

Software Design Document (SDD)

Project: Adaptive English Learning App

Version: 1.0

Date: 24/11/2025

Authors: Group 30

Introduction

Purpose

The aim of this Software Design Document is to define the architecture, system components, data structures, user interface, and technical design for the Adaptive English Learning App. The application uses AI/ML to create personalized learning experiences, providing real-time translations, vocabulary support, adaptive exercises, and teacher analytics.

Scope

The system includes:

- Mobile / Web application for learners
- AI-driven user interface that adapts based on behavior and proficiency
- Real-time AI assistance for translation, vocabulary, and exercises
- Teacher/Coordinator dashboard with analytics
- Secure backend for authentication, data storage, and machine learning models

Intended Audience

- Developers
- UX/UI Designers
- Data Engineers
- Project Stakeholders
- QA/Testers

Definitions

- AI Adaptive UI – UI lay-out changes based on user behaviour / proficiency
- ML Model – Predicts difficulty, engagement, and recommendations
- Learner – Primary user who studies English

- Coordinator/Teacher – Monitors student progress

System Overview

The system is composed of:

- Frontend App (Mobile + Web) – UI, exercises, AI assistant
- Backend Services – API, authentication, analytics, adaptation logic
- AI / ML Layer – NLP, translation, difficulty prediction, analytics
- Database – User profiles, progress, exercise content
- Admin Dashboard – Teacher analytics and reporting

Functional Requirements

User Profile Management	Users can register/login securely Users create a profile specifying language background, proficiency, culture
Adaptive Home Dashboard	Layout changes based on AI behaviour tracking Shows recommended learning tasks
Learning Exercises	Exercises adjust difficulty dynamically System tracks performance and time
AI Assistant	Real-time translation Vocabulary explanations AI-generated practice exercises Speech, text, and multimodal input
Teacher Analytics Dashboard	View learner progress Engagement prediction graphs Exportable reports
Data Storage	Save user progress Save vocabulary words Cloud sync
Notifications System	Reminders New exercises Teacher messages

Non-Functional Requirements

Performance	UI loads within 2 seconds API response < 400ms
Scalability	Support 10, 000 concurrent learners Cloud auto-scaling
Security	End-to-end encryption (HTTPS/TLS) JWT authentication Secure password hashing
accessibility	WCAG AA contrast Font resizing

	Multilingual UI
Reliability	99% uptime target

Detailed Design

Frontend App Design

Technologies

- Option A: Flutter (Dart) for cross-platform
- Option B: React (Web) + React Native (Mobile)

Main UI Modules

1. Authentication
2. Profile Setup
3. Dashboard (Adaptive Layout)
4. Exercises Module
5. AI Assistant Interface
6. Vocabulary & Translation Pop-Up
7. Settings & Accessibility

Backend Design

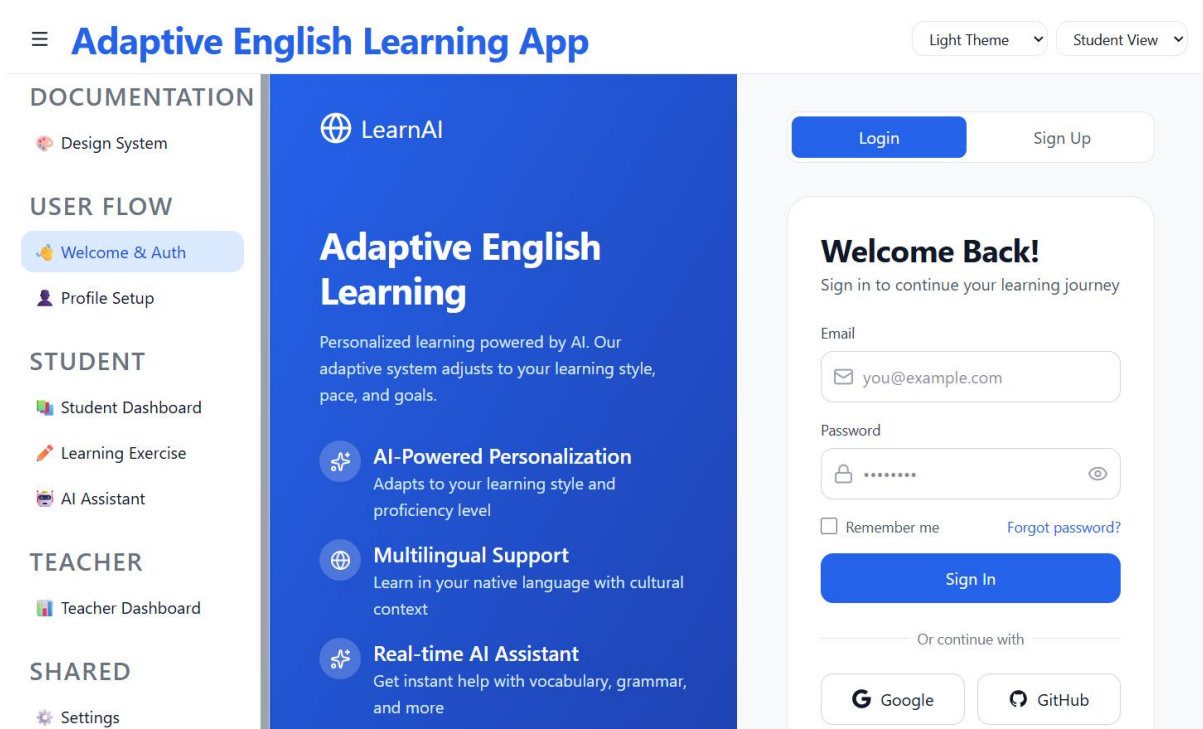
Technologies

- Node.js (TypeScript) or Python (FastAPI)
- PostgreSQL (main DB)
- Firebase/Mongo (event logs)

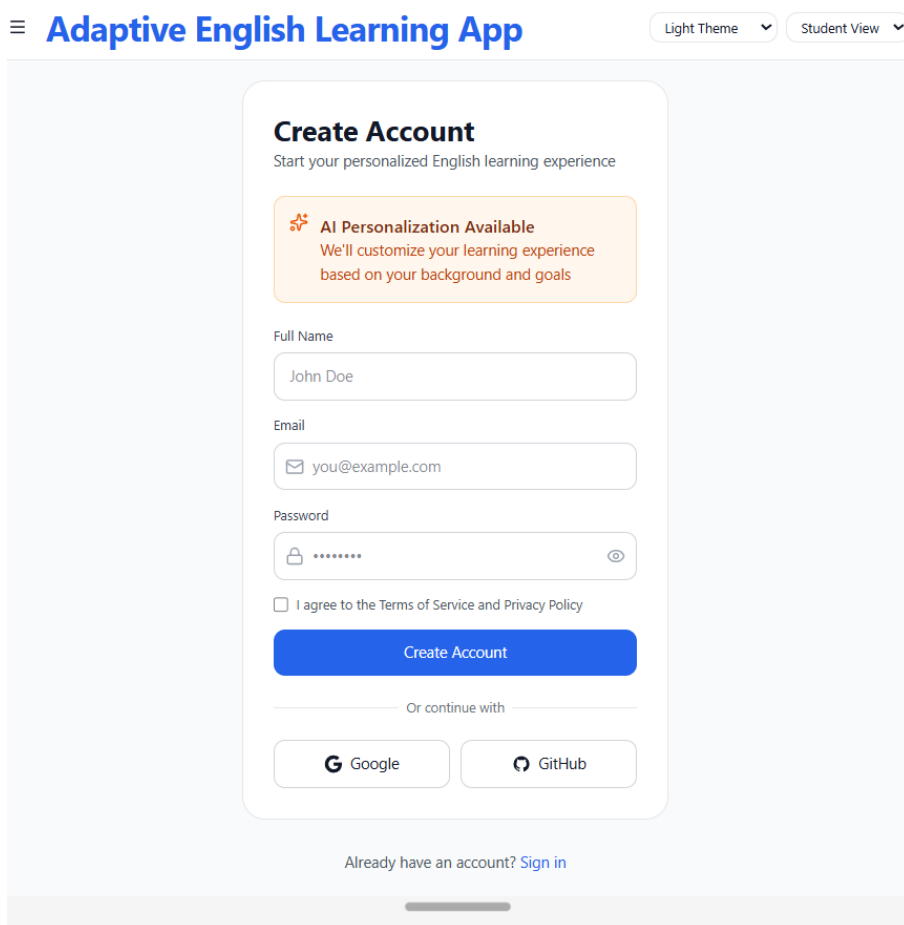
API Modules

- /auth/ - login, signup, token refresh
- /profile/ - user details
- /exercise/ - difficulty engine, question fetch
- /assistant/ - AI/NLP interface
- /analytics/ - teacher dashboard data

Figma wireframes



Signup page



Adaptive English Learning App

Light ThemeStudent View

Profile Setup

Step 1 of 4

Language Background

Help us understand your linguistic background

What is your native language?

Select your native language

Do you speak any other languages? (Optional)

Spanish

Mandarin

Hindi

Arabic

French

Portuguese

Russian

Japanese

German

Cultural background region

Select your region

Next >

Profile Setup

Step 2 of 4



English Proficiency

Let's assess your current English level

How would you rate your current English level?

Beginner (A1-A2)

Basic words and phrases

Intermediate (B1-B2)

Comfortable with everyday conversation

Advanced (C1-C2)

Fluent in most situations



AI Proficiency Test Available

After setup, we'll provide a quick adaptive test to fine-tune your level assessment.

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Profile Setup

Step 3 of 4



Learning Goals

What do you want to achieve with English?

Primary learning goal

Academic

Professional

Travel

Personal Growth

Test Preparation

Immigration

How much time can you dedicate to learning daily?

10 min

20 min

30 min

1 hour+

Topics of interest (select all that apply)

Business

Technology

Arts & Culture

Science

Sports

Entertainment

News

Literature

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Learning Style

How do you learn best?

Visual

Auditory

Reading/Writing

Kinesthetic

Mixed



Your Personalized Learning Path

- ✓ **Content customized** for your speakers
- ✓ **Difficulty adjusted** to your level
- ✓ **Lessons focused** on your goals
- ✓ **Content about** your interests
- ✓ **Adaptive UI** optimized for your learning style

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Complete Setup ✓

Adaptive Layout Demo

AI automatically adjusts this layout based on your proficiency and behavior

Intermediate View

Welcome back, Sarah! 🙌

You're making great progress. Keep it up!

AI Assistant

🔥 Day Streak
12

🎯 Today's Goal
18/30 min

👤 Level
B2

⭐ XP
2450

Today's Recommended Lesson

Personalized based on your progress

AI Recommended

📖 Business Email Writing
25 minutes • Writing & Grammar

▶ Start Lesson

Practice Activities

🗣️ Speaking Practice
Pronunciation and conversation

10 min >

🎧 Listening Exercise
Audio comprehension

15 min >