

Software Design Document (SDD)

Project: Adaptive English Learning App

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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)

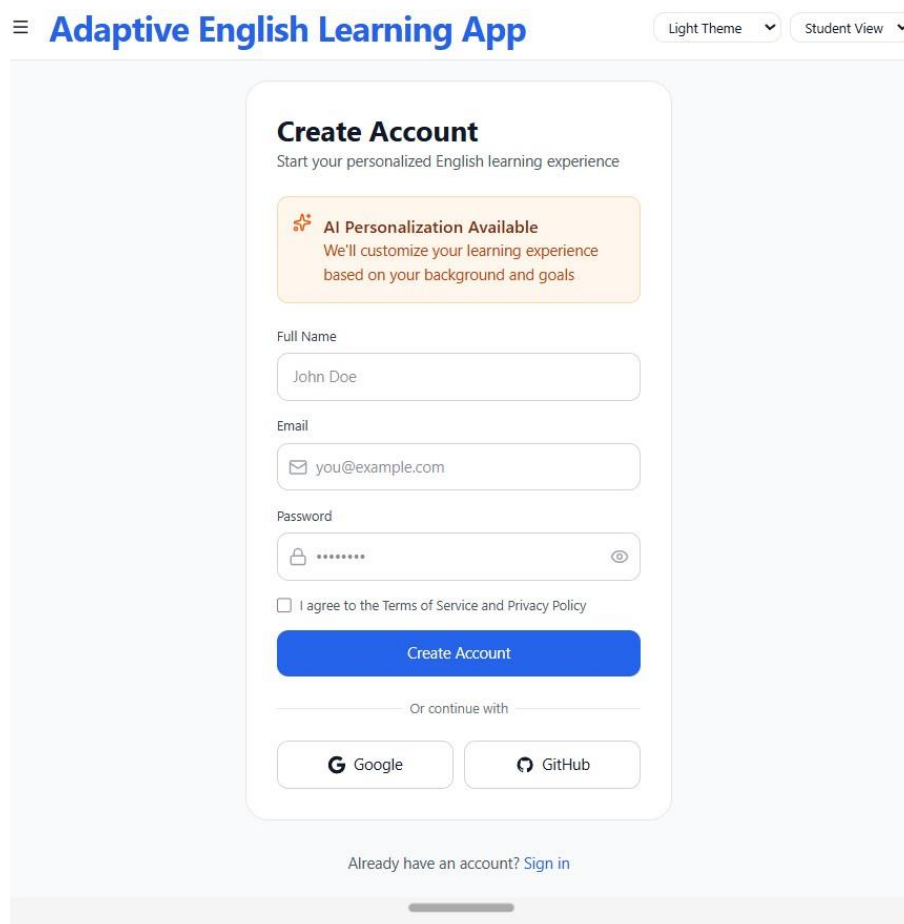
API Modules

- /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



Profile setup pages

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.

< Previous

Next >

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

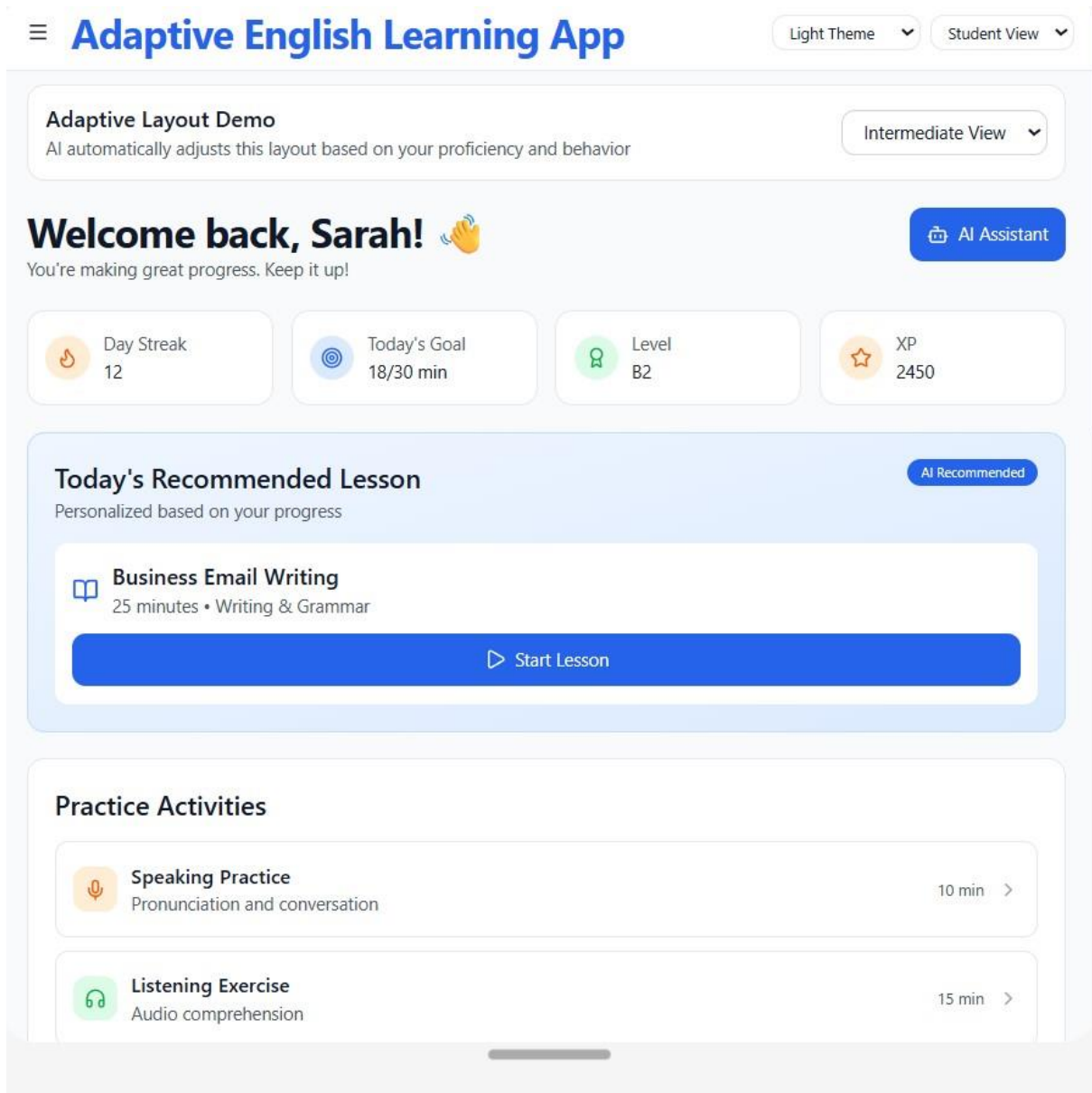


Your Personalized Learning Path

- ✓ 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

< Previous

Complete Setup ✓



Story Board

Story Board

Email

Password

☐

Sign In

User signs
into their
account

Select Native Language

Other Languages

background region

New users
are
assess
on their
language
background

- they set their native language
- Pick other languages they can speak

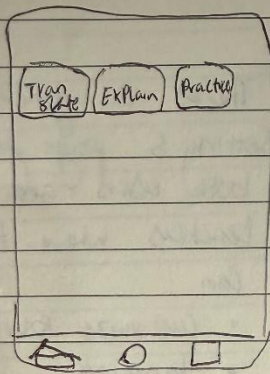
Welcome back, Name
 Day streak Goal
 Level XP
 Recommended Lesson
 Home icon, Circle icon, Square icon

The user is taken to the home page where they can see info like

- Their streak
- Daily Goals
- Level
- Each day they also get a recommended lesson.

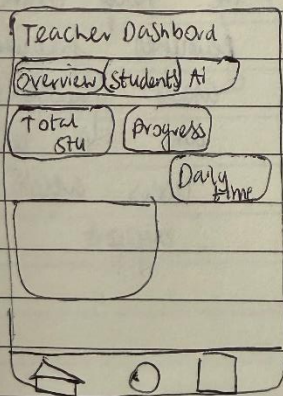
Choose the word
 Input field 1
 Input field 2
 Home icon, Circle icon, Square icon

IF the user goes into the learning exercise they will be asked to finish sentences testing them

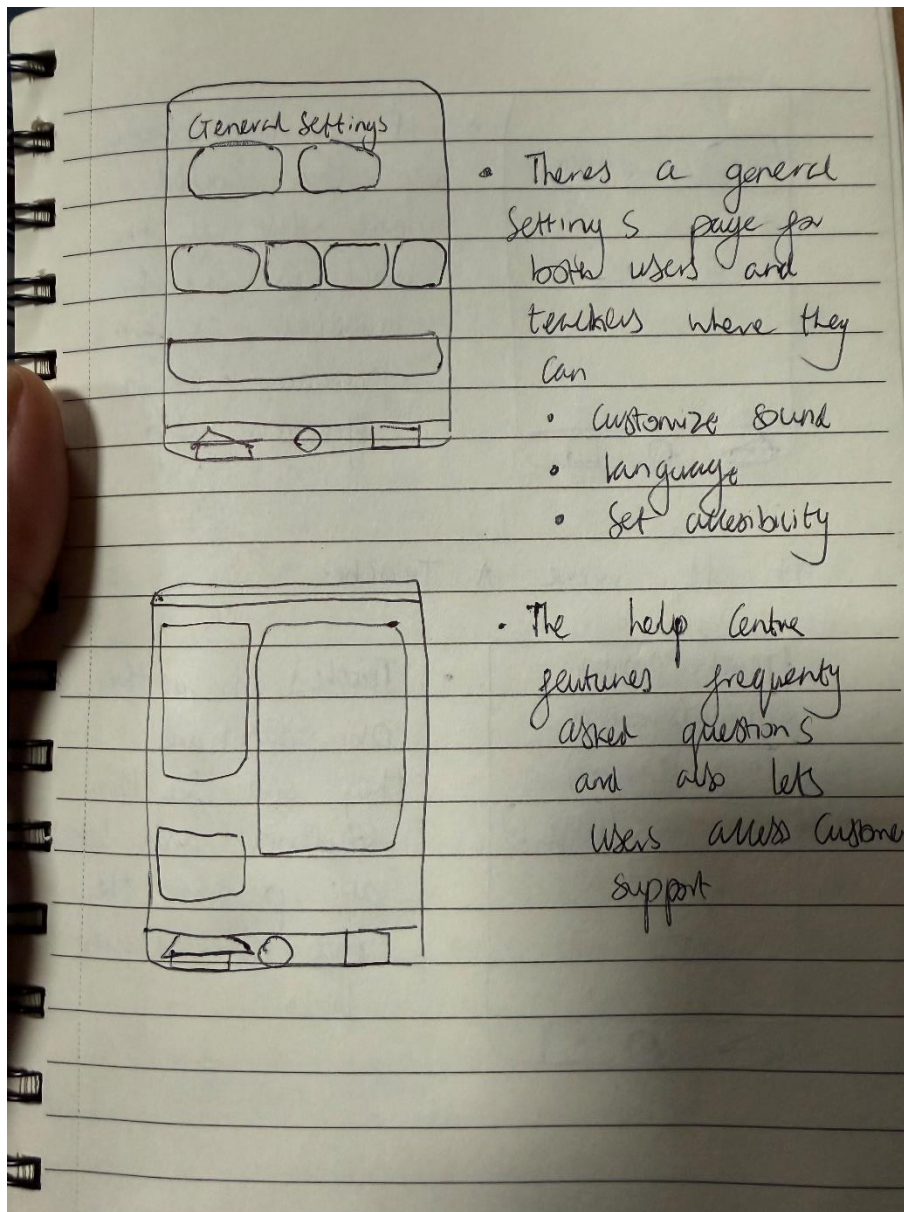


- If a user needs help they could make use of the built in ai to translate, explain, practice and for grammar help

If it were a Teacher



- Teachers have their own dashboard they can see their students and look at progress, they also get ai analytics



Storyboard explanation

Storyboard Explanation: AI-Driven English Learning Application

1. Introduction

This storyboard presents the conceptual design and user flow for an AI-driven English language learning mobile application. The app is designed to support both English learners and teachers by combining personalised learning, progress tracking, and integrated artificial intelligence tools. The application focuses on improving vocabulary, grammar, and sentence construction through interactive exercises and adaptive recommendations.

The storyboard illustrates the complete user journey, beginning with authentication and onboarding, progressing through learning and AI support features, and concluding with administrative and teaching-focused functionality.

2. User Authentication (Sign-In Screen)

Purpose:

The sign-in screen allows registered users to securely access their accounts.

Description:

Users are required to enter their email address and password to log in. A checkbox is included to support optional features such as remembering login details. Once authenticated, users are directed to either the onboarding process (for new users) or the home dashboard (for returning users).

This screen establishes account-based personalisation, which is essential for tracking learning progress and enabling AI-driven recommendations.

3. Onboarding and Language Background Setup (New Users)

Purpose:

The onboarding screen collects essential linguistic background information to personalise the learning experience.

Description:

New users are asked to:

Select their native language

Indicate any additional languages they can speak

Specify their background region

This information is used by the AI system to adapt explanations, translations, and difficulty levels. For example, learners with different native languages may require different grammatical explanations or vocabulary emphasis.

This step ensures that learning content is tailored from the start, improving accessibility and learning effectiveness.

4. Home Dashboard (Learner Overview)

Purpose:

The home dashboard provides learners with a clear overview of their progress and motivates consistent engagement.

Description:

The dashboard displays:

A personalised welcome message

Daily streak, showing consistent practice

Daily learning goals

Level and experience points (XP)

A recommended lesson, generated by the AI based on user progress and learning patterns

The AI recommendation system reduces decision fatigue by guiding learners toward the most suitable next activity.

5. Learning Exercise Interface (Vocabulary and Sentence Construction)

Purpose:

This screen represents the core learning activity within the application.

Description:

Users are presented with interactive exercises such as “Choose the correct word” or sentence completion tasks. These exercises test vocabulary knowledge, grammar understanding, and sentence structure in context.

User responses are evaluated immediately, allowing the system to provide feedback and update progress metrics such as XP and lesson completion.

6. AI-Assisted Learning Support

Purpose:

The AI support features assist learners when they encounter difficulty or wish to deepen their understanding.

Description:

The AI provides three main functions:

Translate: Converts words or sentences into the user’s selected support language

Explain: Offers grammar explanations and breakdowns of sentence structure

Practice: Generates additional examples or exercises related to the current topic

These features allow learners to receive immediate, contextual help without leaving the lesson, promoting independent learning and reducing frustration.

7. Teacher Dashboard (Educator View)

Purpose:

The teacher dashboard supports educators in monitoring student performance and engagement.

Description:

Teachers have access to:

An overview of total students

Student progress tracking

Daily learning time statistics

AI-driven analytics and insights

This data enables teachers to identify struggling students, monitor class-wide trends, and adapt teaching strategies accordingly. The AI insights assist educators in making informed, data-driven decisions.

8. General Settings (Users and Teachers)

Purpose:

The settings screen allows users to customise their application experience.

Description:

Settings include:

Sound preferences

Language preferences

Accessibility options

These features ensure inclusivity and allow users to tailor the app to their individual needs, enhancing usability for a wide range of learners.

9. Help Centre and Support

Purpose:

The help centre provides users with assistance and troubleshooting support.

Description:

Users can access frequently asked questions (FAQs) or contact customer support if further help is required. This reduces reliance on external assistance and improves overall user satisfaction.

10. Conclusion

This storyboard demonstrates a comprehensive design for an AI-driven English learning application that supports personalised learning, continuous feedback, and teacher oversight. By integrating artificial intelligence into onboarding, lesson recommendations, learning assistance, and analytics, the app aims to enhance learner engagement, improve language acquisition outcomes, and support educators in managing student progress effectively.

Role of Artificial Intelligence in the Application

Artificial Intelligence (AI) plays a central role in enhancing personalisation, learner support, and instructional effectiveness within the English language learning application. Rather than functioning solely as a static content provider, the system uses AI to adapt to individual users, provide real-time assistance, and generate insights for educators.

1. AI-Driven Personalisation and Onboarding

During the onboarding process, the AI system uses information provided by the learner—such as native language, additional languages spoken, and background region—to tailor the learning experience. This enables the system to:

Adjust grammatical explanations based on the learner's linguistic background

Select vocabulary and sentence structures appropriate to the learner's proficiency

Reduce common errors influenced by first-language interference

This initial personalisation ensures that learning content is relevant and accessible from the first interaction.

2. Intelligent Lesson Recommendations

The AI system continuously analyses learner behaviour, including:

Completed lessons

Accuracy rates

Time spent on exercises

Error patterns

Using this data, the system generates recommended lessons displayed on the home dashboard. These recommendations prioritise areas where learners require additional practice, supporting adaptive learning and preventing learners from progressing without sufficient understanding.

3. Real-Time AI Learning Assistance

AI provides contextual support during learning exercises through three key features:

Translation: AI-powered translation allows learners to quickly understand unfamiliar words or sentences.

Explanation: The system explains grammatical rules, sentence structures, and vocabulary usage in a learner-friendly manner.

Practice Generation: The AI dynamically generates additional practice exercises related to the learner's current mistakes or weak areas.

This real-time support reduces learner frustration and promotes self-directed learning without external assistance.

4. Adaptive Feedback and Progress Tracking

AI evaluates user responses in real time and provides immediate feedback. This allows the system to:

Reinforce correct language usage

Identify recurring mistakes

Adjust difficulty levels dynamically

Progress indicators such as XP, level progression, and streaks are updated based on AI evaluation, ensuring accurate representation of learner performance.

5. AI-Supported Teacher Analytics

For teachers, AI aggregates and analyses student performance data to generate actionable insights. These insights include:

Identification of struggling students

Trends in class-wide errors or weak topics

Analysis of engagement through daily learning time

This allows teachers to make informed instructional decisions and provide targeted support, enhancing teaching effectiveness.

6. Enhancing Accessibility and Inclusion

AI also supports accessibility by adapting explanations and learning methods to different learner needs. This includes simplifying explanations, supporting multilingual translation, and enabling flexible learning paths for users with varying proficiency levels.

7. Summary of AI Impact

Overall, AI transforms the application from a traditional language-learning platform into an adaptive educational system. By personalising content, providing real-time assistance, and supporting educators with data-driven insights, AI improves learner engagement, learning outcomes, and instructional efficiency.