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# Abstract

Nohoud is a distributed microservices-based platform designed to support all Syrians, including refugees, returnees, and residents, in developing their skills, improving employability, and building personalized development plans powered by AI.

The platform’s primary goal is to evaluate users’ current skill sets, match them with relevant job opportunities, and provide AI-generated personal development plans. It leverages a scalable architecture using NestJS microservices, MongoDB, and an AI pipeline orchestrated through n8n, connected to a stateless LLM (Gemini).

Users complete their profiles, which are then analyzed to produce job suggestions and tailored growth plans. The system emphasizes usability, modularity, and personalization, making it a practical solution for job seekers across the Syrian population—regardless of their background or displacement status. The results show that combining AI with scalable backend services can  
meaningfully assist in career development and employment integration.

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# List of Abbreviation and Terminology

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| --- | --- |
| **Abbreviation/Term** | **Definition** |
| **Nohoud** |  |
| **UI/UX** | User Interface/User Experience; principles and practices involved in designing the interface and experience of the platform. |
| **API** | Application Programming Interface; a set of protocols and tools for building software applications. |
| **BSON** | Binary JSON; a binary-encoded serialization of JSON-like documents. |

# Chapter 1: Introduction

## 1.1 Motivation

Syria’s civil war has caused one of the worst displacement crises, leaving millions of refugees and internally displaced persons (IDPs) in urgent need of support. By 2025, an estimated 16.7 million Syrians will require humanitarian aid, including 6.2 million refugees abroad and 7.2 million IDPs. A major challenge is unemployment, as many skilled Syrians struggle to find work due to broken labor market connections. AI and modern technologies, such as machine learning for job matching and microservices for scalable platforms, offer solutions. The Nohoud project leverages these innovations to provide personalized job recommendations and career development plans, helping Syrians rebuild their livelihoods.

## 1.2 Problem Description:

Despite the clear need, existing support systems for Syrian job-seekers are fragmented and incomplete. Most humanitarian job platforms or job boards are either basic registries of openings or manual counseling programs; they typically do not personalize matches or guide users on skills development.

Technically, most current platforms suffer from rigidity and poor scalability. Traditional systems are often monolithic (single-unit) applications that are hard to maintain or extend. Communication between services can be slow or unreliable, especially across regions with limited network infrastructure.

no existing system holistically solves the problem of guiding all Syrians — whether in camps, urban centers, or abroad — through a personalized pathway from skill assessment to employment. Nohoud is designed to fill these gaps. It identifies three core problems: (1) lack of personalized matching: existing platforms do not use AI or user profiling to adapt to individual needs; (2) lack of integrated skill development: refugees need guidance on training/certification, not just job listings; and (3) poor system design for scale: many solutions cannot easily add features or handle high loads. By targeting these issues, Nohoud aims to overcome the shortcomings of current practice and effectively support Syrian livelihoods.

## 1.3 Project Objectives

The Nohoud system has the following specific, actionable objectives:

AI-driven Job Matching using n8n workflow: Develop an intelligent recommendation engine that matches each user’s profile (skills, experience, preferences) to relevant job openings and opportunities. The matching will leverage including large language model to analyze curricula vitae and job descriptions for optimal alignment.

Personal Development Plans using n8n workflow: For every user, generate a customized career development plan outlining recommended training, courses, or certifications. These plans will be tailored using the user model and labor-market insights, enabling users to systematically build employable skills over time.

Microservices Architecture: Implement the platform as a set of distributed microservices (using NestJS) so that each major function (e.g. user management, job search, recommendation, content delivery) is an independent service. This will ensure the system is scalable, maintainable, and fault-tolerant.

Efficient Communication: Use gRPC (Protocol Buffers over HTTP/2) for inter-service communication to maximize performance. Studies show gRPC can significantly outperform traditional REST APIs (e.g. 7–10× faster throughput in benchmark tests), which will allow Nohoud to handle high volumes of requests across components.

Flexible Data Storage: Use MongoDB as the primary data store, taking advantage of its schemaless document model to handle diverse user profiles and job data. This will allow the system to evolve (e.g. adding new user attributes or content types) without disruptive schema migrations.

Together, these objectives ensure that Nohoud not only delivers intelligent matching and guidance, but does so on a robust technical foundation. By meeting these goals, Nohoud will empower Syrian refugees, returnees, and residents to develop marketable skills and find employment opportunities in an effective, scalable way.

# Chapter 2: Background

## 2.1 Theoretical Underpinnings

## 2.2 Related Works

## 2.3 The Proposed Solution

# Chapter 3: Project Management & Methodology

## 3.1 Development Methodology: Agile Scrum

We adopted **Agile Scrum** as the development methodology for this project due to its flexibility, iterative nature, and proven effectiveness in managing complex projects with evolving requirements. With a team of three members possessing diverse skills, ranging from backend development to AI services. Scrum enabled us to deliver functionality incrementally while continuously adapting to new insights.

### 3.1.1 Why Agile Scrum Fits This Project

* **Adaptability to Changing Requirements**: Our platform targets nuanced needs of migrants and refugees. As we progressed and understood our users better, our requirements evolved. Scrum allows backlog reprioritization between sprints without derailing the project plan.
* **Iterative and Incremental Delivery**: We used 1-week sprints. At the end of each sprint, we delivered a working increment—whether a functional endpoint, a microservice, or a UI

feature—allowing for constant feedback and continuous validation.

* **Hands-on Collaboration**: As a small team, we benefitted from close communication and fast decision-making. The daily standups (virtual or async) enabled full visibility of who was working on what, and reduced blockers.

### 3.1.2. Roles and Responsibilities

While a formal Scrum team has distinct roles (Scrum Master, Product Owner, Development Team), we streamlined responsibilities for our context:

* **Scrum Facilitator** (nawrz qal): Ensured Scrum events happened on time, facilitated

planning, and managed progress tracking.

* **Product Ownership** (shared): Prioritized backlog items based on user impact and project goals. Decisions were made collaboratively.
* **Development Team**: All three members contributed to development across all services, splitting work based on technical strength and availability.

### 3.1.3. Sprint Planning and Execution

 We held sprint planning at the start of each sprint to:

* Define the **Sprint Goal**.
* Select user stories from the Product Backlog.
* Break them down into tasks and estimate effort (using relative sizing).

 We executed in **short, focused iterations**, allowing us to continuously adjust course based on learnings or blockers.

 Example Sprint Goal: "Implement authentication service and integrate user role-based

routing for the job platform."

### 3.1.4. Self-Organizing Team Structure

Our team operated as a self-organizing unit:

* **Autonomy**: Each member owned their tasks. Work was pulled, not pushed.
* **Cross-fertilization**: Our team members had varied skills (backend, frontend, AI, DevOps), allowing diverse input across the board.
* **Requisite Variety**: When tasks demanded new approaches, team members quickly adapted and experimented (e.g., new workflows for handling async communication or CI scripts).
* **Learning to Learn**: Retrospectives were used to re-evaluate how we work, not just what we built.
* **Self-evaluation**: We reflected on velocity, quality, and team satisfaction every sprint and adjusted our flow.

### 3.1.5. Scrum Ceremonies

 **Daily Stand-ups**: Brief check-ins, async via chat or GitHub comments. Covered progress, blockers, and coordination.

 **Sprint Review**: Demoed completed features and gathered feedback (both internal and

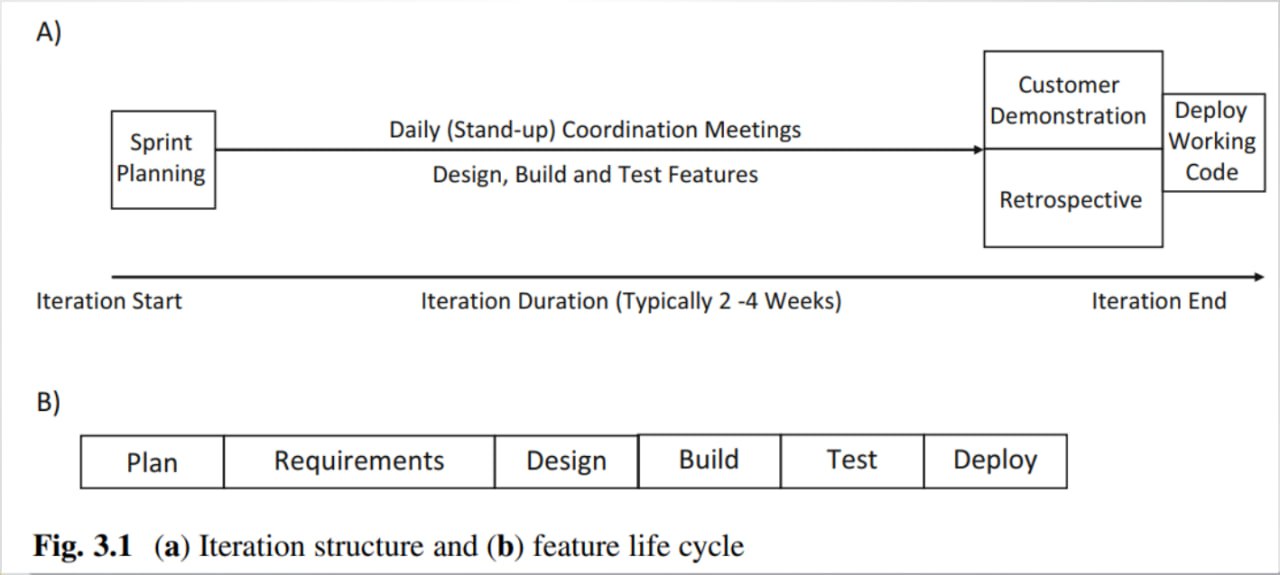
supervisor input).

 **Sprint Retrospective**: Reviewed what went well, what didn’t, and what to improve. Actions were added to the next sprint’s plan.

### 3.1.6. Sustainable Engineering Practices

* We operated under the principle of **Sustainable Pace**. No team member worked nights or weekends. This led to higher-quality, more maintainable code, and consistent delivery.
* We enforced **Collective Code Ownership** through pull requests, shared knowledge of services, and agreed coding standards.
* No module or service was siloed—anyone could improve or refactor any part of the   
  system with proper testing and PR review.

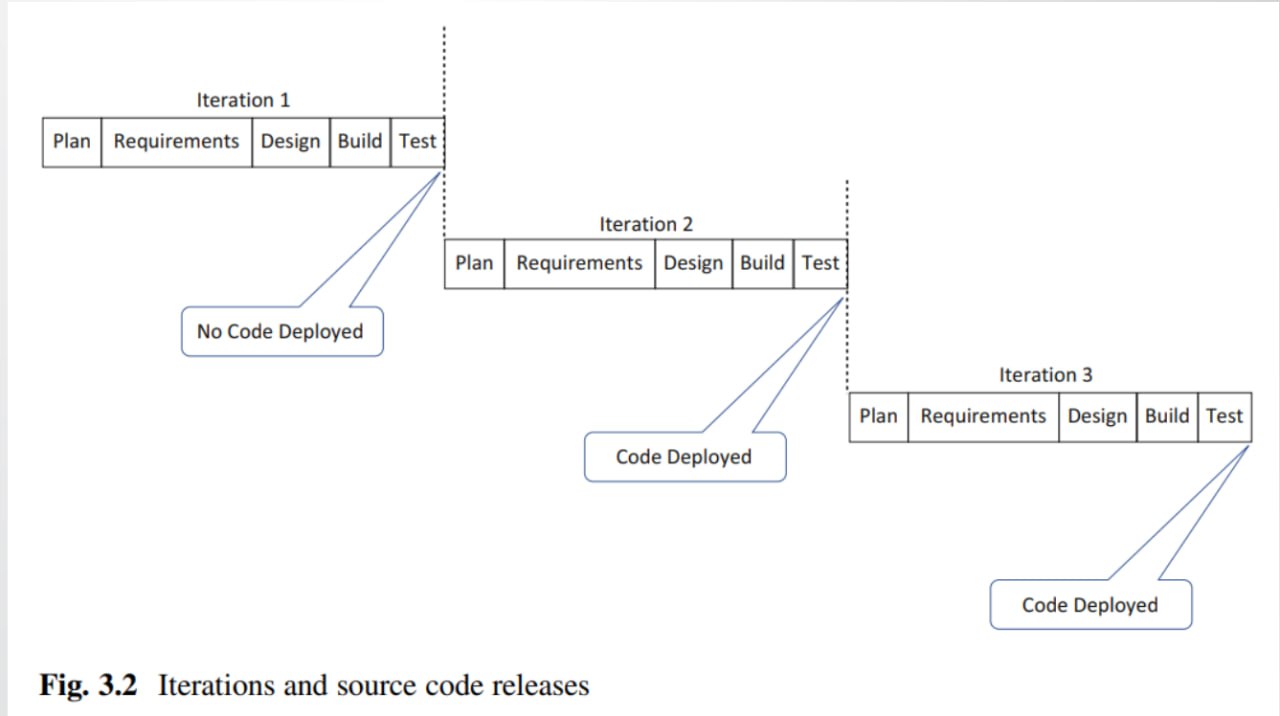
### 3.1.7. Iteration Structure and Feature Lifecycle

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Iteration structure showing the lifecycle of features through Plan → Requirements → Design → Build → Test within each sprint.

This diagram reflects how we structured each 1-week sprint: we planned, broke down user stories, designed, built locally, and tested before merging.

### 3.1.8. Code Publication & Versioning Strategy

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## 2.2. Remote Pair Programming for Complex Tasks

Although our team was small and partially co-located, we operated as a **virtual team** due to varying schedules and remote collaboration. To overcome the challenges of asynchronous development, we adopted **Remote Pair Programming** during critical implementation phases—especially for complex services like authentication, AI job matching logic, and cross-service integration.

### 3.2.1 Purpose and Benefits

* **Tactical Collaboration**: We used remote pair programming as a focused tactic to tackle complex logic, resolve integration bugs, or review sensitive code (e.g., security features, async flows, database interactions).
* **Real-time Code Quality Feedback**: One member acted as the **Driver** (writing the code), while the other was the **Navigator** (reviewing in real time, thinking about structure, edge cases, and design consistency).
* **Onboarding Support**: When a team member worked on an unfamiliar service, pair programming was used to onboard them quickly without long delays or documentation overhead.

### 3.2.2 Setup and Approach

* We used **Google Meet** for implementation sessions.
* Pairing was scheduled during sprint planning when high-risk or shared ownership tasks were identified.
* Sessions had **clear goals** and were time-boxed to avoid fatigue and maintain flow.
* We occasionally used the **ping-pong** method: one person wrote tests, the other wrote the implementation, and then roles were swapped.

## 2.3. Managing a Multi-Service Platform with Scrum

Our project consists of four core services, each with its own focus, but all contributing to a

unified platform. Scrum helped us manage this structure effectively:

* **Single Product Backlog**: Centralized and prioritized across all services. This ensured that we always focused on the most impactful items regardless of where they belonged in the system.
* **Service-Focused Sprint Goals**: Each sprint goal either cut across multiple services or focused on delivering complete functionality within one. This avoided context switching and maintained team focus.
* **Example**: One sprint focused on user authentication (Auth + Frontend), while another focused on job listing filtering and display logic (Job Service + Search Layer).

## 3.4. Project Management Tools: Jira

We used **Jira** as our main project management and tracking tool, configured to reflect Scrum best practices.

**Jira** is a **project management and issue tracking software** developed by **Atlassian**. It is widely used by teams to plan, track, and manage tasks, bugs, and agile (Scrum & Kanban)   
workflows.

**Key Features of Jira:**

* **Issue Tracking** – Log and track bugs, tasks, and improvements.
* **Agile Project Management** – Supports Scrum and Kanban boards for sprint planning.
* **Customizable Workflows** – Adapt processes to team needs.
* **Dashboards & Reports** – Visualize progress with burndown charts, velocity reports, etc.
* **Integration** – Works with Confluence, Bitbucket, Slack, and other tools.

### 3.4.1. Epics, User Stories, and Tasks

* **Epics**: Represented large features or services (e.g., AI Recommendation, Job Matching,

Authentication).

* **User Stories**: Written in user-centric format and linked to the product goals.
* As a job seeker, I want to receive personalized job listings based on my profile so that I can find relevant opportunities faster.
* **Tasks/Sub-tasks**: Broke user stories down into actionable development items with effort

estimates.

### 3.4.2. Sprint Board and Burndown Charts

* The Jira board had columns for To Do, In Progress, Code Review, and Done.
* **Burndown Charts** were used to track progress during each sprint. Irregularities in the burndown graph helped us identify underestimations or scope creep early.

### 3.4.3. Visual Artifacts from Jira Workspace

**Still empty**

## 3.5. Version Control Strategy

We used **Git** and managed our codebase under a **GitHub Organization** to support collaboration, issue tracking, and code review workflows.

### 3.5.1. Branching and Git

* **Branch Strategy**:
  + main: Production-ready code.
  + develop: Latest working build.
  + feature/xyz: Feature development.
* **Pull Request Process**:
  + Each feature or bug fix was submitted via PR.
  + At least one team member reviewed and approved it before merging.
  + Linked Jira issues and included testing instructions when relevant.

## 2.6. Communication and Collaboration

Effective communication and collaboration were essential to the success of our self-organizing team, especially given our hybrid work environment. We established clear communication channels and structured interactions to ensure transparency, accountability, and fast feedback.

### 3.6.1 Primary Communication Channels

* **Google Meet**: Used for real-time meetings such as sprint planning, sprint reviews, and occasional ad-hoc discussions.
* **Telegram Group**: Our central communication hub. We organized conversations into topic-specific threads to maintain clarity and focus:
  + #visual-identity: UI/UX and branding discussions.
  + #discussion: General project decisions, blockers, and coordination.
  + #files-and-docs: Shared links to documentation, files, and assets.

### 3.6.2 Meeting Cadence

* **Weekly Sprint Meetings**:
  + Sprint Planning at the start of each sprint.
  + Sprint Review/Demo at the end of the sprint.
* **Daily Async Stand-ups**:
  + Team members posted brief updates (what was done, what’s next, blockers) in the Telegram #discussion thread or via GitHub issue comments.

# Chapter 4: Requirements Engineering

# Chapter 5: System Design and Architecture

## 5.1. Architectural Style: Microservices

**What is Microservices Architecture?**

Microservices architecture (often shortened to microservices) refers to an architectural style for developing applications. Microservices allow a large application to be separated into smaller independent parts, with each part having its own realm of responsibility. To serve a single user request, a microservices-based application can call on many internal microservices to compose its response.

**Monolithic vs. microservices architecture**

Traditional monolithic applications are built as a single, unified unit. All components are tightly coupled, sharing resources and data. This can lead to challenges in scaling, deploying, and maintaining the application, especially as it grows in complexity. In contrast, microservices architecture decomposes an application into a suite of small, independent services. Each microservice is self-contained, with its own code, data, and dependencies. This approach offers several potential advantages:

* **Improved scalability:** Individual microservices can be scaled independently based on their specific needs
* **Increased agility:** Microservices can be developed, deployed, and updated independently, enabling faster release cycles
* **Enhanced resilience:** If one microservice fails, it doesn't necessarily impact the entire application
* **Technology diversity:** The flexibility of microservices allows teams to use the most suitable technology for each service

### 5.1.1. Rationale for Choosing Microservices

The Nuhoud system uses a microservices architecture to maximize scalability and flexibility. Each microservice can be scaled independently – for example, if the Job Service experiences heavy load, only its instances need to be increased. This avoids over-provisioning and improves resource utilization. Microservices also enforce **separation of concerns**: distinct business   
domains (user management, job postings, notifications, AI) reside in separate services, making each codebase smaller and more maintainable. Changes or faults in one service (say, the AI   
Recommendation Service) do not directly affect others, improving fault isolation. Independent services can be deployed and updated on their own schedules, enabling faster iteration.   
In practice, we organize teams and development pipelines around these bounded domains; for example, one team owns user/profile features while another owns job postings. Overall,   
microservices offer the agility (parallel development, polyglot persistence), resilience, and fine-grained scalability that suit Nuhoud’s requirements.

* **Scalability:** Each service can be scaled on demand (e.g. adding instances of the Job Service) without scaling unrelated components.
* **Separation of Concerns:** Services are aligned to single business capabilities (following the Single Responsibility Principle) so they are cohesive and independently maintainable.
* **Independent Deployment:** Teams can deploy or upgrade services separately, reducing risk. The database-per-service pattern decouples data, so updates do not require cross-database schema changes.

These factors make microservices well-suited for Nuhoud’s event-driven, domain-oriented system. (As one guide notes, “Bounded Contexts (each BC correlates to a microservice)” when using DDD principles

### 5.1.2. Service Decomposition and Granularity

We decomposed Nuhoud according to Domain-Driven Design (DDD). Each microservice corresponds to a bounded context – a coherent subdomain with its own data and logicIn Nuhoud, the main services are:

* **Authentication & User Service:** Manages the ***User*** domain. It handles registration, login (email or phone), profiles (personal info, experience, education, skills) and tracks each user’s job applications and development history. All user-related data is stored here. When an OTP is needed, it generate it and invokes the Alerts Service over gRPC to send it.
* **Alerts & Notifications Service:** Manages the ***Notifications*** domain. It exposes a gRPC interface for sending one-time passwords (used by Auth) via WhatsApp or email.   
  It subscribes to Kafka events (e.g. job application or status events) to notify users of job matches, application updates
* **AI Recommendation Service:** Handles the ***Recommendation*** domain. Orchestrated by an n8n workflow, it analyzes user profiles (skills, experience) and job data to generate personalized job recommendations and Personal Development Plans. It relies on external AI model ( Gemini ).
* **Job Service:** Encapsulates the ***Job Posting*** domain. Employers post jobs here; users browse and apply. It tracks job status (Active, Closed, Draft, Expired) and application status. When a user submits an application, this service records it and consume a   
  job.application.submit Kafka message to proccess it. when an application’s status changes, it emits job.application.statusChange Kafka event.

Each service thus owns a single, well-defined domain. This decomposition follows best practices (DDD/Single-Responsibility) by grouping related functionality within one service. For example, all user authentication and profile logic stays in the User Service, and job logic stays in the Job Service. This keeps services highly cohesive and loosely coupled. No service tries to span multiple domains (avoiding “distributed monolith” issues). In summary, Nuhoud’s microservices align with bounded contexts and business capabilities, ensuring each service has clear responsibilities.

## 5.2. High-Level System Architecture Diagram

## 5.3. Core Design Principles

### 5.3.1. SOLID Principles Application

### 5.3.2. Key Design Patterns

## 5.4. Inter-Service Communication

### 5.4.1. Communication Patterns

### 5.4.2. Asynchronous Communication with Apache Kafka

### 5.4.3. Synchronous Communication with gRPC

## 5.5. Data Management Strategy (e.g., Database-per-Service)

**- Database per Service with Controlled Data Replication**

## 5.6. AI Service Integration using n8n

# Chapter 6: Technology Stack and Rationale

# Chapter 7: Implementation

# Chapter 8: Testing

# Chapter 9: Conclusion and Future Work

https://cloud.google.com/learn/what-is-microservices-architecture#monolithic-vs-microservices-architecture

# Appendices

Note:

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