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The Skill Navigator - An AI Driven Personalized Learning and Skill Gap Analyzer

Bhumika Rawat, Udaykiran Saddala, Aanchal Sahu, Chetana Sahu
Final Year Student, Department of Computer Engineering, Zagdusing Charitable Trust\'s Thakur Polytechnic, Kandivali, Maharashtra, India

Mr. Lalchandra Gaund
Lecturer, Department of Computer Engineering, Zagdusing Charitable Trust\'s Thakur Polytechnic, Kandivali, Maharashtra, India

Abstract - The Skill Navigator is an AI-driven web application that analyzes users' existing competencies and identifies skill gaps relative to their desired career or learning goals. By leveraging the GROQ-powered LLaMA 3.3-70B language model, the system delivers personalized learning recommendations, an adaptive AI chatbot assistant (BOD – Bot of Development), and an interactive quiz engine. The platform integrates a React.js frontend with a Flaskbased REST API backend and Supabase for authentication and profile management. Users receive curated skill paths across categories including Web Development, AI/ML, Cloud Computing, Cybersecurity, and Soft Skills. The system dynamically adapts its recommendations based on userprofile data, quiz performance history, and stated learning objectives. This paper presents the system architecture, core modules, database design, and the outcomes of deploying an AI-personalized learning navigator for modern skill development.

Key Words: artificial intelligence, skill gap analysis, personalized learning, LLM, adaptive quiz engine, Flask, React.js, Supabase

1. INTRODUCTION

The rapid evolution of technology has fundamentally transformed the global job market, creating an everwidening gap between the skills employers demand and those that individuals currently possess. Traditional learning management systems (LMS) often provide static course catalogues with no awareness of a learner's prior knowledge, goals, or progress. As a result, learners frequently feel overwhelmed, unsure of which skills to prioritize or how to bridge their specific knowledge deficits. The Skill Navigator addresses this challenge by combining modern artificial intelligence with a personalized, goaloriented interface. The platform is developed to help users understand their current competency landscape, identify gaps that prevent them from achieving their career aspirations, and receive actionable, ranked recommendations for skill development. By integrating large language model (LLM) reasoning, voice-interactive chatbot capabilities, and a dynamic quiz engine, the system provides a holistic and adaptive learning experience.

Designed with accessibility and usability at the forefront, the application allows learners across skill levels—beginner, intermediate, and advanced—to interact with the system through natural conversation. Users can explore skill categories ranging from Web Development and AI/ML to Cybersecurity and Soft Skills. The embedded BOD chatbot provides contextual guidance, answers queries, and orchestrates quiz sessions based on conversational intent detection. The system also incorporates a profile management layer backed by Supabase, enabling persistent storage of user goals, interests, and quiz performance history.

This paper presents the motivation, system design, implementation details, and outcomes of the Skill Navigator, demonstrating how modern AI technologies can be harnessed to deliver practical, personalized, and scalable learning solutions.

2. LITERATURE REVIEW

Research on intelligent tutoring systems and adaptive learning platforms underscores the transformative potential of AI in education. Existing studies highlight how personalization—achieved through learner modelling, knowledge tracing, and recommendation algorithms—significantly improves learner outcomes and engagement. Early work by Corbett and Anderson (1994) on knowledge tracing demonstrated that models of learner mastery could outperform static curricula. Subsequent research has expanded these ideas through machine learning and, more recently, large language models.

Studies on skill gap analysis emphasize the importance of aligning learner competencies with industry requirements. Reports by the World Economic Forum (2023) note that over 50% of employees globally will require reskilling within five years due to automation. This has spurred significant investment in AI-powered learning platforms such as Coursera, LinkedIn Learning, and proprietary corporate

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upskilling tools. However, many of these platforms lack the ability to converse naturally with learners, understand subjective goals, or generate entirely custom assessment content on demand.

The emergence of large language models (LLMs) such as GPT4 and LLaMA has opened new avenues for building conversational educational agents. Research by Brown et al. (2020) demonstrated that instruction-tuned LLMs can perform reasoning, summarization, and content generation at a level previously requiring domain experts. More recent work has applied LLMs to quiz generation, learning path recommendation, and personalized feedback delivery in educational contexts.

Several researchers emphasize the importance of user-centered design in educational technology. A well-structured interface with clear feedback mechanisms, minimal cognitive load, and conversational interaction improves both engagement and learning outcomes. Studies also highlight the value of progress tracking and gamification elements such as streaks, scores, and rankings in sustaining user motivation over time.

The Skill Navigator builds upon this body of work by integrating LLM-driven chat, profile-aware recommendations, and an ondemand quiz engine within a unified platform. Unlike existing solutions, it prioritizes conversational skill gap analysis, producing personalized learning paths grounded in user-declared goals and demonstrated quiz performance.

3. SYSTEM DESIGN

Overview:

The Skill Navigator is architected as a full-stack web application composed of four principal layers: the React.js frontend, the Flask REST API backend, the GROQ/LLaMA inference service, and the Supabase database layer.

The frontend, built with React.js and styled using Tailwind CSS with shadcn/ui components, delivers a responsive and accessible user interface. Key screens include a Home/Dashboard page, a Skill Explorer with category and level filters, an AI Chat interface hosting the BOD chatbot, and a User Profile page displaying quiz history, streaks, and learning progress.

The backend is a Flask application organized into modular blueprints. The Chat Blueprint (/api/chat) handles all conversational logic, including intent detection for quiz invocation, state management across multi-turn quiz sessions, and personalized system prompt construction. The Skills Blueprint (/api/skills) exposes endpoints for browsing and filtering the skill catalogue by level and category. The Profile Blueprint (/api/profile) manages user authentication via Supabase JWT tokens and CRUD operations on learner profiles.

The AI inference layer uses the GROQ API with the llama3.370b-versatile model. The system constructs a dynamic system prompt for each conversation that incorporates the user's name, stated learning goal, interests, current skill progress, and recent quiz results. This context-aware prompting ensures that the chatbot's recommendations are highly personalized and relevant to the individual learner.

4. FUNCTIONALITY OF THE SYSTEM/FLOWCHART/CORE MODULES

The Skill Navigator integrates four primary functional modules that work together to deliver an intelligent and personalized learning experience.

4.1 Skill Catalogue and Gap Explorer

The platform maintains an 18-skill catalogue organized into 10 categories (Web Dev, Programming, Design, Data, Mobile, AI/ML, Cloud, Security, DevOps, and Soft Skills) and three difficulty tiers (Beginner, Intermediate, Advanced). Each skill entry includes a title, description, category, level, and a progress percentage indicating community-level completion rates. Users can filter the catalogue by category and level, enabling targeted gap identification. The backend /api/skills endpoint serves filtered results dynamically, supporting future extension through database-backed storage.

4.2 BOD – AI Chatbot and Skill Advisor

BOD (Bot of Development) is the conversational core of the Skill Navigator. It is implemented as a stateful chat agent powered by the LLaMA 3.3-70B model via the GROQ API. Each request to /api/chat includes the full conversation history and a user context object containing profile data and quiz history. The system constructs a personalized system prompt on every request, ensuring that recommendations reflect the user's stated goal, interests, and demonstrated knowledge.

BOD supports three conversational modes: general skill advisory, quiz orchestration, and feature navigation assistance. In advisory mode, it suggests specific skills from the catalogue, explains why they align with the user's goal, and recommends learning sequences. In quiz orchestration mode, it detects quiz intent through regular-expression pattern matching (e.g., 'start test on Python') and transitions to the quiz engine seamlessly within the same chat interface.

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4.3 Adaptive Quiz Engine

The quiz engine enables users to assess their knowledge on any topic through dynamically generated multiple-choice questions. Upon detecting quiz intent, the backend calls the GROQ API with a structured prompt requesting exactly five questions in a strict Q/A/B/C/D/Answer format. The parse_quiz_questions utility parses the raw LLM output using regular expressions into a structured list of question objects.

Quiz state—including the question list, current question index, topic, and user answers—is embedded as a JSON block within the assistant's message history. This stateless design eliminates the need for server-side session storage. On each subsequent user response (A/B/C/D), the server extracts the quiz state from the conversation history, evaluates the answer, and either presents the next question with feedback or computes the final score. Completed quiz results (score, total, per-question breakdown) are returned to the frontend for display and stored in the user's quiz history.

4.4 User Profile and Progress Tracking

The profile module provides persistent learner identity across sessions. Users are authenticated via Supabase JWT tokens, and their profiles store: full name, bio, location, learning goal, interests array, and avatar URL. The /api/profile/stats endpoint exposes aggregated statistics including quizzes taken, average quiz score, learning streak (days), and community rank. These metrics are surfaced in the Profile UI to provide motivational feedback and track growth over time.

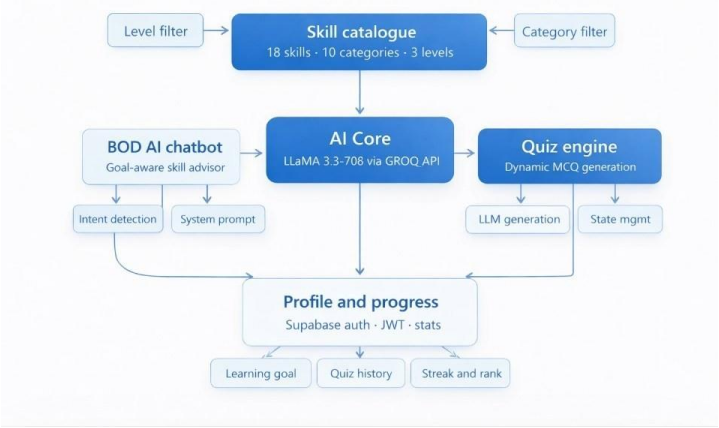

Fig -1: Functionality System

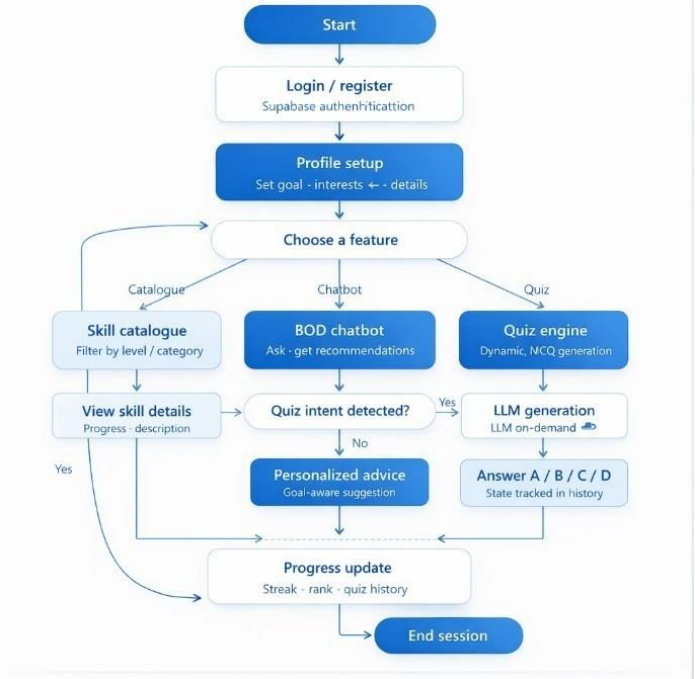

Fig -2: Flowchart

5. DATABASE DESIGN

The Skill Navigator uses Supabase (PostgreSQL) as its primary data store, providing scalable relational storage with built-in authentication. The schema is organized around four principal entities.

The Profiles table stores user identity and learning preferences. Fields include: id (UUID, primary key, foreign key to auth.users), full_name, bio, location, learning_goal (string describing the user's career objective), interests (text array), and avatar_url. The learning_goal and interests fields are directly consumed by the chatbot's system prompt builder to personalize BOD's responses.

The Quiz Results table records completed quiz sessions. Fields include: result_id (UUID, primary key), user_id (foreign key to Profiles), topic, score, total, percentage, and created_at. Indexed on user_id and created_at, this table supports efficient retrieval of a user's recent quiz history for inclusion in the chatbot context.

The Skill Progress table tracks individual learner progress on catalogue skills. Fields include: progress_id (UUID), user_id, skill_id (integer), completion_percentage, and last_updated. This enables future personalized gap analysis by comparing a learner's progress against the catalogue's target completion thresholds.

The Emergency Contacts table (aligned with future SOS functionality) stores user-designated contacts with fields:

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contact_id, user_id, contact_name, and phone_number. The database schema is designed for future scalability, with indexing on frequently queried columns (user_id, topic, created_at) and a flexible JSONB interests field supporting arbitrary learner interest taxonomies.

6. PROBLEM STATEMENT

The problem addressed in this project focuses on the difficulties faced by visually impaired individuals when performing everyday tasks such as recognizing objects, navigating unfamiliar environments, and accessing important information independently. Traditional navigation and assistance methods often rely on human support, guide dogs, or basic tools like walking sticks, which may not always provide sufficient information about the surrounding environment. As a result, visually impaired individuals often face challenges in understanding obstacles, identifying objects, and moving safely in public or unfamiliar spaces. Although some assistive technologies exist, many of them are either expensive, limited in functionality, or require specialized hardware that is not easily accessible to everyone. In many cases, available solutions focus only on a single feature, such as navigation or object recognition, without providing a comprehensive system that supports multiple aspects of daily life. Additionally, some systems lack intuitive interfaces and voice-based interaction, making them difficult for visually impaired users to operate effectively.

Another major challenge is the lack of real-time environmental awareness and emergency support within many existing assistive systems. Without immediate feedback about surrounding objects or obstacles, visually impaired individuals may face safety risks when moving through crowded or unfamiliar areas. Similarly, the absence of quick emergency communication features can make it difficult for users to seek help during critical situations.

Furthermore, many existing solutions do not fully utilize the capabilities of modern technologies such as artificial intelligence, computer vision, and voice recognition to provide an integrated accessibility experience. The lack of a unified platform that combines object detection, voice navigation, intelligent assistance, and safety features limits the effectiveness of assistive applications designed for visually impaired individuals.

Therefore, there is a clear need for a smart and accessible system that can provide real-time assistance, improve environmental awareness, and support safe navigation. The proposed AI-powered accessibility application aims to address these challenges by integrating object detection, voice navigation, AI-based assistance, and emergency support within a single platform. By leveraging modern AI technologies and designing the system with accessibility in mind, the project seeks to enhance independence, safety, and quality of life for visually impaired users.

7. ADVANTAGES

The Skill Navigator offers several significant advantages over conventional learning and skill development platforms.

Personalized AI Recommendations: The platform leverages LLaMA 3.3-70B to generate skill recommendations that are uniquely tailored to each user's learning goal, interests, and quiz history—a level of personalization beyond rule-based systems.

Dynamic Assessment: Unlike static question banks, the quiz engine generates fresh, topic-specific questions for any subject on demand, ensuring assessments remain relevant and cheatresistant.

Unified Platform: By combining skill discovery, gap analysis, conversational advisory, and assessment within a single application, the system eliminates the friction of contextswitching across multiple tools.

Scalable Architecture: The modular Flask blueprint design and Supabase backend support independent scaling of individual components and straightforward addition of new skill categories, assessment types, or integration endpoints.

Accessibility and Usability: The conversational chatbot interface removes the need for complex form-based navigation, allowing learners of all backgrounds to engage with the platform through natural language.

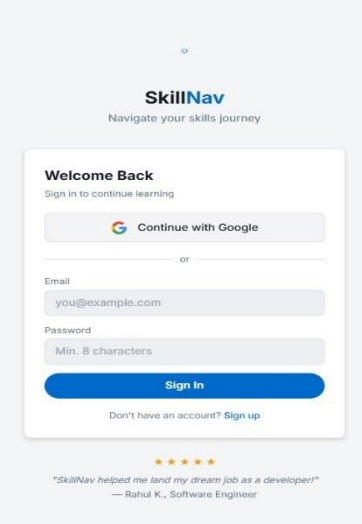

Fig -3: Sign-in/up Page

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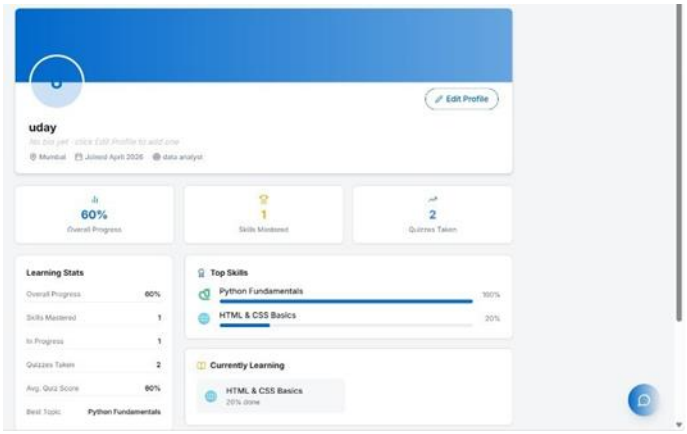

Fig -4: Profile Page

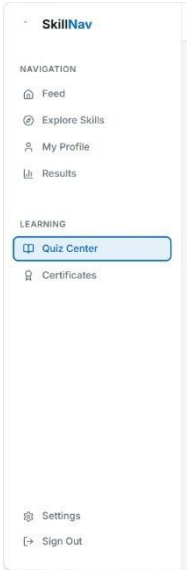

Fig -5: Side Bar

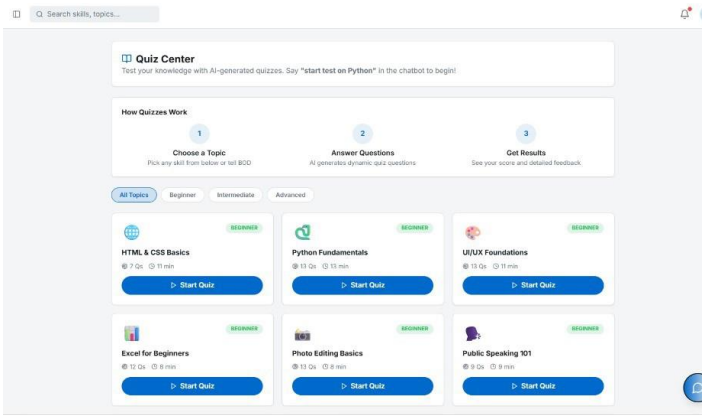

Fig -6: Quiz Center Page

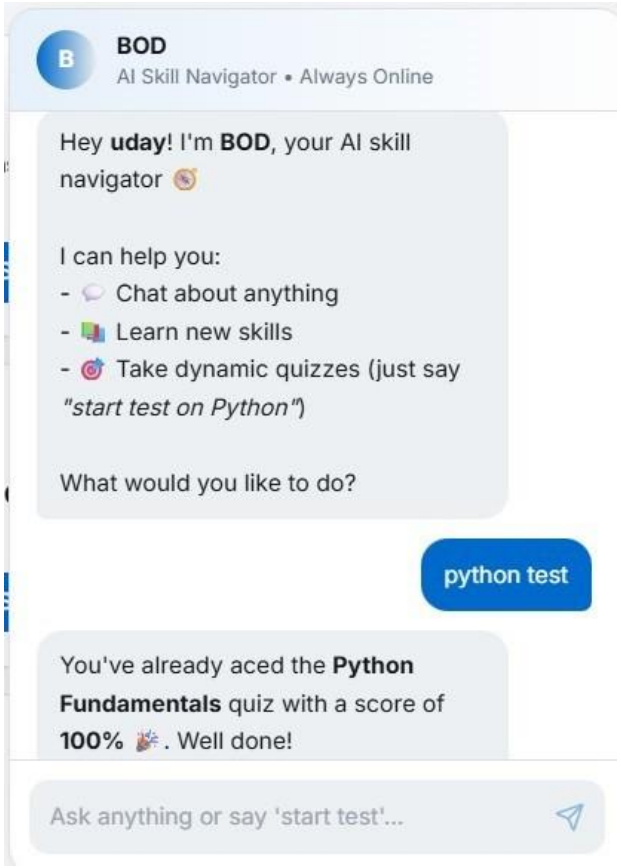

Fig -7: AI Chat-Bot

8. CONCLUSIONS

The Skill Navigator demonstrates how modern AI technologies can be synthesized into a cohesive, personalized, and practically useful learning platform. By combining large language model reasoning, adaptive quiz generation, and goal-aware recommendation within a user-friendly interface, the system substantially reduces the cognitive burden of planning a skill development journey.

The integration of the LLaMA 3.3-70B model via the GROQ API enables the BOD chatbot to function as a knowledgeable and empathetic learning advisor—one that understands each user's context, tracks their progress, and responds with targeted, motivating guidance. The dynamic quiz engine further strengthens the platform by providing formative assessments on any topic of the learner's choosing, delivered in real time without requiring a pre-built question bank.

The modular Flask backend and Supabase data layer provide a robust and scalable technical foundation, ensuring that the system can accommodate growing user bases and expanding skill catalogues without significant re-architecture. The React.js frontend delivers a responsive, accessible experience

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that meets the needs of learners across devices and connectivity environments.

Future work will focus on expanding the skill catalogue with community-contributed content, integrating learning resource links (courses, tutorials, documentation) directly into skill recommendations, implementing streak-based gamification and leaderboard features, and developing a longitudinal gap analysis dashboard that visualizes skill progression over time. With continued development, the Skill Navigator has the potential to become a comprehensive AI-powered career development companion for learners worldwide.

REFERENCES

[1] Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th ed., Pearson Education, 2020.
[2] Meta AI, 'LLaMA: Open and Efficient Foundation Language Models,' arXiv preprint arXiv:2302.13971, 2023.
[3] Tom B. Brown et al., 'Language Models are Few-Shot Learners,' Advances in Neural Information Processing Systems (NeurIPS), 2020.
[4] Groq Inc., 'GROQ API Documentation and LLM Inference Platform,' https://groq.com, 2024.
[5] Supabase Inc., 'Supabase: The Open Source Firebase Alternative,' https://supabase.com, 2023.
[6] World Economic Forum, 'The Future of Jobs Report 2023,' WEF Publications, Geneva, 2023.
[7] A. T. Corbett and J. R. Anderson, 'Knowledge Tracing: Modeling the Acquisition of Procedural Knowledge,' User Modeling and User-Adapted Interaction, vol. 4, no. 4, pp. 253– 278, 1994.
[8] Palak Bahl et al., 'Personalized Learning Path Generation Using AI: A Systematic Review,' IEEE Transactions on Learning Technologies, vol. 15, no. 3, pp. 312–328, 2022.