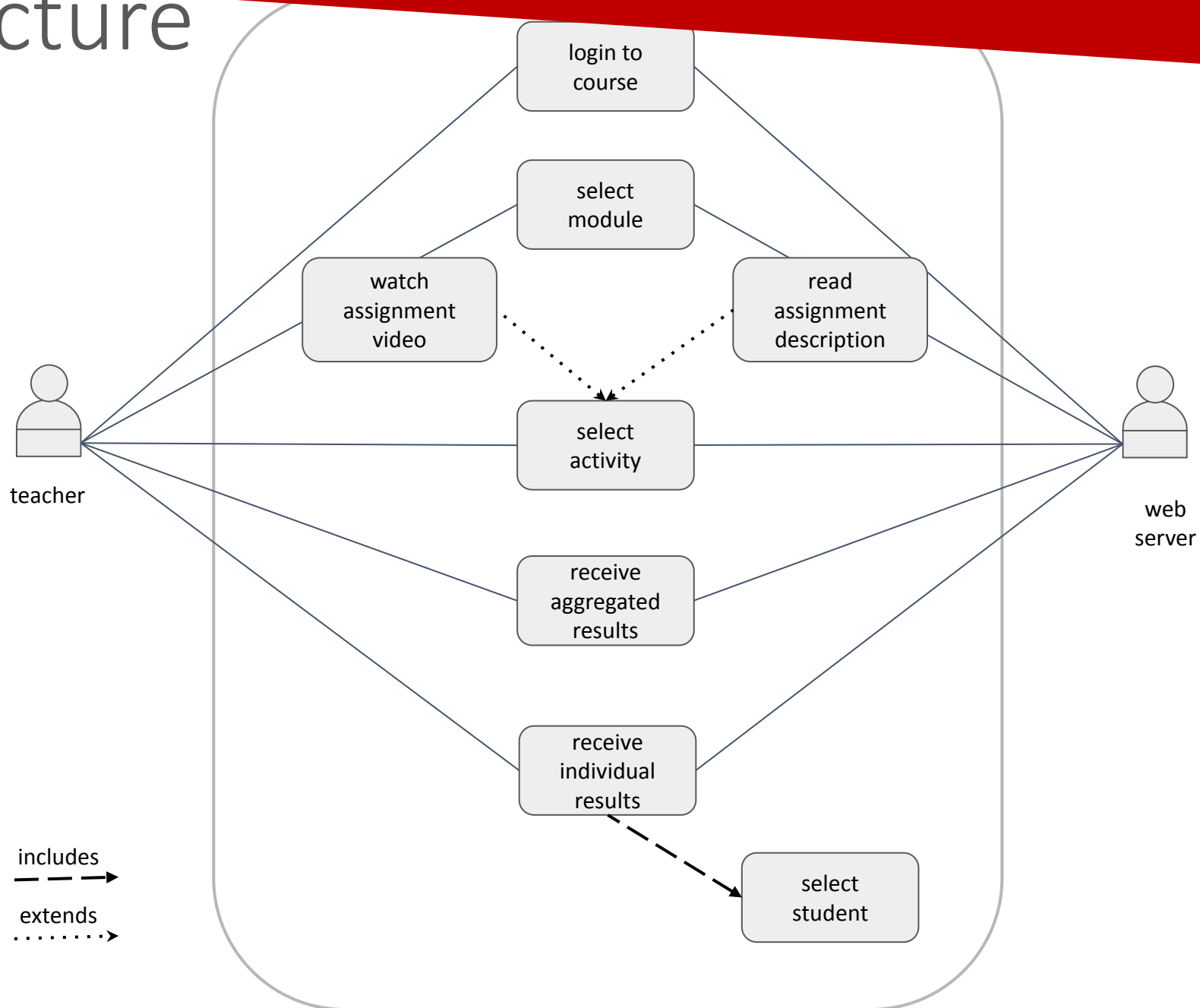
Functional Requirements

Moodle

- web server
- course db
- Moodle plugin for video recording
- Moodle plugin for adding activity
- activity & trial tables in Moodle db
- WebRTC/REST integration with Moodle
- WebRTC/REST server
- avatar animation
- avatar gesture annotation

WebRTC/REST server

- keyframe detection
- 3D keypoint detection
- detect dominant hand
- identify missing & extra gestures
- compute score
- fingerspelling translation
- handshape recognition
- detect opening sequence
- compare hand motion (path & speed)
- SL to Gloss translation
- gesture recognition
- ignore other people
- compare body & head motion

- which rating scale?
- which body parts are important?
- path & speed accuracy
- handshape accuracy
- extra gestures
- missing gestures
- head & body motions
- facial expressions
- number of repetitions

CAT-SL Future Work

- **Pilot installations**
- **Multiplier Events**

CAT SL

Thank you!

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