LLM-driven training application for sheltered workshops

Author: Maxim Peeters **Promotor: Prof Dr. Eva Geurts**

Introduction

Training a diverse workforce on critical work instructions using static, monolingual documents faces steep learning curves and rapid memory decay (Ebbinghaus Forgetting Curve [1][Figure 2]).

This presents three core challenges:

- **Language Barriers: Diverse employees struggle to grasp complex instructions not available in their native language.**
- **Fast Knowledge Decay: Even when initially understood, critical information is quickly forgotten after reading it just once.**
- **High Manual Overhead: Instructors lack the time to manually create personalized, multilingual quizzes and follow-up materials.**

Objective

To develop an automated, AI-driven platform that transforms static PDF instructions into interactive, multilingual learning experiences. The system leverages spaced repetition to combat knowledge decay and eliminates manual instructor workload.

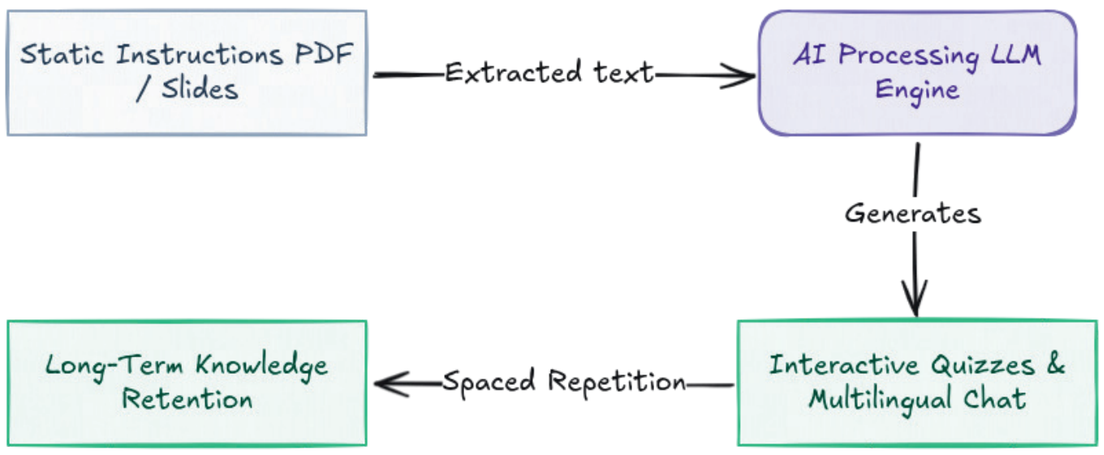

Figure 1: High-level overview of the platform's microservices.

Methodology

The platform counters memory decay using Spaced Repetition, scheduling reviews just before an employee is predicted to forget the material.

This approach relies on three core mechanisms:

- **Automated Scheduling: Triggers initial reviews and recurring follow-ups to guarantee long-term retention.**
- **Context Injection: Extracts text from static slides and dynamically feeds it to the AI for accurate, localized questions.**
- **Performance Tracking: Logs quiz scores across sessions to visualize individual retention curves.**

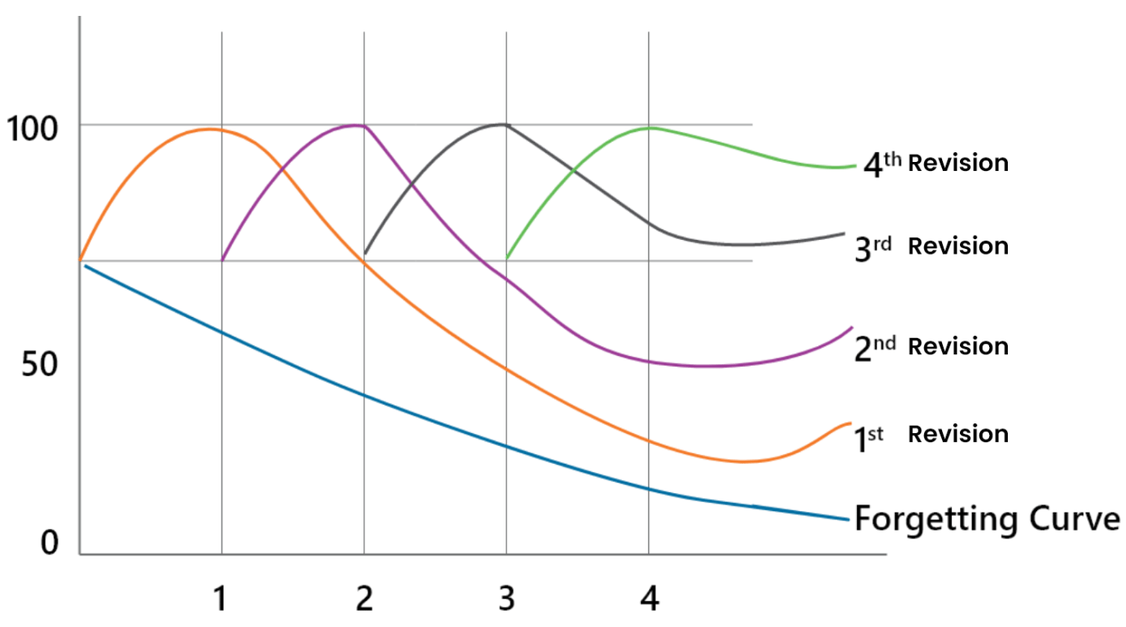

Figure 2: The impact of spaced repetition on mitigating knowledge decay over time. [1]

[1] Murre, J. M. J., & Dros, J. (2015). Replication and Analysis of Ebbinghaus' Forgetting Curve.

Architecture

A modern, decoupled, and scalable architecture designed for secure processing and flexible AI integration:

- **Frontend: React & Tailwind CSS for a responsive, interactive UI.**
- **Backend: Spring Boot for secure authentication and automated PDF parsing.**
- **Database: Dockerized PostgreSQL for reliable user progress and quiz storage.**
- **AI Engine: OpenRouter API to route requests to advanced LLMs for quiz generation and multilingual chat.**

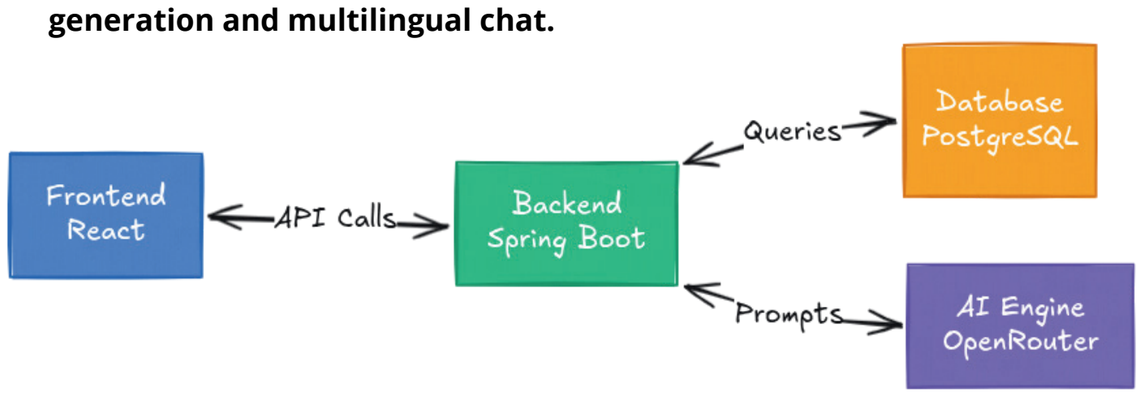

Figure 3: High-level system architecture separating the front-end, back-end, and external AI services.

Implementation

Figure 4: Context-aware AI assistant providing localized, multilingual support.

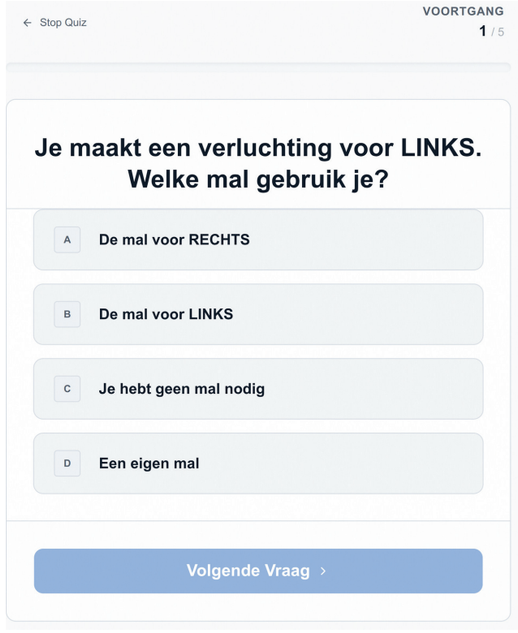

Figure 5: Automated AI quiz generation based on static work instructions.

Figure 6: Interactive slide viewer featuring personal notes and context-aware AI support.

Conclusion

- **Core Approach: Integrates LLM overlays with spaced repetition into existing workflows.**
- **The Benefits: Fixes routine blindness and language barriers without altering original instructions.**
- **The Next Steps: Future field studies will quantify long-term impacts on operator independence and workplace safety.**

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