

A

Project Report On

Skill Orbit

Skill Competency Management System

Submitted to

**RAJIV GANDHI UNIVERSITY OF KNOWLEDGE AND
TECHNOLOGIES RK VALLEY**

On completion of Project-I

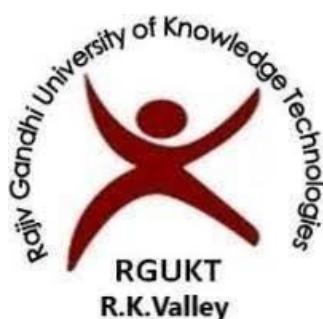
Submitted By

S.MOMINTAJ(R200280)

Under the guidance of

Mr. P. SANTHOSH KUMAR , ASSISTANT PROFESSOR

Department of Computer Science and Engineering



RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES(AP IIIT)

R.K Valley, Vempalli, Kadapa(Dist) – 516330

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

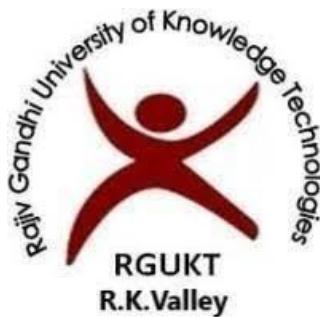
2025-2026

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES (AP IIIT)

R.K Valley, Vempalli(M), Kadapa(Dist) – 516330

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

2025-2026



CERTIFICATE

This is to certify that the project report entitled "***SKILL ORBIT***" being submitted by **S.MOMINTAJ** under my guidance and supervision and is submitted to **DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING** in partial fulfilment of requirements for the award of Bachelor of Technology in Computer Science during the academic year 2025-2026 and it has been found worthy of Acceptance According to the requirements of the University.

Project Guide

Mr. P. SANTHOSH KUMAR ,
M.Tech(Ph.D), Assistant Professor ,
Dept of CSE ,
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Signature :

Head of the Department

Dr. CH Ratna Kumari M.Tech,
(University Of Hyderabad),
PhD (JNTU H),
Ass. Prof . I Dept Of CSE,
Signature :

Signature of External Examiner

ACKNOWLEDGEMENT

I wish to express our sincere thanks to various personalities who were responsible for the successful completion of the main project.

I am grateful to **Dr. CH. RATNA KUMARI**, Head of the Department, for her motivation and encouragement in completing the project in specified time.

I express my deepfelt gratitude to **Mr. P. SANTOSH KUMAR**, internal guide for his valuable guidance and encouragement which enabled me to successful completion of project in time.

I express my sincere thanks to all other faculty members of CSE Department for extending their helping hands and valuable suggestion when in need.

Finally, my heartfelt thanks to my parents for giving me all I ever needed to be a successful student and individual. Because of their hard work and dedication, I have had opportunities beyond my wildest dreams.

**WITH SINCERE REGARDS
S.MOMINTAJ [R200280]**

DECLARATION

Hereby declare that this project work entitled "***SKILL ORBIT***" submitted to **DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING** is a genuine work carried out by me, for the fulfilment of Bachelor of Technology in the Department of Computer Science & Engineering during the academic year 2025-2026 under the supervision of my project guide **Mr. P. SANTOSH KUMAR**, Department of Computer Science & Engineering in **RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES(AP IIIT), R.K. Valley**.

WITH SINCERE REGARDS
S.MOMINTAJ [R200280]

ABSTRACT

The traditional approach to employee skill management and training often suffers from inefficiencies, lack of centralized tracking, and communication barriers between managers and employees. To overcome these challenges, **Skill Orbit – Skill Competency Management System** has been developed as an intelligent platform designed to streamline and enhance the overall skill development process. The system integrates modern web technologies with structured competency frameworks to automate training workflows, enable skill gap analysis, and provide data-driven insights into employee performance and growth.

The platform is built using an **Angular** frontend and a **FastAPI** backend, ensuring scalability, security, and responsiveness. It supports competency tracking across standardized levels (**L1–L5**) aligned with CASCADE and MHS frameworks, and includes modules such as training catalog management, assignment tracking, feedback collection, and role-based dashboards for managers and engineers. The solution enables seamless interaction between managers and employees, improves training efficiency, and facilitates performance evaluation through real-time analytics and automation.

The implementation of **Skill Orbit** demonstrates significant improvement in training management, enhanced employee engagement, and streamlined coordination between team members and supervisors. The system not only simplifies competency tracking but also represents a modern, data-driven approach to human resource development. Future enhancements aim to incorporate machine learning–based training recommendations, multi-language support, and predictive analytics for proactive skill gap identification.

INTERNSHIP DESCRIPTION

I am currently pursuing my internship at **ZF Group** as part of my academic curriculum. This internship has provided me with a valuable opportunity to gain practical experience in the field of **software development** and **enterprise application design**. Working in a professional environment has helped me bridge the gap between theoretical knowledge and real-world implementation.

During my internship, I have been working on the project titled “**Skill Orbit – Skill Competency Management System**”, which is also being presented as my major project for the fulfillment of my undergraduate degree requirements. The project is being developed under the mentorship of experienced professionals at **ZF Group**, who have guided me throughout the stages of system design, development, and testing.

ZF Group is a global technology company that specializes in mobility solutions, automotive systems, and industrial technology. The organization focuses on developing innovative products for vehicle motion control, electric mobility, and digital transformation. Being part of such a dynamic work environment has significantly enhanced my understanding of **software engineering practices**, **collaborative development**, and **problem-solving** in large-scale systems.

The **Skill Orbit** platform developed during this internship aims to modernize and automate the skill management and training process within organizations. It integrates modules such as skill tracking, role-based dashboards, training catalog management, feedback collection, and competency analysis using structured frameworks. My contribution primarily involved designing the **system architecture**, developing the **frontend using Angular**, building the **backend services with FastAPI**, and integrating APIs to ensure smooth data communication between components.

This report represents the complete documentation of the project undertaken during my internship at **ZF Group**, demonstrating how academic learning has been effectively applied to build an innovative, industry-oriented solution that supports efficient and data-driven skill management.

OFFER LETTER

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Internal



Private & Confidential

To,

**Ms.Shaik Momintaj,
Kammuraya Veedi, Nallecheruvu Mandal,
Sri Sathya Sai District, Andhra Pradesh – 515551**

Dept.	Human Resources
From	Rakesh Almal
E-mail	rakesh.almal@zf.com
Our Ref.	79980
Date	11 th Jul 2025

Subject: Internship Letter

Dear Shaik Momintaj,

We are pleased to offer you Internship at **ZF India Private Limited, Research & Development**.

Please find the following confirmation of the specifics of your internship:

1. Internship period: 21-July-2025 to 20-Jan-2026.
2. Initial location: ZF India Private Limited, Survey No 115/Part, Aster Building, IT Sez, Nanakramguda, Serilingampally Mandal, Hyderabad, Telangana 500032.
3. Internship Manager / Supervisor: Mr. Narendra Kumar Vajji – Industrial Division Lead
4. Internship Project: Refer Annexure A.
5. Stipend: INR 20,000 per month, subject to applicable deductions. You will not receive any of the employee benefits that regular employee of the Company receives.
6. Working hours and leave: You would be required to be available for 9 hours each day during the course of your internship. During the course of your internship, in case you require to take leave for any personal emergencies, you would be required to take approval from your Internship Manager / Supervisor prior to taking such leave.
7. Internship termination:
 - (i) 30 days' prior written notice from either side.
 - (ii) The Company shall be entitled to terminate the internship with immediate effect (but without prejudice to any other rights and remedies of the Company) if you are guilty of dishonesty or misconduct, or without reasonable cause neglect or refuse to attend to assigned Project(s) or fail to perform any of your obligations hereunder or any other applicable regulations of the Company.



8. Confidentiality: During your internship, you may have access to trade secrets and confidential information belonging to the Company and/or its associates, related companies ("ZF Group"). By accepting this internship, you acknowledge that you must keep all of this information strictly confidential, and refrain from using it for your own purposes or from disclosing it to anyone outside the Company. In addition, you agree that, upon conclusion of your internship, you will immediately return to the Company all of its property, equipment, and documents, including electronically stored information. You agree that during the internship period, you shall not directly or indirectly own, manage, control, participate in, consult with, render services for (as an intern or otherwise), or engage in any business competing with ZF Group.

9. Intellectual property Rights:
 - (i) All patents, inventions, designs, copyrights, trade secrets, trade/commercial names, proprietary rights, logos, slogans and all other intellectual property rights developed by or for the Company by you during the internship period, including but not limited to intellectual property rights relating to any or all of the Confidential Information ("Intellectual Property Rights") shall be owned by the Company.
 - (ii) You agree that all rights, title and interest in the Intellectual Property Rights shall be owned exclusively by the Company. The Company will retain ownership of all Intellectual Properties including but not limited to all inventions, original works of authorship, developments, concepts, know-how, improvements, trademarks, software programs, domain names or trade secrets, whether or not patentable or registerable under patent, designs, trademark, copyright or similar laws, generated during the internship period.
 - (iii) You shall at the request of the Company or otherwise, promptly execute worldwide, royalty free, and fully paid up specific, irrevocable and perpetual assignment of title in favour of the Company, and do, whatever else as deemed necessary or advisable by the Company including execution of necessary documents, making an application, registration to secure, perfect, and maintain for the Company any and all Intellectual Property Rights, in any and all the countries.
 - (iv) You confirm and agree that all Intellectual Property which is developed by you (solely or jointly with others) within the scope of and during the internship period is a "work made for hire" and is compensated by your stipend, with no additional claims or compensation.

10. You will not enter into any commitments or dealings on behalf of the Company. Any violation of this may lead to termination of your internship program with immediate effect.

11. Data Privacy:
 - (i) By signing this Letter, you consent to the Company holding and processing your personal data for legal, personnel, administrative and management purposes and in particular to the Company processing any personal data as necessary for the purposes of your internship. You hereby acknowledge and grant your consent to the Company collecting, using, processing, storing, disposing off, and transferring, whether to any other ZF Group company, or to third party service providers, within or outside India, any such personal information relating to you.
 - (ii) The personal data related to you will be held only as long as is necessary. You may, at any time, view your personal data held by the Company, request additional information about the storage and processing of your personal data, recommend any necessary corrections to your personal data or refuse or withdraw the consents herein in writing, by contacting the Company's Human Resources department.

12. You understand that you are not an "employee" or a "workman" for the purposes of any employment statute and there is no assurance or guarantee that you will be employed by the Company upon completion of your internship.



13. This Letter constitutes the complete understanding between you and the Company regarding your internship and supersedes all prior discussions, letters or agreements. This Letter may only be modified by a written document signed by both Company and you.
14. The terms of this Internship Letter and any disputes which may arise under, out of, or in connection with your internship, shall be governed by and construed in accordance with the laws of India and the Courts having territorial jurisdiction over the registered office of the Company shall alone have exclusive jurisdiction to try and entertain such disputes.

We hope that your internship with the Company will be successful and rewarding.

Please indicate your acceptance of this Internship letter by signing below and returning it to Mrs. Sharifa Mohammed. If you have any questions, please contact do not hesitate to contact Sharifa Mohammed at sharifa.mohammed@zf.com

For ZF India Private Limited

For ZF India Private Limited

Signature

Name: Indumethi Singh Valluri
Designation: Head of HR - TCI

Signature

Name: Rakesh Almel
Designation: Head of Talent Acquisition, Region India

Encl: Annexure A

ACCEPTANCE

I accept the internship with ZF India Private Limited on terms and conditions set out in this Letter. The original of this Letter is in my possession.

S. MominTaj

Signature

Name Shaik MominTaj

Address Kammuraya Veedi, Nallacheruvu Mandal, Sri Sathya Sai District, Andhra Pradesh - 515551

Date 17/07/2025



ANNEXURE A

INTERNSHIP PROJECT

The Project you will be expected to support during your internship period is as under:

This Job Role is part of Job Family "Research&Development"

We are seeking a highly skilled and motivated Full Stack Developer with strong expertise in Python and Angular.

Candidate will be responsible for designing, developing, and maintaining scalable applications, ensuring seamless integration between front-end and back-end components.

Key Responsibilities:

Design and develop robust, scalable, and secure applications using Python and Angular.

Build RESTful APIs and integrate them with front-end components.

Write clean, maintainable, and well-documented code.

Optimize application performance and troubleshoot issues across the stack.

Stay updated with the latest trends and technologies in tool development.

Required Skills:

Strong proficiency in Python.

Solid experience with Angular (Angular cli , Strong Knowledge on Components, Directives ,Data Binding, Directives, Services, Routing, pipes, modules, forms).

Experience in building and consuming RESTful APIs.

Familiarity with SQL and NoSQL databases (e.g., PostgreSQL, MongoDB).

Knowledge of version control systems like Git.

Understanding of software development lifecycle (SDLC) and Agile methodologies.

You should use your best efforts in performing and delivering the Project.



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Chapter – 1

INTRODUCTION

The rapid growth of digital technologies, automation, and data-driven systems has significantly transformed how organizations manage workforce skills. Traditional methods such as manual tracking and spreadsheets often result in inefficiencies, data duplication, and limited visibility into employee competencies. As industries evolve with emerging technologies, the need for structured, measurable, and data-driven skill management systems has become crucial.

Skill Orbit – Skill Competency Management System is developed to overcome these challenges by providing an intelligent, automated, and centralized platform for managing employee skills and training. The platform ensures a structured and data-driven approach to workforce development through competency-based tracking, automated training assignments, performance evaluation, and real-time analytics. It bridges the communication gap between managers and employees by offering role-based dashboards, structured feedback mechanisms, and integrated workflows for training and development.

The system leverages an **Angular**-based frontend for a responsive and interactive user experience and a **FastAPI** backend for handling secure and scalable business logic. A **PostgreSQL** database ensures reliable data storage, while authentication and authorization mechanisms protect sensitive employee data. Furthermore, the platform incorporates **CASCADE** and **MHS** competency frameworks to assess employee proficiency across five levels (L1–L5), ensuring standardized evaluation across teams.

By combining automation, structured competency tracking, and analytics, **Skill Orbit** transforms the traditional manual skill management process into a modern, intelligent ecosystem. It enables managers to make informed decisions, track team growth, and ensure that training programs are aligned with organizational objectives. At the same time, it empowers employees to monitor their own progress and engage in continuous skill

enhancement.

In short, **Skill Orbit** represents a shift from conventional training methods to a comprehensive, technology-driven competency management model that promotes efficiency, transparency, and continuous learning.

1.1 INTRODUCTION TO INTERVIEWEASE

Skill management plays a critical role in every organization's success, particularly in the technology-driven world where skill requirements evolve constantly. Conventional systems lack centralized tracking, clear visibility, and a standardized framework for evaluating skills. To address these challenges, **Skill Orbit** introduces a streamlined and intelligent competency management system designed to modernize how organizations manage workforce capabilities.

Skill Orbit enables managers and employees to collaborate efficiently through an intuitive digital platform. Employees can view their skill sets, identify competency levels, and track progress from **L1 to L5** based on standardized frameworks. Managers, on the other hand, can view team competencies, assign relevant trainings, and monitor overall skill development using analytical dashboards. The system also includes modules for training catalogs, feedback collection, and skill gap analysis, ensuring that both employee growth and organizational development move in sync.

Developed using **Angular** for the frontend and **FastAPI** for the backend, the system ensures a fast, secure, and scalable architecture. The use of **PostgreSQL** as a database supports efficient data handling, while API integration ensures seamless communication between components. The modern UI, combined with structured logic and automation, creates a highly user-friendly experience suitable for enterprise-level deployment.

By introducing structured competency mapping and automation, **Skill Orbit** transforms traditional skill management into a smart, data-driven process that improves training efficiency, reduces manual effort, and enhances collaboration between teams.

1.2 PROBLEM STATEMENT AND OBJECTIVES

Problem Statement:

Traditional skill management and training systems in organizations often rely on manual methods that are time-consuming, error-prone, and lack standardization. The absence of structured competency frameworks and real-time tracking results in unclear performance insights and limited opportunities for targeted development. Communication gaps between managers and employees further delay training decisions and hinder effective progress evaluation.

There is a need for an intelligent, automated, and centralized system that standardizes competency tracking, simplifies training management, and leverages data analytics for better decision-making in employee development.

Project Objectives:

- To design and develop a **full-stack web platform** using Angular and FastAPI for skill and competency management.
- To implement **structured competency tracking** using **L1–L5 levels** aligned with **CASCADE and MHS standards**.
- To create **role-based dashboards** for managers and employees with controlled access and personalized features.
- To provide **automated training management**, including assignment, feedback, and tracking modules.
- To analyze **skill gaps and progress trends** using data-driven insights and analytics.
- To ensure **secure authentication** and **role-based authorization** for all users.
- To develop a **user-friendly and responsive interface** for seamless navigation and accessibility.
- To deploy and validate the platform for **real-time performance** and scalability.

1.3 APPLICATIONS AND SCOPE

APPLICATIONS

The Skill Orbit – Competency Management Ecosystem can be effectively applied in various domains where skill tracking, training, and performance evaluation are essential. The major areas of application include:

- Corporate Organizations:**

Enables human resource and training departments to monitor employee skills, assign trainings, and evaluate competency levels efficiently.

- IT and Software Companies:**

Assists technical managers in assessing employee skill gaps, planning training programs, and tracking team performance using standardized competency frameworks.

- Educational Institutions:**

Facilitates skill-based learning and training management for students, allowing institutions to evaluate competencies through structured assessments.

- Consultancy and Professional Services:**

Helps consultancy firms manage workforce skill data, plan upskilling programs, and maintain client-oriented performance records.

- Government and Public Sector Organizations:**

Ensures transparency and uniformity in training programs and competency evaluations across different departments.

- Research and Development Institutions:**

Provides structured frameworks to identify key skills required for innovation and

project-specific technical advancements.

Scope for Research and Development:

The **Skill Orbit** platform is developed with a scalable and modular architecture, allowing easy expansion and integration of advanced technologies in the future. The possible areas for enhancement include:

- Integration of **Machine Learning (ML)** models to provide personalized training recommendations based on user skill profiles and career growth paths.
- Implementation of **Predictive Analytics** to forecast future skill requirements and training needs within an organization.
- Development of a **Mobile Application** to provide on-the-go access for users to track skills, manage trainings, and submit feedback.
- Integration with external systems such as **Learning Management Systems (LMS)**, **Human Resource (HR)** platforms, and collaboration tools like Microsoft Teams or Slack.
- Addition of **Multi-Language Support** to make the system adaptable for global organizations.
- Introduction of **Gamification Features** such as badges, progress tracking, and leaderboards to enhance user engagement and motivation.

- Addition of **AI-driven bias detection modules** to ensure fair and ethical recruitment practices.

In conclusion, **Skill Orbit –Skill Competency Management System** provides a modern, intelligent, and automated solution for managing employee training and development. By integrating technology, analytics, and standardized competency frameworks, it empowers organizations to build a more skilled, efficient, and future-ready workforce. The system's modular design, secure architecture, and data-driven insights make it an essential tool for the digital transformation of talent and skill management processes.

Chapter – 2

MODEL BUILDING AND DEVELOPMENT

The main objective of **Skill Orbit – Competency Management Ecosystem** is to design and build a full-stack competency management system that simplifies and enhances employee development through automation, real-time tracking, and intelligent evaluation. The platform integrates modules such as skill tracking, training catalog management, assignment systems, role-based dashboards, and feedback collection to support both managers and employees in a secure and scalable environment.

The development process included five major stages:

1. Gathering system requirements and platform specifications
2. Frontend design and implementation
3. Backend development with business logic and database integration
4. Database schema design and data import functionality
5. Deployment, integration, and testing

Each stage was implemented carefully to ensure the system is modular, efficient, and user-friendly..

2.1 Gathering Requirements & Data Sources

Before development, system requirements were gathered by analyzing workflows of managers and employees. The requirements were categorized into functional and non-functional aspects.

Functional Requirements

- **User roles:** Engineer, Manager, Administrator, Trainer
- **Skill data:** Employee competencies with current and target levels (L1-L5), additional self-reported skills
- **Training data:** Training catalog with details, prerequisites, trainers, schedules, and assignments
- **Assignment data:** Training assignments, submissions, scores, and feedback

- **Manager-employee relationships:** Hierarchical structure for team management
- **Notification data:** Training assignments, approvals, and reminders

Non-Functional Requirements

- **Performance:** The system should ensure minimal latency and smooth operations for multiple users.
- **Scalability:** Must support an increasing number of users and data volume.
- **Security:** Password encryption and token-based authentication for user safety.
- **Usability:** Simple, interactive, and responsive user interface for all user roles.
- **Reliability:** Consistent data accuracy and integrity across all modules.

2.2 System Architecture and Design

The **Skill Orbit** platform follows a **three-tier architecture** comprising the frontend, backend, and database layers.

- **Frontend (Angular):**
Handles user interactions and presents dynamic dashboards for managers and employees.
- **Backend (FastAPI):**
Manages authentication, training assignments, feedback collection, and data communication between the frontend and database.
- **Database (PostgreSQL):**
Stores user information, skill levels, training details, assignment data, and feedback records securely.

Architecture Flow:

User → Frontend (Angular) → Backend APIs (FastAPI) → Database (PostgreSQL) → Response → Frontend Display

This architecture ensures modularity, scalability, and efficient communication between all components.

2.3 Frontend Implementation

The frontend was built to deliver a smooth and intuitive user experience using reusable UI components.

Key modules include:

- **Authentication:**
Login and registration pages for managers and employees with validation and role-based routing.
- **Engineer Dashboard:**
Allows employees to view skill levels, browse training catalog, submit assignments, and track progress.
- **Manager Dashboard:**
Enables managers to view team skills, assign trainings, approve requests, and give feedback.
- **Skill Management Module:**
Displays skills with L1–L5 levels, skill gaps, and additional self-reported skills.
- **Training Catalog Module:**
Lists available trainings with search and filter options.
- **Assignment and Feedback Module:**
Manages assignment submissions, scoring, and structured feedback collection.

The frontend uses **Angular Material** and **Tailwind CSS** for creating a visually appealing interface and responsive layouts.

2.4 Backend Implementation

The backend is developed using **FastAPI**, chosen for its high performance, security, and easy integration with modern frontend frameworks.

Key Backend Services

- **User Service:** Handles registration, login, and role-based access with JWT authentication.
- **Skill Service:** Manages employee competencies, tracks levels, and performs skill gap analysis.
- **Training Service:** Maintains training catalog, assignments, and scheduling.

- **Assignment Service:** Handles assignment creation, submission, scoring, and retrieval.
- **Manager Service:** Tracks team performance, manages training approvals, and stores feedback.
- **Feedback Service:** Collects and stores user feedback for performance evaluation.
- **Data Import Service:** Enables uploading of Excel or CSV files for bulk data import (trainings, employees, competencies).

Technologies Used:

FastAPI, PostgreSQL, SQLAlchemy ORM, Pydantic models, JWT for authentication, and Bcrypt for password encryption.

Data Flow:

Frontend Request → FastAPI Endpoint → Database Operation → Response → Frontend Update

This ensures seamless and secure communication between all modules.

2.5 AI Evaluation and Visualization

The **Skill Orbit** system ensures seamless data flow between the Angular frontend and FastAPI backend using **RESTful APIs**. All major operations—such as authentication, training management, and feedback submission—are handled through secure API calls.

The frontend communicates with the backend using HTTP methods (**GET, POST, PUT, DELETE**) and receives JSON responses for real-time updates. **JWT authentication** and **CORS configuration** are implemented to ensure secure communication and controlled data exchange.

This integration enables reliable, fast, and efficient communication between all modules of the system.

The design and development phase of **Skill Orbit – Competency Management Ecosystem** was executed using a structured, modular, and scalable approach. The combination of **Angular**, **FastAPI**, and **PostgreSQL** ensures a secure, efficient, and interactive platform for both managers and employees.

Each module—from skill management to feedback collection—was developed to work in synchronization, enabling seamless data flow and improved user experience. The system design supports future enhancements such as machine learning-based recommendations, predictive analytics, and mobile application integration, making **Skill Orbit** a reliable and adaptable platform for modern competency management.

Chapter - 3

TESTING AND VALIDATION

Testing and validation are crucial phases in the development of the Skill Orbit – Competency Management Ecosystem, ensuring that the system performs reliably, meets functional requirements, and delivers a seamless experience to users. Throughout the development lifecycle, systematic testing approaches were implemented to identify defects, verify module behavior, and validate workflows under real usage conditions. This chapter outlines the testing methods, validation processes, and reliability measures undertaken to ensure the overall quality of the platform.

3.1 Testing

Testing was performed at multiple levels to ensure that the **Skill Orbit** platform operates smoothly and efficiently. The testing phase focused on verifying both the **frontend (Angular)** and **backend (FastAPI + PostgreSQL)** functionalities, along with the overall integration between modules.

- **Frontend Testing:**

Verified login, registration, dashboard navigation, skill tracking, training catalog, assignment, and feedback modules. Checked responsiveness and compatibility across browsers.

- **Backend Testing:**

Ensured all APIs function correctly, authentication using JWT works securely, and data is stored and retrieved properly from the PostgreSQL database.

- **Integration Testing:**

Verified smooth communication between Angular frontend and FastAPI backend through RESTful APIs, ensuring accurate data exchange and synchronization.

Overall, all modules were tested successfully, and the system functioned without major errors.

3.2 Validation

Validation ensures that the system meets the objectives and performs according to user expectations. The system was validated by cross-checking every feature with the requirements gathered during the design phase.

- Verified competency tracking (L1–L5) for accurate skill representation.
- Checked role-based dashboards for managers and employees.

- Confirmed proper data flow across modules like training assignments and feedback.
- Conducted user acceptance testing to ensure usability and responsiveness.
The system met all validation requirements and delivered consistent, expected results across modules.

3.3 Reliability Measures

To maintain reliability and stability, several measures were implemented during development:

- Error handling for invalid inputs and failed API calls.
- Data validation on both frontend and backend.
- Secure authentication with encrypted passwords using **Bcrypt** and token-based access using **JWT**.
- Cross-browser compatibility and responsive design checks.
- Database integrity maintained through transaction management.

3.4 PERFORMANCE EVALUATION

Performance evaluation was carried out to assess the efficiency, responsiveness, and overall stability of the Skill Orbit – Competency Management Ecosystem under different operational scenarios. This step ensured that the system not only functions correctly but also performs efficiently when handling real-time user interactions and data processing.

3.4.1 Response Time Analysis

The system was observed for its response time during common operations such as login, loading dashboards, fetching skill data, viewing the training catalog, updating skill levels, and accessing team information.

- API responses remained consistent and fast under normal usage.
- Page transitions in the Angular frontend were smooth without noticeable delays.
- Data retrieval from PostgreSQL performed efficiently even for larger datasets.

3.4.2 Load Handling

Multiple modules were accessed simultaneously to simulate real user load.

- The backend handled concurrent API calls without performance degradation.
- Training assignments, requests, and skill updates ran reliably even during peak load.

3.4.3 Resource Utilization

The system was evaluated for memory and CPU usage during operations.

- Resource consumption remained within optimal limits.
- No memory leaks or abnormal spikes were observed during repeated module access.

3.4.4 System Reliability Under Extended Use

Continuous interaction with various modules—such as viewing skills, assigning trainings, updating progress, and navigating dashboards—proved that the system:

- Maintains stability over extended usage periods
- Does not crash or slow down
- Handles long-running sessions securely through JWT token validation

3.4.5 User Experience (UX) Evaluation

User feedback was collected to refine the system's usability:

- Navigation was found intuitive and easy to understand
- Pages loaded smoothly with no visual inconsistencies
- Dashboard metrics and progress indicators enhanced clarity and user engagement

CHAPTER-4

IMPLEMENTATION AND RESULTS

The **Skill Orbit – Competency Management Ecosystem** is a full-stack web-based application designed to automate and streamline the process of skill tracking, training management, and performance evaluation. It provides a centralized platform for both engineers and managers to monitor skills, assign trainings, and track overall competency growth.

This chapter presents the implementation details of each module along with the outcomes of the developed system.

4.1 Implementation Overview

The system implementation involved both frontend and backend development, ensuring smooth communication between all components.

- **Frontend:** Angular
- **Backend:** FastAPI (Python)
- **Database:** PostgreSQL
- **Styling:** Tailwind CSS, Angular Material
- **Authentication:** JWT-based secure login
- **Deployment:** Modular, API-driven architecture

The platform includes two main dashboards one for **Engineers** and another for **Managers**, both sharing common features and additional role-specific modules.

Home page:

- Provides a clean and simple interface for first-time users.
- Shows quick access to login or register options.
- Highlights the purpose of the Skill Orbit platform.
- Offers a smooth navigation flow to begin using the system

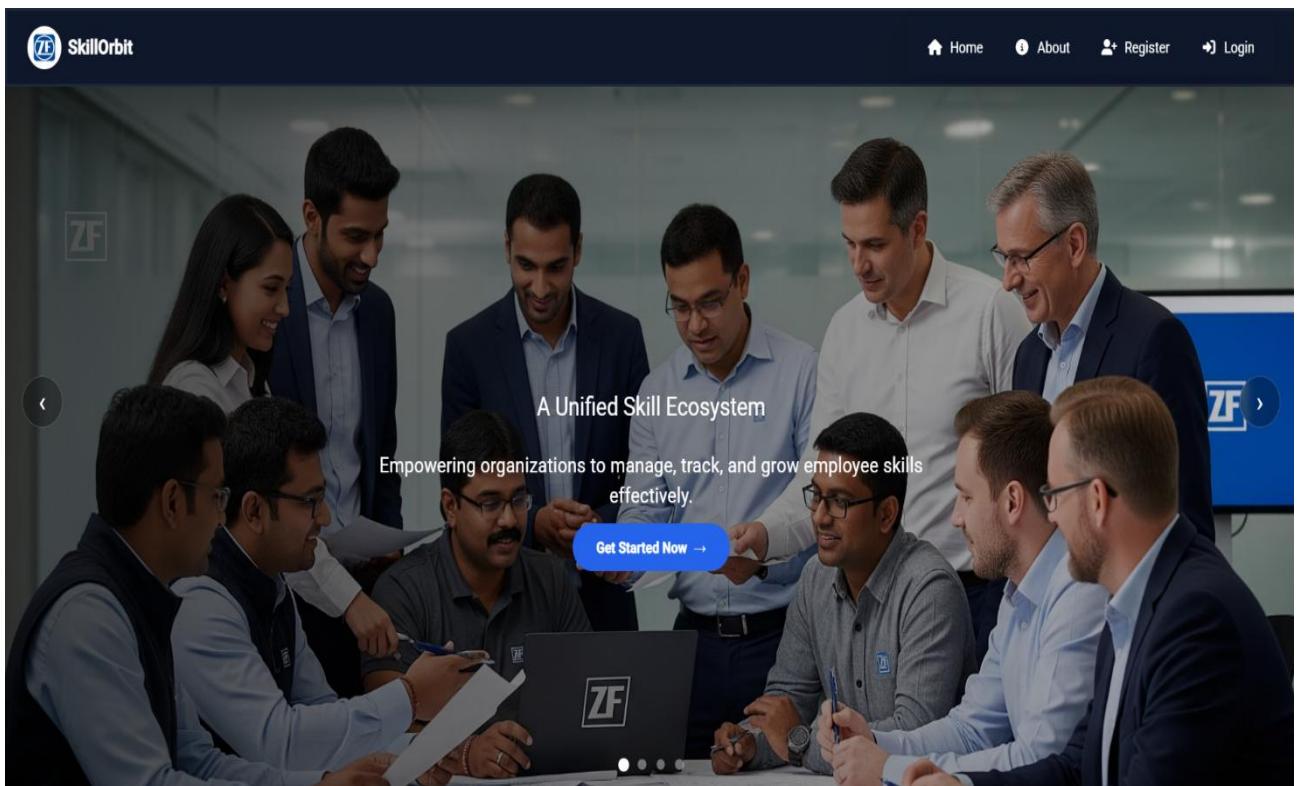


Fig 1:Home page

4.2 System Architecture

The architecture of Skill Orbit follows a client–server model, ensuring scalability and security.

- The Angular frontend provides a responsive and user-friendly interface.
- The FastAPI backend handles all business logic and communicates with the PostgreSQL database.
- JWT authentication ensures secure access to the system.

Architecture Flow:

User → Frontend (Angular) → Backend (FastAPI) → Database (PostgreSQL)

4.3 Major Modules

The system is divided into multiple modules that together form an integrated and intelligent competency management platform:

4.3.1 User Authentication Module

This module provides secure login and registration functionality for users.

- Users can sign up using their employee ID and password.
- JWT-based authentication is implemented for secure sessions.
- Role-based routing ensures users are directed to the correct dashboard after login

Registration Page:

- Enables new users to create an account with required details.
- Supports role selection to ensure personalized access.
- Stores user information securely in the database.

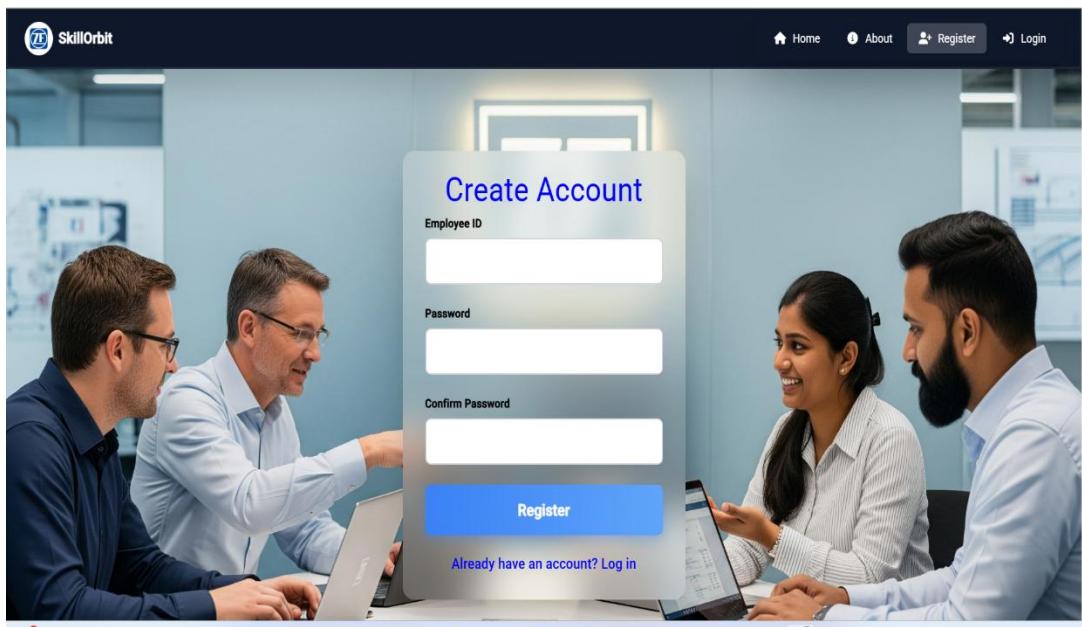


Fig 2: Registration Page

Login Page:

- Allows existing users to sign in securely using their credentials.
- Redirects users to their role-based dashboard (Manager / Engineer).
- Ensures authentication using JWT tokens for protected access.

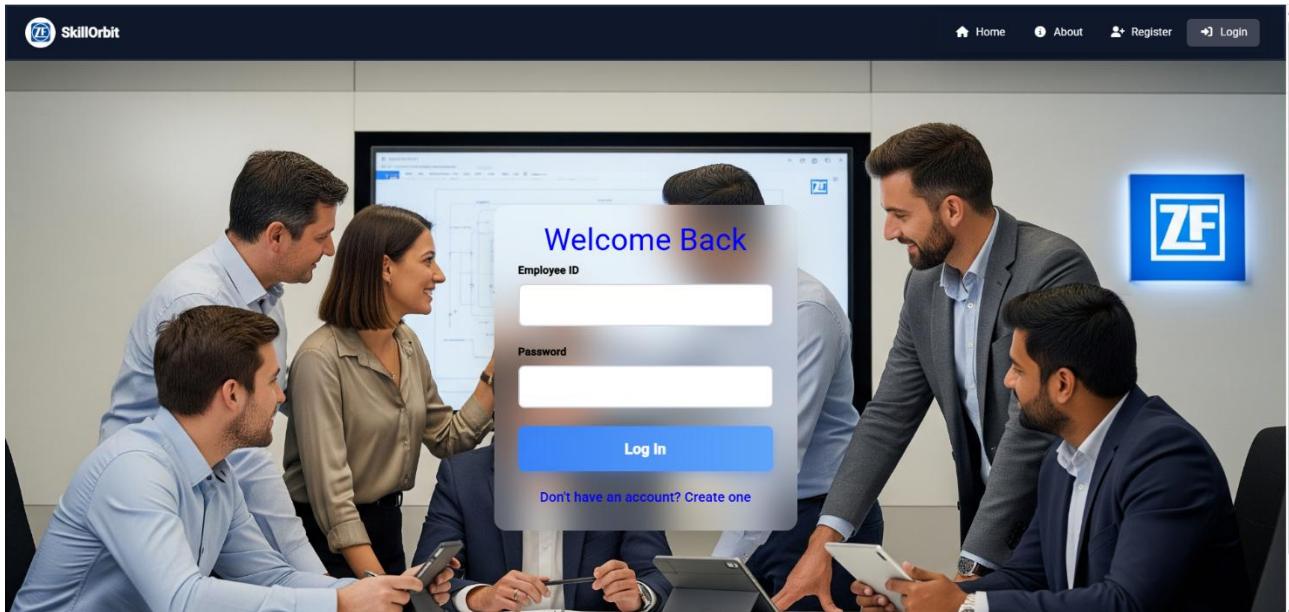


Fig 3: Login Page

4.3.2 Engineer Dashboard Module

The **Engineer Dashboard** serves as the main interface for employees. It provides access to key modules such as skill management, training catalog, assigned trainings, and badges.

Features:

- View and manage personal skill levels.
- Access the training catalog and request new trainings.
- Check assigned trainings and their completion status.
- Track earned badges and achievements.

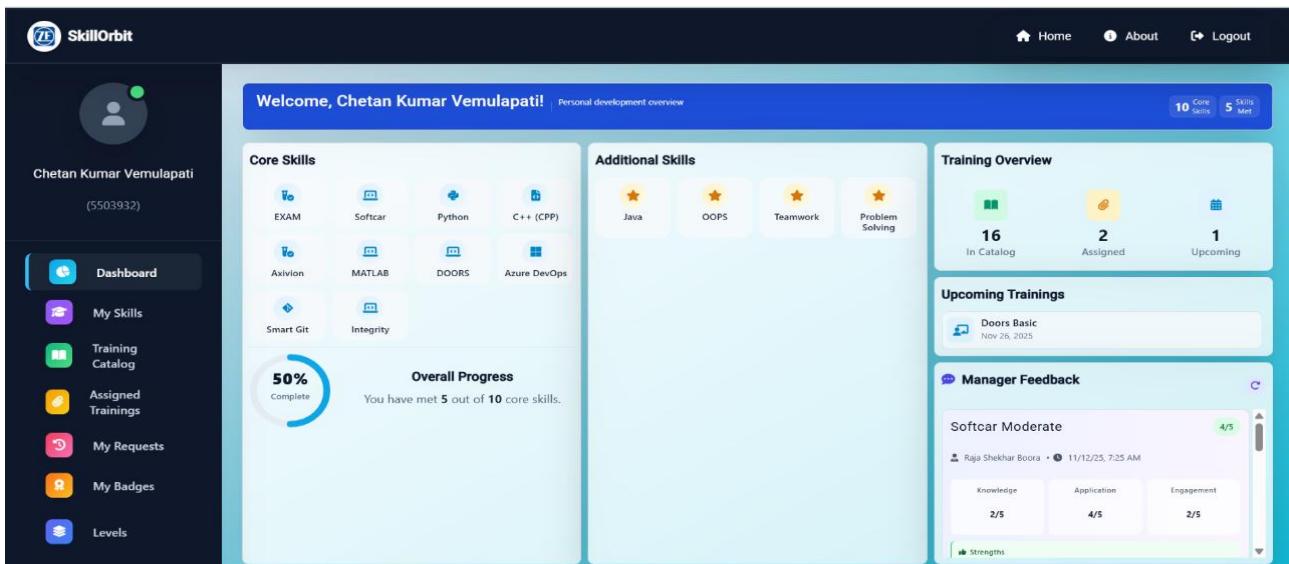


Fig 4: Engineer Dashboard

4.3.3 Manager Dashboard Module

The **Manager Dashboard** provides managers with tools to monitor their team's performance, assign trainings, and review progress.

Features:

- View team skills and competency levels.
- Assign or approve trainings for engineers.
- Monitor assigned trainings and feedback.
- Access personal skill and badge sections.

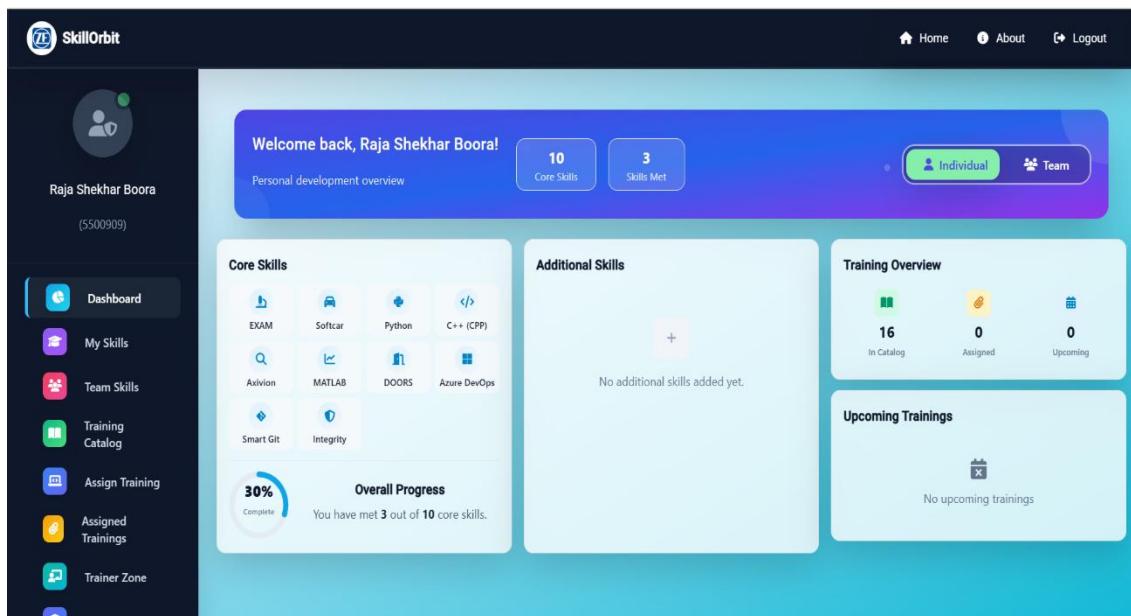


Fig 5: Manager Dashboard

4.3.4 About Page

The About Page gives users an overview of the Skill Orbit platform, explaining its purpose, features, and objectives.

It helps users understand how the system supports skill management and training coordination.

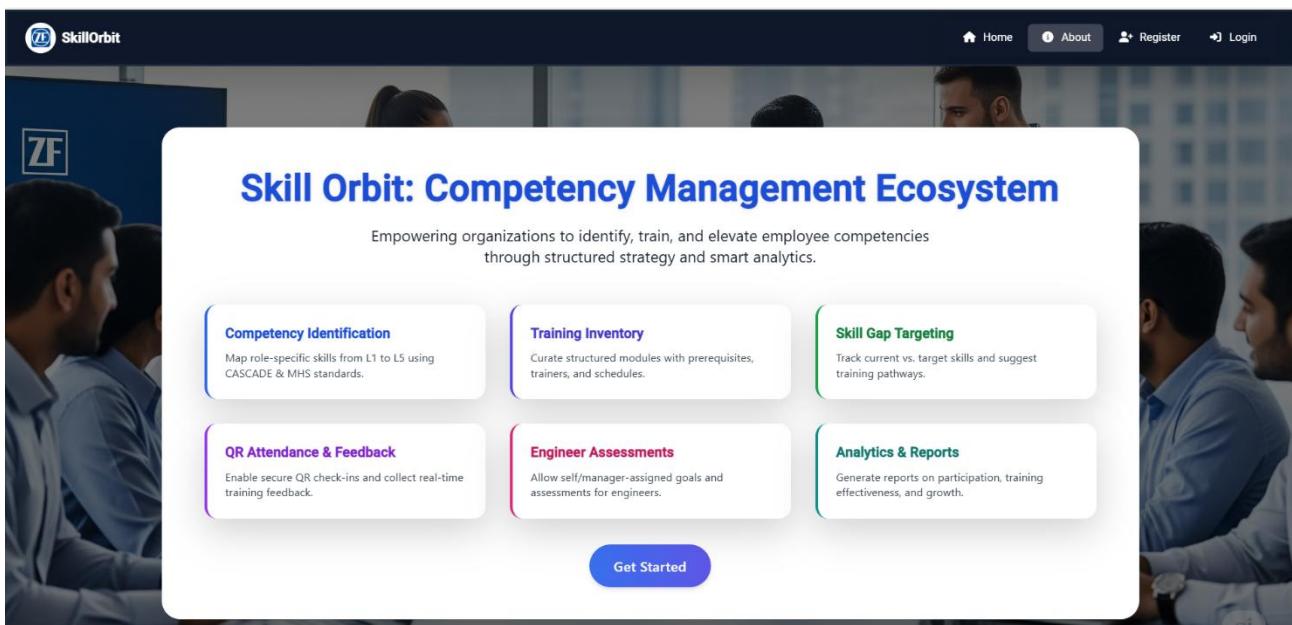


Fig 6: About Page

4.3.5 My Skills Module

This module allows users to view and update their skill details.

- Skills are displayed with current and target levels.
- Engineers can track their progress visually.
- Managers can review skill gaps across their team.

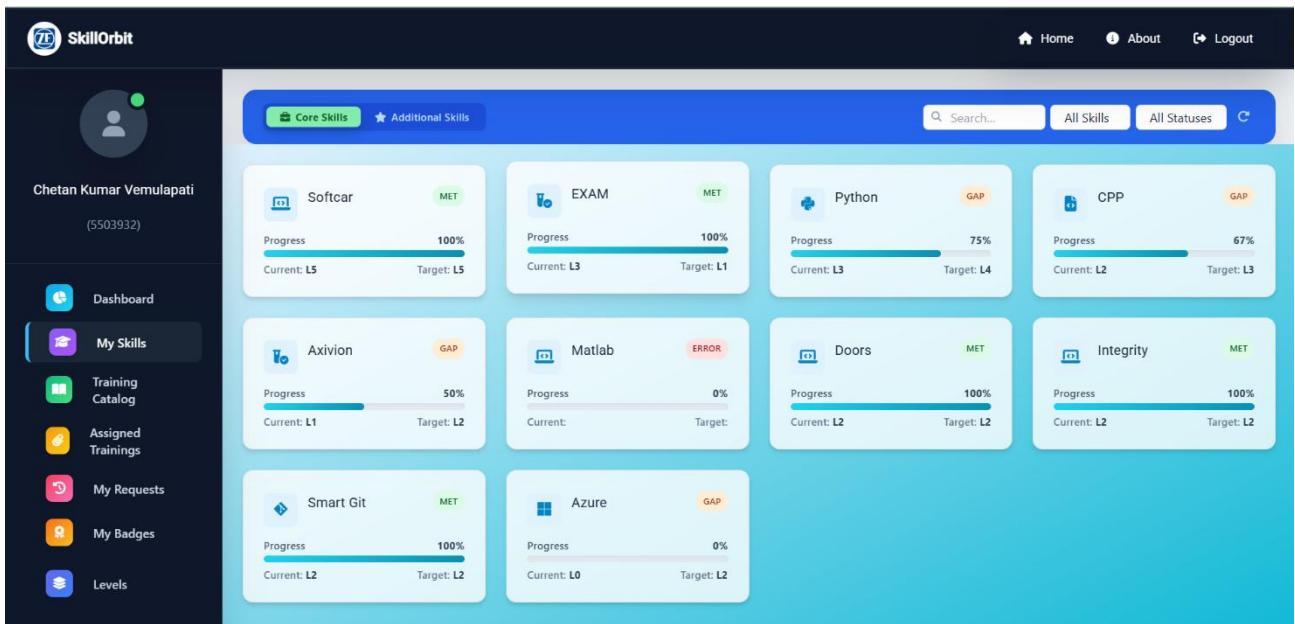


Fig 7: My Skills Module Page

4.3.6 Training Catalog Module

This section lists all available training programs in the organization.

- Users can browse, filter, and select trainings based on skills or levels.
- Each training displays title, trainer, schedule, and description.
- Engineers can request trainings, and managers can approve or assign them.

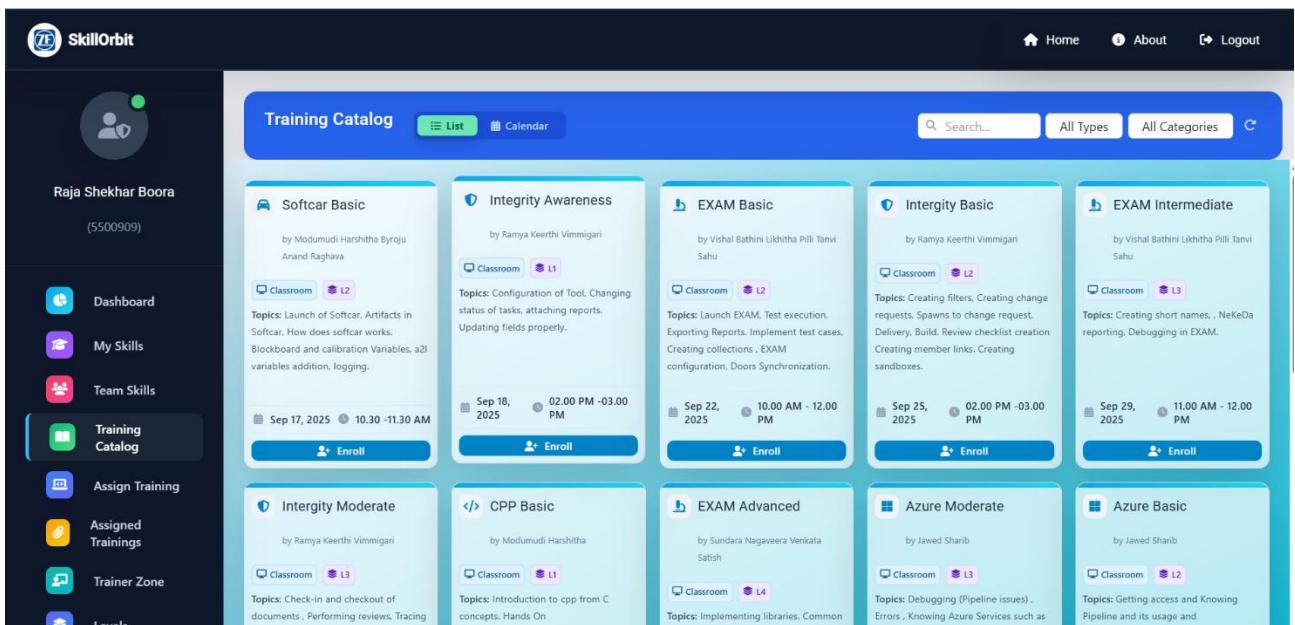


Fig 8: Training Catalog Page

4.3.7 Assigned Trainings Module

This module displays all trainings assigned to the user.

- Users can check the training name, schedule, and completion status.
- The progress bar shows how much of the training has been completed.
- Managers can view assigned trainings for their team members.

The screenshot shows the 'Assigned Trainings' section of the SkillOrbit platform. On the left, a sidebar displays the user's profile (Chetan Kumar Vemulapati, ID 5503932) and navigation links: Dashboard, My Skills, Training Catalog, Assigned Trainings (highlighted), My Requests, My Badges, and Levels. The main content area is titled 'Assigned Trainings' with 'List' and 'Calendar' tabs. It lists three training sessions:

- CPPModerate**: by Kohir Abilash. Date: Monday, October 27, 2025. Time: 10.30 AM - 12.30 PM. Location: Classroom, L2. Status: Assignment Submitted, View Results, Give Feedback.
- Softcar Moderate**: by Modumudi Harsitha Byroju Anand Raghava. Date: Thursday, October 30, 2025. Time: 10.30 - 11.30 AM. Location: Classroom, L2. Status: Assignment Submitted, View Results, Give Feedback.
- Doors Basic**: by Raja Shekhar Boora. Date: Wednesday, November 26, 2025. Time: 10.30 - 11.30 AM. Location: Classroom, L2. Status: Assignment Submitted, View Results, Give Feedback. (Upcoming)

Fig 9: Assigned Trainings Page

4.3.8 My Badges Module

This module displays badges earned by users based on skill completion and performance.

- Badges are awarded automatically upon meeting certain criteria.
- Both engineers and managers can view their earned badges and levels of achievement.

The screenshot shows the 'My Badges & Achievements' section of the SkillOrbit platform. The sidebar is identical to Fig 9. The main content area is titled 'My Badges & Achievements' and displays four badge achievements:

- Softcar**: Competency Met. Achieved on Thursday, November 13, 2025.
- EXAM**: Competency Met. Achieved on Thursday, November 13, 2025.
- Doors**: Competency Met. Achieved on Thursday, November 13, 2025.
- Integrity**: Competency Met. Achieved on Thursday, November 13, 2025.
- Smart Git**: Competency Met. (This badge is partially visible at the bottom of the screen.)

Fig 10: My Badges Page

4.3.9 Assign Training Module (Manager Specific)

This module allows managers to assign trainings directly to their team members.

- Managers can select multiple engineers and assign one or more trainings at a time.
- A notification is sent to the assigned employees.
- The system updates the status automatically upon completion.

Fig 11: Assign Training Page

4.3.10 Team Skills Module (Manager Specific)

The Team Skills Module provides an overview of all team members' competencies.

- Displays each engineer's current and target skill levels.
- Helps managers identify skill gaps and recommend relevant trainings.
- Supports exporting team skill data for performance analysis.

Fig 12: Team Skills Page

4.3.11 Levels Module

The **Levels Module** defines and displays the competency levels used within the system.

- Each skill is categorized under one of five levels (L1–L5).

- Users can refer to level descriptions to understand required expectations.
- Ensures consistent evaluation standards across teams.

Typical Level Definitions:

- **L1 – Basic Understanding:** Awareness of basic concepts and terminology.
- **L2 – Basic:** Ability to perform tasks under supervision.
- **L3 – Intermediate:** Independently handles tasks and provides reliable outputs.
- **L4 – Advanced :** Deep understanding and ability to guide others.
- **L5 – Expert:** Recognized subject expert capable of mentoring and designing strategies.

The screenshot shows the SkillOrbit platform's 'Levels Definitions' page. On the left, there's a sidebar with a user profile for 'Chetan Kumar Vemulapati (5503932)' and links for Dashboard, My Skills, Training Catalog, Assigned Trainings, My Requests, My Badges, and Levels. The main area has a blue header 'Levels Definitions' with a search bar for 'All Skills' and 'Search levels, keywords...'. Below is a table with columns for SKILL, L1 - BEGINNER, L2 - BASIC, L3 - INTERMEDIATE, L4 - ADVANCED, and L5 - EXPERT. Two rows are visible: 'EXAM' and 'Softcar'.

SKILL	L1 - BEGINNER	L2 - BASIC	L3 - INTERMEDIATE	L4 - ADVANCED	L5 - EXPERT
EXAM	<ul style="list-style-type: none"> • Launch EXAM • Test execution • Exporting reports 	<ul style="list-style-type: none"> • Implement test cases • Create collections • EXAM configuration • DOORS synchronization 	<ul style="list-style-type: none"> • Create short names • NeKeDa reporting • Debugging in EXAM 	<ul style="list-style-type: none"> • Implement libraries & common sequences • Know-how on libraries (1–4) • Create baselines • Release configuration • Update variable mapping • System configurations 	<ul style="list-style-type: none"> • EXAM administration • Model domain configuration • Set up new project • Groovy scripting
Softcar	<ul style="list-style-type: none"> • Launch Softcar • Artifacts in Softcar 	<ul style="list-style-type: none"> • Blockboard & calibration variables • Add A2L variables • Logging 	<ul style="list-style-type: none"> • Debugging • Error simulation • CAN message error simulations • Script execution in Softcar 	<ul style="list-style-type: none"> • Create layouts • Trigger files • Startup script • Softcar scripting 	<ul style="list-style-type: none"> • Plant model creation • CAN configuration • DLL files

Fig 13: Levels Page

4.3.12 My Requests Module

The **My Requests Page** displays all the training requests raised by employees and their approval status.

- Engineers can track whether their requests are approved or pending.
- Managers can view, approve, or reject requests from this page.

The screenshot shows the 'My Requests' section of the SkillOrbit platform. On the left, a sidebar displays the user's profile (Chetan Kumar Vemulapati) and navigation links for Dashboard, My Skills, Training Catalog, Assigned Trainings, My Requests (selected), My Badges, and Levels. The main area is titled 'My Training Requests' with filters for All, Pending, Approved, and Rejected. It lists three requests:

- Integrity Awareness**: Status: Pending. Requested by Ramya Keerthi Vimmigari on Nov 13, 2025. Classroom L1.
- CPP Basic**: Status: Rejected. Requested by Modumudi Harshitha on Nov 13, 2025. Classroom L1.
- Softcar Basic**: Status: Approved. Requested by Modumudi Harshitha Byroju Anand Raghava on Nov 13, 2025. Classroom L2.

Fig 14: My Requests Page

4.3.13 Team Dashboard (Manager Specific)

The **Team Dashboard** consolidates all team-related insights.

- Displays team size, skill statistics, and average progress.
- Allows managers to compare skill growth across different team members.

The screenshot shows the 'Team Dashboard' section of the SkillOrbit platform. On the left, a sidebar displays the user's profile (Raja Shekhar Boora) and navigation links for Dashboard, My Skills, Team Skills, Training Catalog, Assign Training, Assigned Trainings, Trainer Zone, and Levels. The main area is titled 'Welcome back, Raja Shekhar Boora!' and includes a 'Team management overview' button. It features a 'Team Skills Matrix' table:

Team Member	Skills Met	Skill Gaps	Total Skills	Progress
Prabhakar Reddy Nayeni	2	6	10	20%
HM Harshitha Modumudi	3	6	10	30%
Chetan Kumar Vemulapati	5	4	10	50%
Varalakshmi Avadla	3	5	10	30%
dummy employee	0	0	0	0%
Santhi Chandra	3	6	10	30%
Total	16	27	50	32%

Below the matrix are three cards: 'Team Training Submissions' (6), 'Pending Training Requests' (1 pending), and 'Integrity Awareness' (Pending).

Fig 15: Team Dashboard Page

Chapter – 5

FUTURE ENHANCEMENTS AND IMPROVEMENTS

5.1 FUTURE ENHANCEMENTS

The Skill Orbit platform has been successfully developed with essential functionalities like skill tracking, training management, competency-level mapping, and feedback mechanisms. However, there are several potential enhancements that can make the system more intelligent, interactive, and adaptable to large-scale enterprise requirements.

The following are the proposed future enhancements:

1. Machine Learning–Based Training Recommendations

Incorporating machine learning models can make the platform more personalized and adaptive.

- The system can analyze employee behavior, skill progression, and role-specific requirements.
- Based on this data, it can automatically suggest the most relevant training programs.
- Recommendation engines can also help employees discover new skills aligned with their career goals.

2. Predictive Skill Gap Analysis

Predictive analytics can be used to forecast potential skill shortages within teams or departments.

- The platform can analyze current competency levels and upcoming project requirements.
- Managers can be alerted about skill gaps before they affect performance.
- Automated suggestions for targeted training plans can improve workforce readiness.

3. Advanced Analytics Dashboard

A more comprehensive analytics module can offer deep insights into training effectiveness . Enhancements include:

- Interactive charts and visualizations
- Comparison metrics for individual and team progress
- Heatmaps for competency distribution
- Custom reports for management reviews

This would help managers make data-driven decisions and track organizational skill growth more accurately.

4. Mobile Application Support

Developing mobile applications for **Android** and **iOS** would make Skill Orbit more accessible and convenient.

- Users can track their trainings and progress anytime.
- Managers can approve requests and monitor team skills on the go.
- Push notifications can ensure users stay updated with deadlines and new assignments.

Mobile support enhances usability and increases engagement.

5. AI-Powered Feedback Analysis

Integrating Natural Language Processing (NLP) can automate the interpretation of employee feedback.

- The platform can analyze written feedback and extract key insights.
- Sentiment analysis can highlight areas where an employee excels or needs improvement.
- AI-driven summaries can save managers time while maintaining accuracy in evaluations.

6. Multi-Language and Accessibility Support

To accommodate global teams, the platform can be expanded to support:

- Multiple languages
- Screen readers
- High-contrast display modes
- Keyboard-only navigation
-

This ensures inclusivity and usability for users with diverse backgrounds and accessibility needs.

7. Automated Notifications and Smart Scheduling

Enhancing the notification system can significantly improve user engagement and task completion.

Proposed features include:

- Automatic reminders for upcoming trainings
- Alerts for pending assignments and approvals
- Push notifications for new skill modules

- Calendar-based scheduling for better time management
- Smart scheduling can also help optimize training timelines based on user availability.

8. Gamification Features

To increase motivation and participation, gamified elements can be introduced.

- Achievement badges
- Skill milestones
- Leaderboards
- Monthly or quarterly performance challenges

These features make learning more engaging and rewarding.

9. Integration With HR and Project Management Systems

Skill Orbit can be extended to integrate with existing enterprise tools such as:

- HRMS platforms
- Payroll systems
- Project management tools (Jira, Asana, Trello)
- Learning Management Systems (LMS)

This allows automatic syncing of employee data and seamless workflow integration.

10. Cloud Scalability and Multi-Tenant Support

To support large organizations, the system can be deployed with:

- Multi-tenant architecture for separate organizational units
- Auto-scaling based on user load
- Containerization with Docker/Kubernetes
- Enhanced security layers

This ensures performance, data isolation, and high availability.

Summary

These enhancements would transform Skill Orbit from a functional competency management system into a **smart, enterprise-level, AI-driven platform** capable of supporting thousands of users, automating decisions, and providing actionable insights to both employees and managers.

Chapter – 6

CONCLUSION

The **Skill Orbit – Competency Management Ecosystem** has been developed as a comprehensive platform designed to simplify and digitalize skill management, training assignments, and competency tracking in an organization. The system integrates a user-friendly frontend with a robust backend, ensuring smooth interaction between managers and engineers.

By implementing modules such as **Authentication**, **Engineer Dashboard**, **Manager Dashboard**, **My Skills**, **Levels**, **Training Catalog**, **Assigned Trainings**, **My Badges**, **Assign Training**, and **Team Skills**, the platform delivers a unified solution for effective employee development.

The project successfully demonstrates the potential of full-stack web technologies — **Angular**, **FastAPI**, and **PostgreSQL** — in creating scalable, data-driven, and automated enterprise applications. It not only improves operational efficiency but also enhances transparency and collaboration between employees and managers.

The platform can serve as a foundation for future innovations in **AI-driven skill development**, **performance forecasting**, and **automated career path planning**. With continuous improvements and future integration of intelligent features, **Skill Orbit** can evolve into a complete digital competency ecosystem that aligns workforce skills with organizational goals.

Chapter - 7

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