Exposé for student project

Project name: HAPPY-HOME

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

Depressive disorders are among the most common and most underestimated illnesses in terms of their severity. Women are affected more often than men, older people more often than young people. The causes of unipolar depression are complex and can include genetic, biological and environmental factors.

Many sufferers initially complain of a general decline in performance and diffuse physical complaints, loss of appetite and sleep disorders. In addition, there is a loss of pleasure and interest, general listlessness and an inability to make decisions. Some complain of feelings of indifference rather than a particular sadness, some also feel restless and driven and suffer from anxiety. It is important to note that depression can vary from person to person and that not all symptoms or manifestations apply to every person. (Source: bundesgesundheitsministerium.de)

A smart home can serve on one hand for diagnosis (see p.ex. article "Smart Homes as Enablers for Depression Pre-Diagnosis Using PHQ-9 on HMI through Fuzzy Logic Decision System") but as well for preventive action. While diagnosis is more difficult and products must are regulated by European law, preventive actions are much more interesting and products are not regulated.

In a smart home a pro-active system must be active in order to do actions which reduce the propability for depression. Depression can be reduced by lighting, activity and medication. The first two can be supported by a smart home solution.

A conference presentation has shown results. (see "At home lighting intervention as an adjunct to antidepressant treatment: A pilot study"). However, in a smart home different pro-active approaches are possible.

Relevant Persons

Prof. Wiehl

Project goal

Within the project the following results should be elaborated:

1. Concept for a smart home solution described on a poster
2. Literature research results on the topic with most current scientific publications
3. System architecture of the smart home solution
4. Simulation that shows selected aspects

Goal of milestone: Concept + Research results + System architecture

Possible implementation

Current smart home solutions are built with reactive systems and automations.

Reactive system: you call "Alexa, close the window." and system reacts and closes the window

Automation with symbolic inductive logic (="good old fashioned AI"): it rains, a system detects rain and closes window. The implemented rule is "IF *it rains* THEN *close window*".

The new solutions must be pro-active.

Pro-active: Smart home has different information and decides, that an action must be taken.

The website healthline has some recommendations for actions (see https://www.healthline.com/health/depression/how-to-fight-depression#routine)

The concept can be created with help of the LaTeX Poster template and the website Icograms to visualize different aspects on the topic.

Scientific literature on medical studies can be found in PupMed.

Technical demonstration of a solution can be done with Webots or/and SimPy. Webots enables to use the apparment world (already setup) and integrate smart home components. A local MQTT broker can be setup to communication with smart home components. SimPy or other libraries in Python can be used to implement logic. SimPy can simulate other smart home components, that are not in added in the Webots world.

Recommended learning sources

Documentation on depression and preventive actions by thrustworthy medical organization (WHO, Bundesministerium für Gesundheit, AOK etc.)

Documentation on webots and SimPy

Desired usage of project results

- Further investigation in following projects
- Publication as Technical Report
- Founding startup on smart caring home solutions
- Your master thesis?