Introduction

This project overview contains details about two separate projects – Virtual Human Package and SpendSense. While one project is developed individually (by me) and the other one is being built by an entire team, I will utilize both of them to demonstrate my knowledge and skills necessary to pass this semester.

Project 1 – SpendSense

In this section you will find a description of the first project I will be working on throughout the semester. Below I will describe the context and goal of this project, along with the way of working and different approaches I might employ.

**Context**

Personal finances are one of the most important resources in today’s world, yet a big portion of our society’s individuals fail to manage it properly. Most people are not only unable to resist the temptation of meaningless purchases, but they also succumb to a bigger underlying issue – financial illiteracy. The goal of this project is to develop an application that gives insights into its users’ spending habits, and to help them improve their financial intelligence.

**Objective**

The aim of this project is to develop a useful and reliable product. The main deliverable is a secure, scalable and responsive web application that allows users to upload their expenses, set budgets and receive reports on their spendings. The application aims to promote financial discipline and provide users with tools to achieve their financial goals.

**Development Approach**

This project will adopt an agile way of working. Since it requires a lot of research, the development process will be heavily guided by frequent iterations and stakeholder feedback.

Project 2 – Virtual Human Package

In the paragraphs below you can find a detailed overview of the group project of the semester. In this section you can read the context and goal of this project, along with the intended way of working.

**Context**

MindLabs and its partners, under the "Digital Innovation District for Society" initiative, are exploring the development of interactive virtual humans and their applications in society. The project focuses on creating a realistic, dynamic interaction between AI-powered virtual humans and real users.

**Objective**

The goal of this project is to create a realistic and functional proof of concept for a virtual human. This application will use a microservices architecture to enable the dynamic deployment of AI models. The aim is to convert an existing Docker Swarm installation to Kubernetes, create deployment scripts, and develop a monitoring dashboard.

**Development Approach**

The team working on this project will employ the SCRUM methodology. We will use sprints to organize the development workflow and we will hold stand-up meetings to track progress. Furthermore, we will use retrospectives to reflect on our process to ensure an efficient way of working.

Professional Standard

Working on SpendeSense and Virtual Human Package, I face various challenges. I always strive to perform thorough research on order to find the answers to my issue and I do my best every time deliver an effective and functional ICT solution. I apply structured research methodologies to validate my decisions and provide well-founded advice to stakeholders.

**Research and Methodologies**

For each of the two projects I conduct applied research to ensure I am developing a quality application. The main topic that I had to research for the group project (Virtual Human Package) so far was the deployment of AI models to Kubernetes. After completing a short course online, I managed to deploy the model in Docker and Minikube, and I am just a few steps away from deploying it in Kubernetes as well.

The research that I had to perform for my individual project (SpendSense) also involved some practical exercises, but a large portion of it was dedicated to reading materials and watching courses online. The aim of this research is to introduce me to the best practices for developing the architecture for cloud-native applications. More details about the scope and context of my research you can read in my Research Plan. So far, thanks to my research I have managed to create a few microservices, deployed in Docker and communicating with databases also in Docker.

Personal Leadership

In both of the projects of this semester I take ownership of my professional development. I set clear goals and I take initiative to grow both technically and personally. I seek feedback often, analyze it and apply it.

**Planning and Goals**

I have set personal goals to broaden my knowledge on how to build a secure, scalable and reliable application. I have also created a rough plan of the activities this semester in which I have set different technical goals to achieve each sprint. You can find that planning in my Project Plan.

**Feedback**

I proactively research the best practices for developing cloud-native applications to make sure that my skills and delivered solution are up to the industry standards. To take it even further, I seek feedback often to ensure that I am moving in the right direction. Once received, I write down my feedback in Feedpulse, I analyze it and then implement everything necessary.

Scalable Architectures

In both applications – Virtual Human Package and SpendSense I strive to design scalable and reliable architecture that prioritizes key software quality requirements such as performance, scalability and security.

**Design for Quality Requirements**

For my individual project – SpendSense I have explicitly defined the non-functional requirements such as scalability, security and reliability (you can find them in my Project Plan). Using these NFRs as a guide I have also designed a plan for the architecture of my application that you can see in my Architecture Diagram.

So far, I have implemented a few microservices that I have deployed in Docker along with their respective databases. This is the first step to scalability as it allows individual components to be independently deployed and managed.

My next step is to implement asynchronous communication between the microservices to ensure system responsiveness and fault tolerance.

For the group project – VHP I have also managed to deploy an AI model and currently I am working on putting it in Kubernetes, which also brings the project a step closer to scalability.

Development and Operations (DevOps)

For both SpendSense and VHP I plan on implementing DevOps practices to ensure smooth development, deployment and monitoring of the software. My goal for these projects is to My goal is to create automated, scalable, and reliable deployment pipelines.

**Continuous Integration & Continuous Deployment (CI/CD)**

So far I have set up the GIT repository for my individual project, but I haven’t applied CI/CD yet.

**Deployment Strategies for Reliability**

**Monitoring & Performance Tracking**

**Automated Testing**

Cloud Native

I am developing my software with cloud-native principles in mind, using Spring Boot and deploying components in a cloud environment. While my knowledge is still growing, I am working on researching and implementing best practices in developing cloud-native applications.

**Current Cloud-Native Implementations**

VHP is hosted on Azure and Netlab environments which provides a scalable infrastructure. Regarding SpenSense I have planned an architecture in which 2 microservices will be deployed on Kubernetes and one will be serverless (for more details, please refer to my ).

Security by Design

In both of the applications that I am working on this semester I prioritize security at every stage of the development. I research common strategies that malicious actors use and best practices on how to build a safe application to make sure I develop a non-vulnerable product.

**Analysis and Built-in Security**

So far, I have analyzed the OWASP top 10 vulnerabilities and researched ways to mitigate the risks. For the development of SpendSense I have decided to use SpringBoot which provides automatic protection against 4 out of the 10 top vulnerabilities - Cross-Site Request Forgery Protection (enabled by default in Spring Security), Cross-Site Scripting Prevention (through built-in input validation mechanisms), SQL Injection Protection (by using Spring Data JPA with parameterized queries), Secure Default Headers (e.g., Content Security Policy, HSTS).

**Authentication & Authorization**

**Planned Security Enhancements**

Distributed Data

My projects of this semester require the handling and storing of data in a structured and a secure way. I will also make sure to take into account legal and ethical considerations. I am focusing on data distribution, security, and compliance with regulations such as GDPR.

**Data Decentralization**

For my project SpendSense, I have decided to follow the Database per Service Pattern. I have connected two of my microservices to two separate databases. This approach ensures that the databases are independent and changes to one will not affect the other. It also allows each database to be scaled individually and makes the isolation of sensitive data easier.