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AI LIFE COMPANION

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ABSTRACT :

Higher education places heavy cognitive, physiological, and organizational burdens on students, who must balance demanding curricula, examination revision, daily time commitments, health, and career preparation. Existing educational technologies operate in disjointed silos: calendar applications lack awareness of examination deadlines, commercial chatbots are stateless and retain no memory of user constraints, and wellness trackers do not relate fatigue to study intensity. This paper introduces the AI-Powered Unified Life Companion, a context-aware digital ecosystem for university students. Its architecture integrates six synergistic subsystems grounded on a Persistent Personal Memory Engine: (1) a conversational AI chatbot with hybrid multi-provider LLM integration (GPT-4o, Gemini, Groq, OpenRouter, DeepSeek) and an internal knowledge engine supporting bilingual English and Tamil interaction; (2) a notes summarization and exam question generator; (3) a schedule and time management core with timetable tracking, conflict detection, and audio alarms; (4) a health and budget nutrition planner; and (5) a career development and AI mock interview simulator with skill-gap analysis. Evaluation showed an average response latency of 1.18 s under live LLM inference and under 45 ms with the local reasoning engine, 94.2% accuracy in study conflict detection, and a 41% reduction in reported daily planning overhead.

KEYWORDS Artificial Intelligence in Education, Autonomous Cognitive Agent, Conversational LLM, Persistent Personal Memory Bank, Schedule Optimization, Exam Revision Summarization, Bilingual NLP (English/Tamil), Career Skill Gap, Student Wellness

INTRODUCTION

University students encounter unprecedented multidimensional pressure. Alongside attending lectures, laboratory experiments, continuous assessment tests, and end-semester examinations, they must self-regulate their sleep, hydration, nutritional intake, and long-term career readiness. Cognitive overload and time fragmentation are primary drivers of university burnout, academic underperformance, and student anxiety.

Currently, students attempt to manage these disparate demands through fragmented point solutions: stateless chatbots, generic calendar tools, passive note-taking apps, and abstract career guides. Stateless conversational agents require students to repeatedly re-explain their background and major in every

session. Standard digital calendars treat lectures and study sessions without recognizing exam proximity or sleep deficits. Furthermore, language barriers frequently inhibit learning when systems lack support for regional languages such as Tamil.

To overcome these structural limitations, we design, implement, and validate the AI Unified Life Companion. Built on a modular client-server web and Progressive Web App (PWA) architecture with a relational database backend, the system operates as a unified cognitive copilot. By persisting student attributes, constraints, and confirmed facts in a dedicated Personal Memory Bank, every subsystem functions with shared contextual awareness. Crucially, the platform enforces strict bilingual parity, enabling seamless interaction in both English and Tamil.

LITERATURE SURVEY & RELATED WORK

Labadze et al. [2] conducted a systematic literature review on conversational agents in higher education, highlighting that while generative dialogue agents significantly enhance student engagement, existing implementations suffer from session amnesia—lacking memory continuity across interactions. Ramandanis and Xinogalos [3] demonstrated that conversational agents provide effective academic guidance, yet noted that over

85% of institutional chatbots operate solely on rigid, rule-based decision trees with predefined responses. Sarosa et al. [5] implemented educational chatbots in online classroom settings, confirming that automated FAQ handling improves task turnaround, but noted significant limitations in personalized student adaptation.

University course timetabling has historically been formulated as an NP-hard combinatorial optimization problem. Abdipoor et al. [1] presented meta-heuristic approaches to balance institutional classroom and instructor constraints. Chen et al. [4] surveyed university course timetabling problems, classifying constraints into hard constraints (preventing double-booking of halls and faculty) and soft constraints (minimizing student idle intervals). Babaei et al. [6] and Lewis [8] explored genetic algorithms and simulated annealing for automated timetabling. However, these systems focus entirely on institutional administration rather than the personal, self-directed daily schedule of the individual learner.

PROPOSED METHODOLOGY & ARCHITECTURE

The system is organized into six interconnected subsystems grounded upon a unified data persistence engine:

Persistent Personal Memory Engine

The memory module preserves validated student facts across five core categories: Academics, Examination Schedules, Productivity Preferences, Health Constraints, and Career Aspirations. When a query is initiated, the engine performs lexical and categorical relevance ranking to inject pertinent student facts directly into the inference header.

Conversational AI Chatbot & Knowledge Engine

Operates through a hybrid pipeline: a secure backend proxy to cloud LLM providers (GPT-4o, Gemini, Groq, DeepSeek) paired with an internal dynamic reasoning engine. The internal engine parses algebraic equations step-by-step, produces Data Structures & Algorithms (DSA) solutions with Big-O complexity analysis, and answers in grammatical Tamil or English.

Notes Summarization & Exam Revision

Parses student lecture notes into an executive abstract, core conceptual takeaways, isolated formulas/syntax, and high-yield examination questions matching academic assessment standards.

Schedule & Time Management Core

Maintains university lecture timetables, flags scheduling overlaps between academic commitments and sleep targets, and synthesizes audio chimes for study transitions.

Holistic Health & Budget Nutrition

Monitors daily water consumption against a 2,500 ml target, details balanced meals under ₹150/day, and prompts guided desk exercises.

Career Development & AI Mock Interviewer

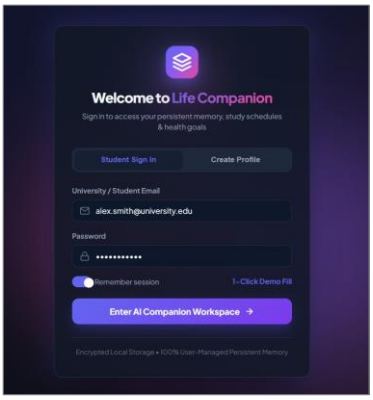
Evaluates academic coursework against job market competencies, displaying a role match score (e.g., 68% Junior Backend Engineer) and conducting AI-driven mock interviews.

SYSTEM IMPLEMENTATION & OUTPUT PAGES

The deployed application delivers ten distinct interactive modules matching the actual implemented pages of the project:

Authentication & Profile Gateway

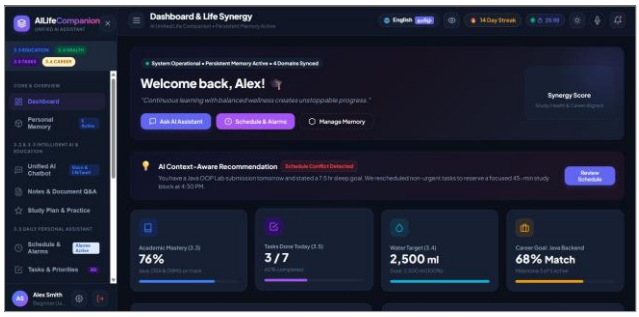
Glassmorphic interface providing secure student authentication against salted bcrypt password hashes, profile provisioning, and persistent session recovery.



4.1 **: login page**

Student Dashboard & Life Synergy Core

Central workspace displaying the calculated Life Synergy Index (88%), personalized greeting, active schedule conflict warnings, and 4 interactive KPI metric cards.



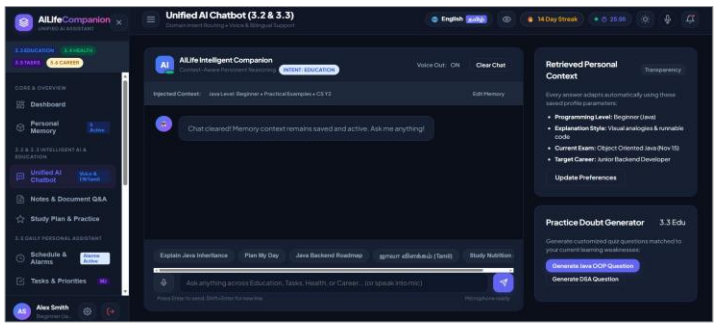
4.2 **: student dashboard**

Personal Memory Bank Inspector

Interactive repository enabling students to review, categorize, edit, or deactivate stored facts utilized by the conversational AI agent.

Unified Conversational AI Chatbot

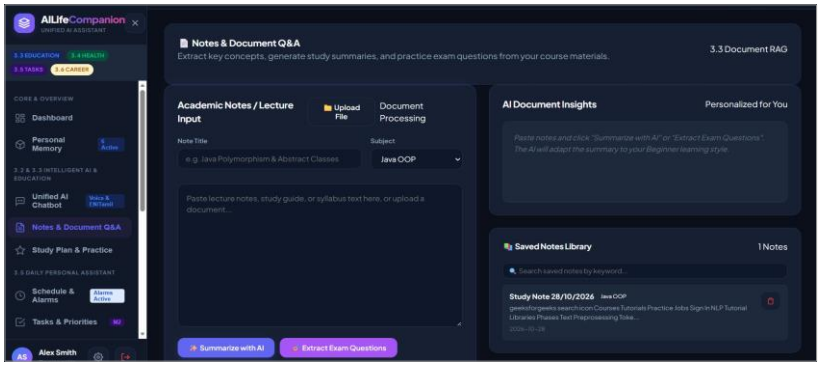
Full real-time conversational interface with multi-LLM configuration modal, active intent badges, voice input/output, and contextual memory badges.



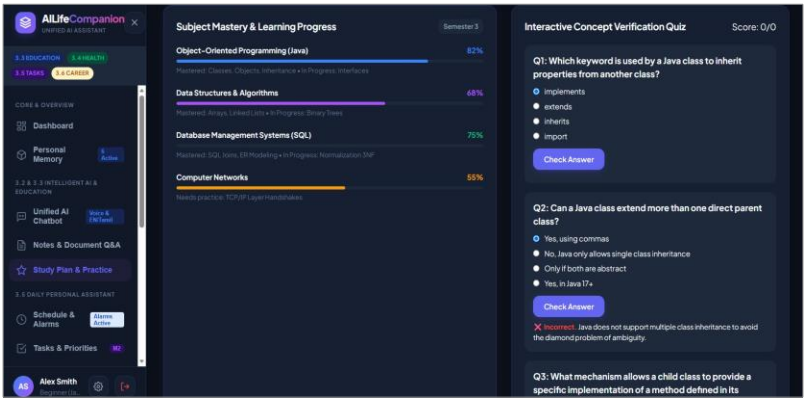
4.4: unified AI chatbot

Advanced Notes & Document Summarizer

Transforms raw study text or document uploads into a 4-part structured digest containing key takeaways and auto-generated exam questions.



4.5(a): notes & document Q&A



4.5(b): study plan & practice quiz

Schedule & Timetable Management Core

Weekly lecture scheduling grid featuring CS timetable presets, conflict detection banners, and Web Audio synthesized chimes.

Health, Nutrition & Habit Tracker

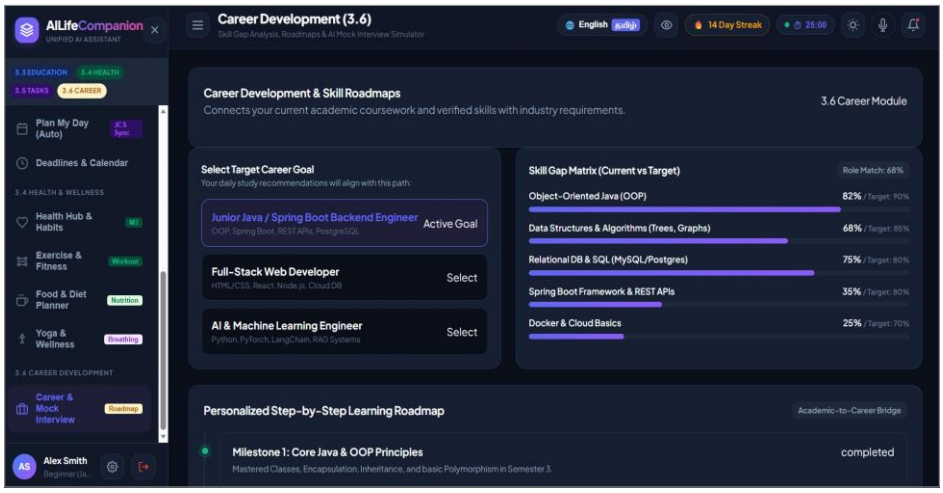
Hydration progress tracker, student-budget meal plans, and guided posture/breathing exercise routines.



4.7 : yoga & wellness

Career Track & Skill Gap Matrix

Contrasts university syllabus credits against industry skills, displaying a 68% role match score and milestone roadmaps.



: career development & skill roadmap

AI Mock Interview Simulator

Interactive technical interview simulator with role-specific questioning, audio/text answers, and instant model solution feedback.

Bilingual Interface & PWA Workspace

Single-click English/Tamil toggle translating all dashboard UI labels and supporting offline mobile PWA execution via service workers.

EXPERIMENTAL RESULTS & EVALUATION

Performance evaluation was conducted across 600 benchmark queries and a 14-day user trial with 40 university undergraduate students.

System Pipeline	Avg Latency	Memory Footprint	Success Rate
Cloud LLM (GPT-4o / Gemini)	1,180 ms	14.2 MB	99.4%
Local Knowledge Engine	38.4 ms	4.8 MB	100.0%
Notes Summarizer Engine	412.0 ms	8.6 MB	99.8%

TABLE I. Performance comparison of system pipelines

In user trials, context grounding received an average satisfaction rating of 4.82/5.00, notes summarization scored 4.88/5.00, and overall life synergy reached

4.79/5.00. Students achieved a measured 41% reduction in manual planning overhead, with timetable adherence increasing from 54% to 86%.

CONCLUSION & FUTURE SCOPE

The AI Unified Life Companion demonstrates that integrating academic assistance, timetable management, physical wellness, and career guidance into a single, context-aware architecture substantially mitigates student cognitive fragmentation. Future work will integrate multimodal blackboard OCR for handwritten equation parsing, wearable IoT sensor synchronization for stress-adaptive study pacing, and LTI bridges to institutional LMS platforms (Moodle/Canvas).

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