

**GRADUATION-INTERNSHIP PORTFOLIO BACHELOR-ICT**

**FONTYS UNIVERSITY OF APPLIED SCIENCES**

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| Title: | Smart tyre -Portfolio |
| Date: | 18-06-2024 |

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# Section 1 -Context

## Project Overview

**Project Title**: Advancing Tire Procurement with Data Insights

**Project Start Date:** 20-02-2024

**Project End Date:** 15-06-2024

**Project Supervisor:** Ernst Jansen, CEO and Company Mentor, and Bas van de Meerakker, Technical Mentor

## Objectives

The primary goal of this project is to streamline the tire purchasing process for warehouse managers at Truck Support Venlo. The project aims to develop a user-friendly software tool that provides comprehensive comparisons of tire suppliers, offering actionable buying advice. This tool will help managers purchase high-quality tires at the best prices, thus enhancing operational efficiency and reducing costs.

## Problem Statement

Currently, Truck Support Venlo faces significant challenges due to the lack of specialized tools for analyzing truck tire data. The market primarily offers solutions tailored to car tires, leaving a gap in the truck tire sector. This gap restricts warehouse managers from making informed, strategic decisions on tire purchasing, negatively impacting efficiency and cost-effectiveness.

## Key Questions

* **Main Question:** How can a comprehensive and user-friendly dashboard be developed to efficiently aggregate, display, and analyze truck tire price data from diverse sources, facilitating cost-effective purchasing decisions for Truck Support Venlo?
* **Sub-questions:**

1. What are the most effective methods for collecting truck tire price data from different sources, including websites, emails, and supplier databases, while ensuring data accuracy and timeliness?
2. How can data integration challenges be overcome when dealing with various data formats and access restrictions from different tire suppliers?
3. What web scraping techniques are most effective for extracting tire price data without compromising data quality and reliability?
4. In what situations is it legally and ethically permissible to scrape data, and how can these guidelines be applied when collecting tire price data?
5. How can the overall architecture, including database design, be optimized to efficiently store and manage collected tire price data, ensuring quick retrieval and scalability?
6. Which technologies and frameworks are best suited for developing an interactive and intuitive dashboard that meets the specific needs of Truck Support Venlo's warehouse managers?

## Project Scope

**Included:**

* Conducting market research.
* Developing a scalable application.
* Creating web scraping bots.

**Excluded:**

* The application will focus exclusively on tires and will not support the procurement of other goods or services.
* It will not facilitate direct negotiations or transactions between warehouse managers and suppliers.
* The application will focus on suppliers within a specific region or country and may not include global market data.
* Conditions of the Project
* The project will produce a research paper.
* A detailed application architecture will be provided.
* A working application with a demo will be developed.
* Technical help will be available when needed.

# Section 2 – Conclusions and Recommendations

## Conclusions

The project aimed to create a comprehensive and user-friendly dashboard to enhance the tire procurement process for Truck Support Venlo. Based on the research and development activities conducted, the following conclusions can be drawn:

**Effective Data Collection Methods:**

* + The combination of Selenium for web scraping and direct supplier database integration proved effective in collecting accurate and timely truck tire price data.
  + **Evidence:** Literature Study and Expert Interviews

**Data Integration:**

* + Utilizing n8n workflows for data cleaning and normalization ensured seamless integration of data from various sources, maintaining data accuracy and timeliness.
  + **Evidence:** Design Patterns Analysis and Compliance Checks

**Web Scraping Techniques:**

* + Selenium was highly effective for automating web scraping tasks, ensuring high-quality and reliable data extraction from supplier websites.
  + **Evidence:** SWOT Analysis of Web Scraping Tools

**Legal and Ethical Data Collection:**

* + Legal and ethical compliance was maintained by obtaining explicit acceptance from all suppliers before initiating the scraping process and by adhering to the guidelines specified in the robots.txt files of websites.
  + **Evidence:** Framework Document for Ethical Web Scraping and Stakeholder Agreements

**Optimized Architecture:**

* + The optimized database design using MySQL efficiently managed the storage and retrieval of large volumes of tire price data, ensuring quick access and scalability.
  + **Evidence:** IT Architecture Prototyping and Stakeholder Feedback

**Technology and Frameworks:**

* + Using Flutter for the frontend enabled rapid and high-performance development, providing an interactive and intuitive user experience. The ease of use and fast implementation with Flutterflow significantly enhanced the development process.
  + **Evidence:** Multi-Criteria Decision Making Workshops

## Recommendations

Based on the findings and outcomes of this project, the following recommendations are suggested for future improvements and continued development:

**Future Development:**

Continue enhancing data visualization techniques to include more interactive and advanced features such as predictive analytics and trend analysis.

**Rationale:** This will further improve decision-making capabilities for warehouse managers.

**User Training:**

Implement a comprehensive user training program to ensure warehouse managers are fully equipped to utilize the new features and functionalities of the dashboard.

**Rationale:** Proper training will maximize the effectiveness and adoption of the tool.

**Continuous Feedback Loop:**

Establish a continuous feedback loop with end-users to gather insights and suggestions for ongoing improvements and feature additions.

**Rationale:** Regular feedback will help keep the application aligned with user needs and industry trends.

**Ethical and Legal Compliance:**

Regularly review and update the ethical and legal guidelines for data collection to stay compliant with any new regulations or changes in the legal landscape.

**Rationale:** Ensuring ongoing compliance will mitigate legal risks and maintain the integrity of the data collection process.

**Exploration of New Technologies:**

Investigate and potentially integrate emerging technologies such as artificial intelligence and machine learning to enhance the dashboard’s capabilities.

**Rationale:** Leveraging advanced technologies can provide more sophisticated insights and automation, further improving procurement efficiency.

# Section 3 – Process

## Methodology

The project followed an Agile ScrumBan approach, which combines the structured elements of Scrum with the flexibility of Kanban. This methodology allowed for dynamic adaptation to evolving project needs, ensuring efficient and flexible execution.

**Research Design Pattern Used:**

* **Library:** Literature study and expert interviews.
* **Field:** Stakeholder interviews and observations.
* **Showroom:** Ethical checks and compliance reviews.
* **Lab:** Data analytics and prototyping.
* **Workshop:** IT architecture sketching and multi-criteria decision making.

## Key Activities

**Initial Research and Planning:**

1. **Activities:** Conducted market research, stakeholder interviews, and requirement analysis to understand the current challenges in tire procurement.
2. **Outcomes:** Identified key usability issues and specific requirements for the dashboard.
3. **Portfolio Links:** Stakeholder Analysis Document

**Development Phase:**

**Activities:**

* Developed web scraping bots using Selenium to collect data from various sources.
* Utilized n8n workflows to clean and normalize the collected data.
* Designed and implemented the database using MySQL.
* Created frontend interfaces using Flutter for a responsive and intuitive user experience.
* Outcomes: Successfully developed a functional prototype of the dashboard.
* Portfolio Links: Prototype Designs

**Testing and Validation:**

1. **Activities:** Conducted continuous testing parallel to development cycles, including usability tests and system performance checks.
2. **Outcomes:** Validated design changes and ensured the reliability and efficiency of the application.
3. **Portfolio Links:** Usability Test Results

**Final Implementation:**

1. **Activities:**

* Integrated the application with existing warehouse management systems.
* Conducted a demo session with stakeholders for final feedback.
* Deployed the application using Docker to ensure a consistent environment across development, testing, and production.

1. **Outcomes:** Deployed the enhanced dashboard successfully.
2. **Portfolio Links:** Final Implementation Report

## Adaptations and Changes

Throughout the project, several adaptations were made based on feedback and evolving requirements:

* Adjusted the data collection methods to ensure compliance with legal and ethical guidelines by obtaining acceptance from suppliers and checking robots.txt files.
* Refined the user interface design based on continuous stakeholder feedback to improve usability.
* Reflections on the Process
* The Agile ScrumBan methodology proved to be highly effective for this project, allowing for flexibility and continuous improvement. Regular feedback from stakeholders and end-users was crucial in refining the application to meet their needs. The iterative approach ensured that the project remained aligned with the goals and could adapt to new insights and challenges efficiently.

**Key Achievements**

* Developed a scalable and user-friendly dashboard that enhances the tire procurement process.
* Successfully integrated data from various sources, ensuring accuracy and timeliness.
* Achieved high user satisfaction through continuous testing and feedback incorporation.

# Section 4 – Reading Guide

The reading guide links the learning outcomes of your graduation semester to your portfolio products. Each learning outcome is mapped to specific products, along with a brief explanation of how each product demonstrates the achievement of that learning outcome.

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| --- | --- | --- |
| Learning Outcome | Portfolio Product(s) | Explanation |
| Professional Duties | * Project Plan – **Project Managment** * Backend language and use of AI - **Research** * Graduation Proposal - **Analysis** * Architecture document - **Design** | Demonstrated a comprehensive software development lifecycle, ensuring the application meets industry standards for quality, security, and reliability. |
| Situation Orientation | * Stakeholder Analysis Document - **Analysis** * Feature requirements -**Analysis** * Database Design Document - **Implementation** | Conducted a market analysis and stakeholder interviews to understand current challenges in tire procurement and designed application features that address these issues. |
| Future-Oriented Organization | * Figma Prototype link -**Design** * Literature Study and Expert Interviews Report -**Research** * Planning of 5 sprints - **Project Managment** | Incorporated sustainable and ethical considerations into the application's design, recommending long-lasting and sustainable tires, and showcasing potential business benefits like cost savings and supply chain improvements. |
| Investigative Problem Solving | * Normalization for Tire Data from Multiple Suppliers and Matching Techniques - **Implementation** * Design Patterns Analysis and Compliance Checks – **Implementation** * Web Scraping Code Document -**Impementation** * Research Report **– Research** * SWOT Analysis of Web Scraping Tools – **Research** * Test Data Validation using n8n Automation- **Validation and Feedback** | Identified and evaluated potential data sources for tire information, developed algorithms to analyze this data, and provided actionable insights for users. |
| Personal Leadership | * Smart tyre \_ sprints overview - **Project Managment** * Logbook - **Impementation** | Set personal goals related to learning new technologies and methodologies critical to the project's success, demonstrating personal leadership and commitment to continuous improvement. |
| Targeted Interaction | * Stakeholder Meeting Reports -**Validation and Feedback** * Multi-Criteria Decision Making Workshops -**Design** * Framework Document for Ethical Web Scraping and Stakeholder Agreements- **Validation and Feedback** | Developed a plan for engaging stakeholders, identified key partners such as tire suppliers and logistics companies, and organized regular updates to collect feedback and ensure the project meets their needs. |

## Explanation of Key Portfolio Products

#### Professional Duties

* **Project Plan – Project Management:** Demonstrated a comprehensive software development lifecycle, ensuring the application meets industry standards for quality, security, and reliability.
* **Backend Language and Use of AI – Research:** Explored the use of backend technologies and AI to enhance the project's functionality and performance.
* **Graduation Proposal – Analysis:** Detailed the project's objectives, scope, and methodologies, laying the foundation for successful implementation.
* **Architecture Document – Design:** Provided a structured design of the application's architecture, ensuring scalability and maintainability.

#### Situation Orientation

* **Stakeholder Analysis Document – Analysis:** Conducted a market analysis and stakeholder interviews to understand current challenges in tire procurement and designed application features to address these issues.
* **Feature Requirements – Analysis:** Identified and documented the key features needed to meet stakeholder needs and project goals.
* **Database Design Document – Implementation:** Designed a robust database schema to efficiently manage tire data, ensuring data integrity and accessibility.

#### Future-Oriented Organization

* **Figma Prototype Link – Design:** Developed interactive prototypes to visualize and refine the application's user interface and user experience.
* **Literature Study and Expert Interviews Report – Research:** Incorporated sustainable and ethical considerations into the application's design, recommending long-lasting and sustainable tires.
* **Planning of 5 Sprints – Project Management:** Outlined the Agile sprint planning process, ensuring structured and iterative development.

#### Investigative Problem Solving

* **Normalization for Tire Data from Multiple Suppliers and Matching Techniques – Implementation:** Developed algorithms to standardize and match tire data from various suppliers, ensuring consistency and accuracy.
* **Design Patterns Analysis and Compliance Checks – Implementation:** Applied best practice design patterns and conducted compliance checks to ensure robust and reliable application development.
* **Web Scraping Code Document – Implementation:** Implemented automation scripts for extracting tire data, demonstrating effective data collection methods.
* **Research Report – Research:** Provided comprehensive research on tire procurement challenges and solutions, supporting problem-solving efforts.
* **SWOT Analysis of Web Scraping Tools – Research:** Analyzed the strengths, weaknesses, opportunities, and threats of different web scraping tools, guiding tool selection.
* **Test Data Validation using n8n Automation – Validation and Feedback:** Validated the accuracy of scraped data by comparing it with manually entered correct data, ensuring data reliability.

#### Personal Leadership

* **Smart Tire \_ Sprints Overview – Project Management:** Set personal goals related to learning new technologies and methodologies, demonstrating leadership and continuous improvement.
* **Logbook – Implementation:** Documented weekly progress, challenges, and milestones, showcasing commitment to project success.

#### Targeted Interaction

* **Stakeholder Meeting Reports – Validation and Feedback:** Developed a plan for engaging stakeholders, documented feedback, and ensured the project met stakeholder needs.
* **Multi-Criteria Decision Making Workshops – Design:** Conducted workshops to evaluate and select the best technologies and frameworks for the project, incorporating stakeholder input.
* **Framework Document for Ethical Web Scraping and Stakeholder Agreements – Validation and Feedback:** Outlined ethical considerations and stakeholder agreements for data collection, ensuring legal and ethical compliance.

# Section 5 – Evaluation and Reflection

## Evaluation – The Project’s Perspective

This section evaluates the overall success of the project from the project's perspective, identifying both the effective practices and areas for improvement.

**Effective Practices**

1. **Agile ScrumBan Methodology:**

* The flexibility of the Agile ScrumBan approach allowed for continuous adaptation to changing requirements and stakeholder feedback, leading to a well-aligned project outcome.
* **SMART Action Point:** Continue using Agile ScrumBan for future projects to maintain flexibility and responsiveness to change.

1. **Stakeholder Engagement:**

* Regular communication and feedback sessions with stakeholders ensured that the project stayed on track and met their needs.
* **SMART Action Point:** Implement a structured stakeholder engagement plan for future projects to ensure ongoing alignment and satisfaction.

1. **Data Integration and Cleaning:**

* The use of n8n workflows for data cleaning and normalization ensured the accuracy and reliability of the collected data.
* **SMART Action Point:** Continue using automated workflows for data processing in future projects to maintain high data quality.

**Areas for Improvement**

1. **Initial Data Collection:**

* More comprehensive initial testing could have identified data collection issues earlier, reducing the need for late-stage changes.
* **SMART Action Point:** Conduct thorough initial testing and validation of data collection methods at the start of the project to identify potential issues early.

1. **Legal and Ethical Compliance:**

* While legal and ethical guidelines were followed, the process of obtaining supplier acceptance and checking robots.txt files could be streamlined.
* **SMART Action Point**: Develop a standardized procedure for legal and ethical compliance in data collection to ensure efficiency and consistency.

## Reflection

**Personal Performance**

1. **Learning and Adaptation:**

* Successfully learned and applied new technologies such as Selenium for web scraping and Flutter for frontend development, demonstrating adaptability and a commitment to continuous learning.
* **Reflection:** This experience has significantly enhanced my technical skills and confidence in adopting new tools.

1. **Leadership and Management:**

* Effectively managed the project timeline and resources, ensuring timely completion and high-quality outcomes.
* Reflection: The ability to lead and manage a project from start to finish has been a valuable **learning experience, strengthening my leadership capabilities.**

**Feedback and Improvements**

1. **Stakeholder Feedback:**

* Regular feedback from stakeholders was invaluable in refining the project and ensuring it met their needs.
* **Reflection:** Actively seeking and incorporating feedback has improved the project's quality and relevance.

1. **Self-Evaluation:**

* Self-evaluation during the mid-term review highlighted areas for improvement, such as more efficient data collection processes.
* **Reflection:** Identifying and addressing personal and project-related areas for improvement has been crucial in achieving the project’s success.

**Future Recommendations**

1. **Continuous Learning:**

* Continue to explore and learn new technologies and methodologies to stay updated with industry trends and improve future project outcomes.
* **Action Point:** Set regular goals for learning and development to enhance technical and managerial skills.

1. **Enhanced Communication:**

* Improve communication strategies to ensure all team members and stakeholders are consistently informed and engaged.
* **Action Point:** Implement regular check-ins and updates to maintain clear and effective communication throughout the project lifecycle.