

Exposé for student project

Project name: ALIA-DELIVERY

Framework for the student project

A student group in the module “**Industrie 4.0 Projekt**” of the Bachelor study program “Industrie 4.0 Informatik” execute a project on its own. The students want to study "Artificial Intelligence for Industrial Applications" master programme and need to apply their competences, improve practical skills and learn new skills necessary for the master programme.

Students can access OTH resources to reach the project goal. These are as example the GPU laboratory, PC rooms, student lounges, mensa, Creative Space and other spaces for meeting and work. Furthermore, they can use OTH gitlab for code repository and organisation, a moodle page for file exchange and video conferencing, rocket chat for chatting, OTH filr for file exchange and repository.

The team size will be between 4 to 8 people depending on nature of the project. The time available for working on the content of a project is around 100-160 hours per person per semester. However, the actual time allocated is determined by the students themselves.

A project leader are responsible for project management and communication to the professor regarding meetings. The project lead chooses the method for project planning (waterfall, V model, SCRUM, Kanban or other methods). Project lead does project planning, progress tracking and presentation of results at the end. He/she is allowed to focus on project management for his/her contribution to the project report.

Target time frame:

- Distribution of project information and Kick off meetings: CW14
- Milestone meeting & demonstration: CW20
- Deadline Transmission of individual reports: CW26
- Final presentation & demonstration: CW27

Each student has to hand in a report about his/her task with focus on technical approaches and solutions.

The project lead instead will hand in a report about the project, used project method, team and the attributed tasks, challenges & solution during execution of the project and summarized results of the project.

The report is evaluated by the professor. The report consists of technical papers of 3 pages which describe the approach, the results and used literature.

Legal framework

Student projects are part of teaching at OTH Amberg-Weiden and are therefore subject to the following framework conditions:

- Student work produced within the framework of student projects is coursework and examination work within the framework of a module (subject) and can be graded as good or bad. OTH Amberg-Weiden has neither rights nor obligations in respect of coursework and examinations; the university or its employees are not responsible. No payments are made to the university for the supervision and correction of coursework and examinations.
- Students are entitled to the copyrights to the coursework they produce. As the author, they may grant third parties (including you) rights of use to this work.
- If third parties are interested in the results of a student research project, they could enter into a (paid) agreement with the student(s) regarding the rights of use. Whether and under what conditions the student(s) grant(s) the rights of use is/are up to them.
- Student groups should not get any confidential information to our university in the context of student projects. Processing confidential information in the context of teaching is generally not compatible with a need for confidentiality.

Motivation

Care 4.0 is highly relevant for society, as it improves the quality of care through the use of digital technologies and at the same time helps carers to work more efficiently. It enables more comprehensive recording and analysis of health data, which leads to more individualised and precise care for people in need of help, residents and patients. The automation of routine activities relieves the burden on care staff, leaving more time for personalised care and human interaction. Finally, Care 4.0 promotes the integration of telemedicine solutions that improve access to care services for people in rural and underserved areas.

Care 4.0 utilises innovative technologies such as AI, big data, robotics and cyber-physical systems to improve the comfort and safety of residents. In Weiherhammer, an inclusive living space for people with and without assistance or care needs with flats and care facilities will be built on the ALIA site by the end of 2026, enabling these technologies to be tested in real-life scenarios.

Relevant Persons

- Prof. Wiehl, OTH Amberg-Weiden
- Dr. David Rester, LUCE Stiftung
- Dipl.-Ing. Andreas Mehta (Mehta-IT)

Project goal

As part of the project, the building is to be created as a digital twin. This is to be used for investigations with autonomous robots in other projects.

In future projects, the environment should enable students to carry out investigations into the following use cases:

1. medication has to be fetched by robot
2. orders from the café are brought to the residents by robot (to be added)
3. various "deliveries" are made to the tenants (flats, short-term care, day care, intensive outpatient care, etc.)

Use cases are described in detail in the appendix.

Goals of the project are:

1. Create a poster presenting the targeted solution
2. Create a simulation world for one floor in Webots
3. Add one robot and further smart devices in the simulation environment to demonstrate new use cases

Goal for milestone: Demonstration of poster and simulation world



Image: 3D visualisation of the ALIA site (Architekturbüro Christian Schönberger)

Possible implementation

(Falls es schon Ideen für eine Realisierung gibt, dann kann das hier notiert werden. Zudem kann hier stehen, was den Studierenden an Hardware oder Software zur Verfügung gestellt wird)

The Webots simulation environment is to be used for the realisation. Either a 3D model is to be created or an existing model is to be imported and tested.

The floor plan can be created based on existing plans or screenshots. At least the rendering above can be used. An exact copy is not needed due to copyright reasons.

In addition, robots are to be used that move in this environment as an example of the above-mentioned use cases.

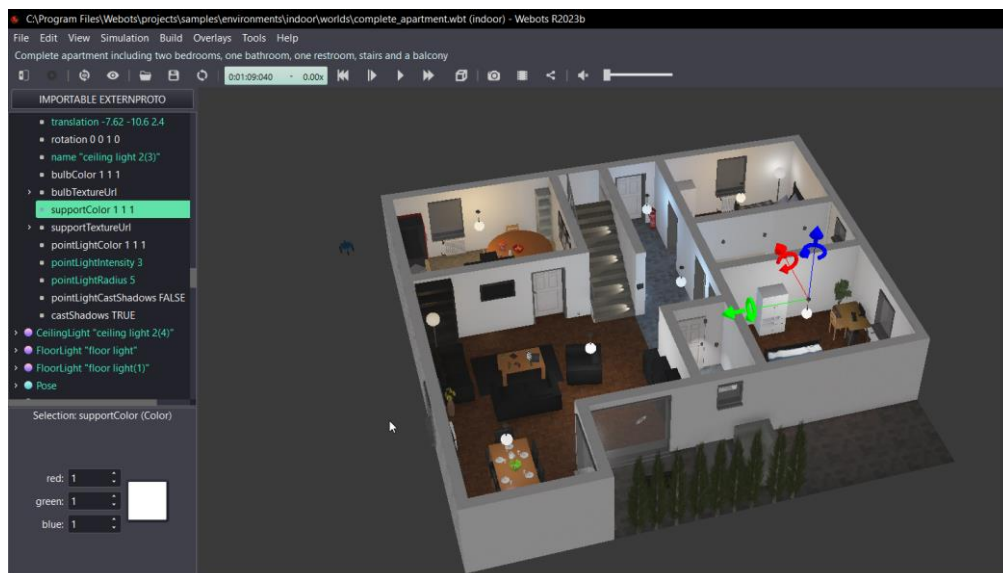


Image: Simulation environment Webots with loaded world "complete apartment"

Recommended learning sources

Tutorials in Youtube to learn webots. As webots is free to use, many tutorials are available.

Documentation in official python page to use MQTT library.

Desired usage of project results

(Was soll nach Abschluss des Projekts mit den Ergebnissen passieren?)

- Marketing at OTH: Demonstration at Study Information Day or Long Night of Science
- As an example for the application areas of robotics
- Project ALIA action day

Luce Stiftung is interested in working with students for internship, master thesis and other contracting types. If you are interested to continue working on this topic, just contact Prof. Wiehl.

Appendix: Use cases

1. Medication Delivery by Robot

The traditional process of delivering medication—where staff members bring medications in a storage box directly to residents' rooms—should not simply be replaced by a robot. Instead, processes should be optimized for new technologies. Ensuring that the **correct medication is given to the right person is essential**, and this should be automatically and **reliably documented**.

A better approach would be to implement a system where smart medication dispensers are stocked and remotely managed via software. These dispensers could be programmed to release the correct dosage at set times, send status updates, and optionally document each dispensing action with an image.

Additionally, access limitations must be considered: currently, only the main connecting doors are automated, while individual room doors are not electrically operated.

2. Delivery of Café Orders by Robot

Orders from the café should be delivered to residents and to staff members.

This use case has been discussed previously and is planned to be available soon after ALIA opens. However, access remains a challenge since not all rooms have automated doors.

For apartment residents, it would be beneficial if the robot could interact with the smart doorbell—either by ringing when it arrives or by triggering a notification through the building control system. Additionally, planned integrations include interfaces for elevator control to enable multi-floor deliveries.

3. Various Deliveries to Residents and Staff

The project aims to create a digital model of the building and integrate at least one mobile robot for deliveries.

Deliveries should not only be made to residents but also to staff members, and they should include essential supplies such as bandages, toilet paper, and other materials for different care units.

This use case has already been discussed multiple times and is expected to be available soon after ALIA launches. However, it is still undecided where the computer-managed central storage facility will be located.

4. Mail delivery

A robot with different post boxes delivers mails from market place to apartments and stations. Access to mails is only possible with authentication.