**Department of Computer Applications**

MCA - D SECTION (Batch: 2024-2025)

Session: May 2024 to August 20225

PROJECT WORK – SYNOPSIS

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| TITLE OF THE PROJECT | : | Fluently (Language Leaning Web-app) |
| STUDENT NAME & SECTION | : | OMPRASAD B L  MCA E Section |
| REGISTRATION NO. | : | 23P01261 |
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Abstract:

Fluently is a modern, interactive language‑learning web application built with the PERN stack (Postgres, Express, React, Node.js), designed to make mastering a new language engaging, accessible, and secure. At its core, the platform features bite‑sized, gamified lessons—ranging from vocabulary drills to listening comprehension and pronunciation exercises—empowered by AI-based voice feedback. Users receive spoken prompts via an AI Text‑to‑Speech engine and respond through a built‑in Speech‑to‑Text interface, enabling real‑time pronunciation assessment and personalized feedback.

User authentication and data security are handled seamlessly through Clerk.js, offering pre‑built, customizable UI components and robust session management including social login, multi‑factor authentication, and role‑based access control. The backend, built with Node.js and Express, interfaces with Postgres to manage learning modules, user progress, and performance statistics. The React frontend delivers a polished, responsive experience with intuitive navigation and dynamic content rendering.

The voice‑enabled features leverage the Web Speech API alongside AI services such as Google Speech‑to‑Text, enabling immersive user interactions and improving pronunciation strategies. Gamification elements—such as XP points, Progress tracking, hearts, and leaderboards—promote sustained engagement and motivation. An administrative dashboard supports content creation, user management, and analytics, making the platform viable for both individual learners and educational institutions.

Overall, “Fluently” combines secure, scalable architecture, advanced speech AI, and compelling UX design to offer a unique, effective solution for language learners seeking interactive, voice‑driven learning experiences.

Introduction:

Fluenlty is an immersive, AI-powered language-learning web application built on the robust **PERN** stack—**PostgreSQL**, **Express**, **React**, and **Next.js**. Designed to help learners master languages through interactive, bite-sized lessons, Fluenlty offers a secure, scalable, and cutting-edge educational platform. It integrates **Clerk.js** for seamless authentication, providing features like email, social sign-in, and multi-factor login, all optimized for Next.js routing and middleware.

The core of Fluenlty is its voice-driven learning experience: lessons prompt users through AI-generated speech via the **Web Speech API** and cloud TTS services, while user responses are captured through speech recognition. This enables dynamic pronunciation feedback—leveraging AI or cloud services like Azure or OpenAI—to offer real-time analysis of accent, fluency, and accuracy, creating an immersive and personalized learning loop.

On the frontend, the Next.js React application delivers a smooth, responsive user interface, incorporating gamified elements such as XP tracking, streaks, hearts, and leaderboards to boost motivation. The backend, powered by Express and PostgreSQL, securely manages user profiles, lesson content, progress metrics, and speech logs. Using Next.js API routes, protected by Clerk’s middleware and auth helpers, ensures security across both client and server.

**Aim of the Project:** Fluenlty aims to bridge interactive web technologies and AI voice tools to create an engaging, effective language-learning platform. By combining secure authentication, voice‑enabled lessons, and performance tracking with a scalable PERN architecture, Fluenlty aims to redefine online language education as intuitive, motivating, and deeply personalized.

Review of Literature

**Existing Systems**

**Duolingo**

* **Strengths**: Widely used; gamified progression with XP, streaks, and social elements; adaptive exercise generation aids vocabulary, reading, listening, and speaking. Studies confirm Duolingo’s effectiveness users often reach similar proficiency to traditional coursework after intensive use .
* **Limitations**: Over-reliance on gamification can distract users from learning goals and encourage competition-focused behavior. Content often lacks contextual depth and explanatory feedback, limiting deeper language understanding. Recent AI-driven features have drawn criticism for inaccuracies and reduced human oversight.

**Proposed System: Fluenlty**

**Contextual Depth & Feedback**

* Integrates grammar explanations directly into lessons, addressing the common gap identified in Duolingo.
* Utilizes Next.js server-side capabilities combined with Clerk.js to deliver personalized, secure learning experiences.

**Balanced Gamification**

* Retains engagement-enhancing features (XP, streaks), but introduces learning-focused incentives and limits on game-first behaviors to prevent misuse.

**Continuous Improvement with Analytics**

* Leverages PostgreSQL metrics and speech logs to track user progress and tailor content dynamically.
* AI-generated exercises align with each learner’s evolving skill level—drawing from research on adaptive learning systems .

Technology used

|  |  |
| --- | --- |
| hardware | |
| PROCESSOR | Intel i5 |
| RAM | 8 GB |
| Hard disk | 1TB |
| SOFTWARE | REQUIREMENTS |
| Operating system | Windows 10 |
| Frontend Technologies | ReactJS, Tailwind CSS,ShadCn |
| Backend Technologies | Nextjs, ExpressJs, Eleven Labs, ClerkJs |
| Database | PostGreSQL |
| Browser | Google Chrome/ FireFox |
| IDE (Development Environment) | Vs Code |
| Technology Tools | GitHub,Netlify,Git |

**Estimated Project Timeline – Fluently**

| **Phase** | **Modules / Milestones** | **Estimated Time** |
| --- | --- | --- |
| **1. Requirement Gathering & Planning** | Define features, user roles, UX expectations, wireframes, tech stack decisions, database schema design | 7–14 days |
| **2. UI/UX Design Phase** | Design landing page, learning interface, dashboard, mobile views using Figma or other tools | 4–6 days |
| **3. Project Setup** | Set up Next.js 14/15 with TypeScript, folder structure, Tailwind + Shadcn UI, routing, Clerk authentication | 2–3 days |

**4. Core Development Phase**

| **Feature / Module** | **Subtasks** | **Time Estimate** |
| --- | --- | --- |
| **User Authentication** | Clerk integration, session management, protected routes | 2–3 days |
| **Landing Page** | Responsive UI, animations | 2–3 days |
| **Lesson System** | Lesson UI (questions, answers), progress tracker, lesson data fetch/store | 5–7 days |
| **AI Voice Integration** | ElevenLabs API setup, pronunciation playback in lessons | 2–3 days |
| **Gamification System** | XP engine, streak logic, achievement tracker | 3–4 days |
| **Hearts System** | Deduction/addition logic, heart popups, practice unlock | 2–3 days |
| **Shop Module** | UI, item logic, XP redemption, heart purchase flow | 2 days |
| **Subscription with Stripe** | Stripe integration, pricing plans, webhooks, upgrade/downgrade handling | 2–3 days |
| **Leaderboard & Quests** | XP tracking, global leaderboard logic, milestone quest logic | 2–3 days |
| **Sound Effects** | SFX integration for user actions and feedback | 1 day |
| **Exit/Error Handling** | Unsaved progress warning, custom 404s, heart exhaustion warnings | 1–2 days |
| **Admin Dashboard** | React Admin setup, lesson CRUD, user management, shop item updates | 2–3 days |
| **Practice Module** | List past lessons, retry mode, regain heart conditions | 1–2 days |

**5. Backend & Database Phase**

| **Module** | **Tasks** | **Time Estimate** |
| --- | --- | --- |
| **Database Modeling** | Define schema for users, XP, lessons, shop, subscriptions | 4–7 days |
| **Drizzle ORM Integration** | Model tables, relationships, migrations | 2 days |
| **API Routes / Server Actions** | Server logic for fetching/storing lesson data, XP, purchases | 3–4 days |

**6. Finalization & Deployment**

| **Activity** | **Tasks** | **Time Estimate** |
| --- | --- | --- |
| **Mobile Responsiveness Polishing** | Ensure all views adapt to mobile/tablet | 1–2 days |
| **Testing & Debugging** | Bug fixing, UX testing, error handling | 3–4 days |
| **Deployment** | Vercel deployment, env config, Stripe/Clerk/ElevenLabs production setup | 1-3 days |
| **Buffer Time** | Unexpected issues, polish, feedback rounds | 7–10 days |

Gantt Chart:

Requirement specification

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| --- | --- | --- | --- | --- |
| SRS /SRA | System Design | Coding | Testing | Deployment and Report |
| 2 weeks | 1 week | 4 weeks | 2 weeks | 1 week |

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