Developing an App to Optimize Learning Strategies for Students

Bachelor/Master project "Information Systems"

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1: Project Overview

Background: Technologies that suggest personalized learning strategies, based on users' flow states and context-related information (e.g., time of the day or study location), have the potential to reduce students' mental workload and improve performance.

Project Goal: Design and implement an application for students that tracks flow states throughout the day, labels contextual data, and generates personalized suggestions to optimize learning strategies.

Highlights: Practical experience in software development through a real-world use case; integration of multiple data sources; final prototype suitable for inclusion in a personal portfolio

2: Project Background

Flow is the experience of being fully focused on an activity and fluidity of action (Csikszentmihalyi, 1990). In this state, individuals often lose track of time and perform at their optimal levels. For students and other knowledge workers whose productivity relies on attention and engagement in the task, entering a flow state can improve their work efficiency and well-being (Adam et al., 2024). Therefore, technologies that help students enter a flow state could provide a valuable benefit, leading to reduced mental workload and improved performance.

To realize this idea, a tool is required that tracks the users' flow states throughout the day — similar to commercially available applications like Apple Health that record activity data. By combining flow data with context-related data, such as time of the day, study activity, or meeting schedule, personalized suggestions can be generated to help students structure their learning routines. For example, the analyzed data of user Michael shows that he is most likely to reach his optimal performance level at 10 a.m. in the university library. Based on these insights, the system suggests a personalized learning schedule and sends push notifications to remind the user to start learning.

A key requirement for developing such a tool is the accurate measurement and automatic detection of flow states. Scientific studies have demonstrated the feasibility of detecting flow using physiological signals (e. g. heart rate or heart rate variability), which can be recorded with ECG chest straps or smartwatches (Knierim et al., 2021; Jha et al., 2022). Recent advances in machine learning have further improved the accuracy of flow state classification. For example, Rissler et al. (2020) achieved a 70% accuracy rate in identifying flow states among knowledge workers using a random forest model.

Building on this knowledge, this project's core focus is to develop a system that combines physiological data and contextual information to optimize learning strategies for students.

3: Project Objective

The overreaching project goals are:

- **Design** of a system to optimize learning strategies for students
- **Development** of an algorithm to create personalized learning strategies
- **Implementation** of the system
- **Evaluation** of the system

The objective of this specific Bachelor/Master project is to lay the foundation for such a system. This includes identifying the app's requirements and functionalities, designing its architecture, and first implementations of selected features. A module-based architecture is required that allows for customization and flexibility in the process. The following scientific papers serve as a first orientation to facilitate practical implementation: Pertutschnig et al. (2022) and Bardram (2022).

In this phase, the project objectives are:

- Review of flow literature in education to identify student challenges and explore how flow state detection can enhance learning outcomes
- Identification of application requirements and functionalities
- Design of software architecture
- Implementation of selected key requirements, e.g.:
    - Real-time ECG data streaming
    - Labeling of flow states and context-related data
    - Push notifications as a reminder
    - Access data from a digital calendar
- Evaluation of results

Depending on group size, adjustments to the project scope can be made. Adjustments will be announced at the kickoff and/or in subsequent milestone meetings.

Each finished artifact has to be properly documented to facilitate understanding and further development by students in follow-up projects.

4: Project Registration and further Information

Bachelor and Master students interested in this project may send their application to Cosima v. Uechtritz (cosima.uechtritz@ris.uni-due.de). Please attach to your mail:

- Your current **Transcript of Records**
- A short **letter of motivation**

The deadline for application is **Tuesday, 07.10.2025, 23:59.**

You can apply as a group. To do so, each person in that group has to submit an individual application where all group members are specified.

If the number of applications exceeds our capacities, we will select participants based on their prior knowledge and academic performance.

For successful completion of the project, master students receive 12 ECTS (corresponding to 360 working hours) and bachelor students receive 6 ECTS (corresponding to 180 working hours)

- Master students will invest 18 hours per week into the project.
- Bachelor students will invest 9 hours per week into the project.

5: Project Schedule (Dates are to be announced)

Kickoff	Kickoff with accepted participants Clarify project scope and responsibilities
Milestone 1	Identification of requirements and functionalities
Milestone 2	Design of a software architecture
Milestone 3	Implementation of selected requirements
Milestone 4	Evaluation of results
Milestone 5	Scientific poster presentation
Milestone 6	Submission of project report

6: Grading

The final grade will be calculated as following based on the sum of the milestones:

- Milestone 1: 10%
- Milestone 2: 15%
- Milestone 3: 25%
- Milestone 4: 10%
- Milestone 5: 20%
- Milestone 6: 20%

7: Sources

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