**Phase 1: Research**

The research phase focused on identifying the best tools, frameworks, and methodologies to build a reliable, maintainable, and scalable full-stack Notes App. The goal was to understand the core requirements of the application and match them with appropriate technologies and design patterns.

**📌 Objectives of Research**

* Determine the ideal frontend and backend technologies for building a CRUD-based Notes App.
* Understand how to synchronize state between frontend and backend.
* Explore RESTful API principles and their role in data communication.
* Identify challenges related to cross-origin requests and real-time updates.

**🔍 Frontend Research**

**Technology Chosen:** React.js  
**Reasons:**

* Component-based architecture
* Efficient state management with hooks (useState, useEffect)
* Rich ecosystem and community support
* Integration capability with libraries like Axios and Material UI

**Supporting Libraries:**

* **Axios**: For sending asynchronous HTTP requests
* **Material UI**: For building responsive and visually consistent UIs

**🔧 Backend Research**

**Technology Chosen:** Node.js with Express.js  
**Reasons:**

* Lightweight and fast I/O for handling REST APIs
* Built-in middleware support
* Ideal for building scalable backend services
* Easy integration with databases like MongoDB

**Supporting Tools:**

* **CORS Middleware**: Solves cross-origin request issues
* **Express Router**: Enables clean routing structure

**🔗 API Communication Research**

**Chosen Approach:** RESTful APIs  
**Why REST?**

* Simplicity and standardization
* Easy to implement and maintain
* Supports CRUD operations cleanly (GET, POST, DELETE)

**🚫 Challenges Identified**

| **Problem** | **Mitigation Strategy** |
| --- | --- |
| CORS Issues | Use of CORS middleware in Express |
| Managing Async HTTP Requests | Use of async/await with Axios in React |
| Ensuring State Synchronization | API-driven state updates in React components |
| Assigning Unique Note IDs | Backend generates unique identifiers |

**✅ Outcome of Research**

* Finalized the technology stack (React, Axios, Express, Node.js)
* Defined a clear synchronization strategy using REST APIs
* Identified reusable components and backend endpoints
* Laid a strong foundation for the design and development phases