



# Design and Implementation of an EMR app

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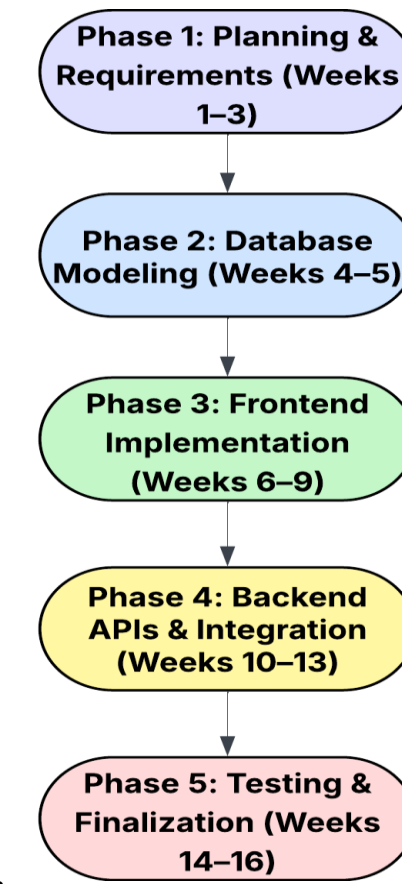


## Introduction

This practicum project developed a Smart Electronic Medical Records (EMR) system using a full-stack architecture (React, Express.js, MySQL) to demonstrate modern health informatics principles in practice. The application supports comprehensive patient management, clinical documentation, diagnostic ordering, and secure authentication addressing core challenges in real-world healthcare data management. The significance of the project lies in its demonstration of how relational database models and RESTful service architecture support high-quality clinical data management. By implementing a normalized schema where all clinical domains link through a single patient identifier, the system ensures data consistency, reduces redundancy, and facilitates comprehensive patient record review. The REST-based API design further illustrates how EMR systems enable interoperability, structured data exchange, and scalable integration between user interfaces and backend services.

## Timeline

**Phase 1: Planning & Requirements**  
Defined system goals, clinician workflows, and full-stack architecture.  
**Phase 2: Database Modeling**  
Designed a normalized MySQL schema and set up linked clinical data tables.  
**Phase 3: Frontend Development**  
Built a responsive React UI for patient management and all clinical modules.  
**Phase 4: Backend & Integration**  
Developed Express.js REST APIs, authentication, and full frontend database connectivity.  
**Phase 5: Testing & Demo Delivery**  
Refined performance, validated data integrity, and deployed a fully functional demo EMR.



## Practicum Outcomes – Professional

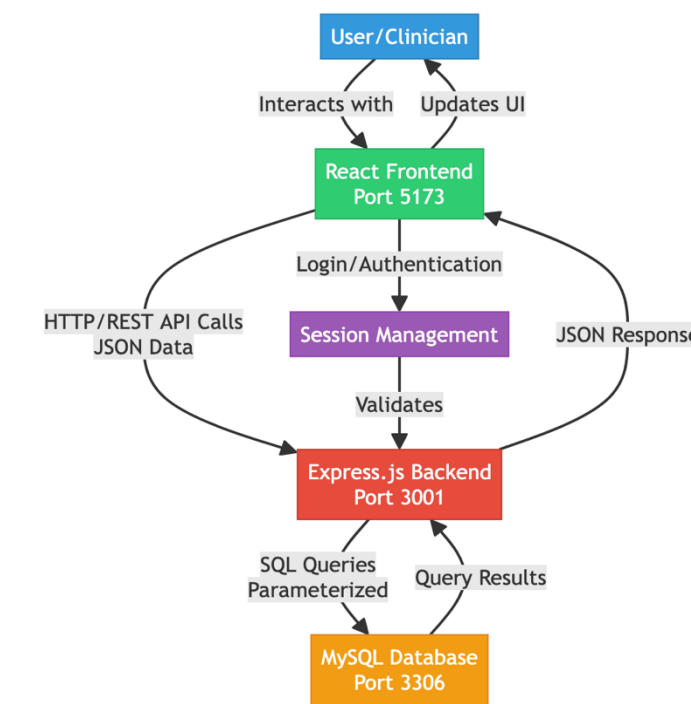
- Delivered a secure, fully functional full-stack EMR system with 10 clinical modules, a responsive React interface, and a modular Express.js backend.
- Built a well-structured, normalized 10-table MySQL database
- ensuring consistent, accurate, and patient-linked clinical data across all workflows.
- Implemented scalable REST-based data exchange through 9 API modules, parameterized SQL queries, and operational authentication/session management to protect sensitive healthcare information.
- Enabled streamlined patient management, diagnostic documentation, lab/imaging orders, renal parameters, and appointment scheduling, all supported by real-time UI updates and a unified patient record retrieval system.

Login to Mini Electronic Health Record System



## Practicum Scope

This practicum involved the end-to-end development of a Smart Electronic Medical Records (EMR) system using a full-stack architecture of React, Express.js, and MySQL. Work focused on designing a responsive user interface for clinical data capture, implementing REST-based backend APIs for patient management and documentation workflows, and creating a normalized relational database schema that links all clinical modules through a unified patient identifier. The scope included secure user authentication, structured data exchange, and comprehensive retrieval of patient-centered records across diagnosis, treatment, pathology, radiology, medical history, lab results, and appointments.

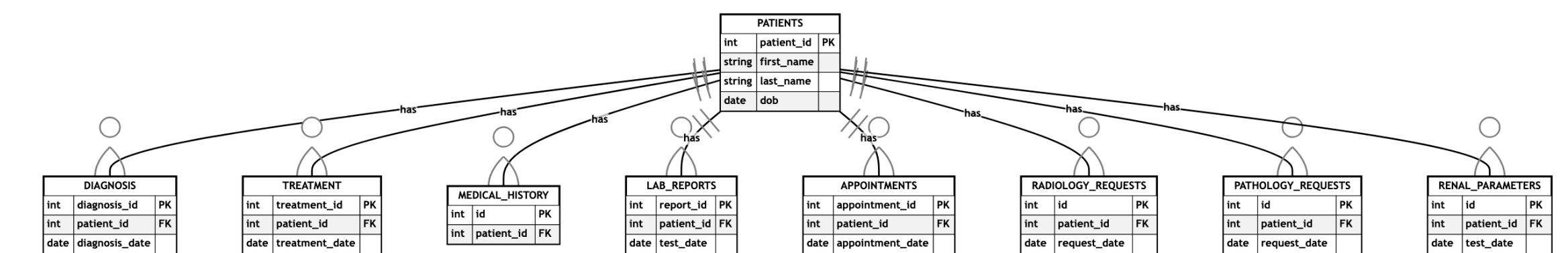


## Practicum Duties

- OBJECTIVES**  
Develop a full-stack EMR system demonstrating core health informatics concepts.  
Design a normalized MySQL schema with unified patient linking.  
Build APIs for clinical data entry and record retrieval.  
Create a responsive React interface for multiple clinical workflows.
- METHODOLOGY**  
Mapped clinical workflows (registration, diagnosis, labs, imaging, treatment, appointments).  
Modeled a normalized relational schema using patient\_id across all tables.  
Built Express.js REST endpoints with secure authentication and parameterized SQL queries.  
Developed React components with structured forms and client-side routing.
- TASKS**  
Designed a 10-table MySQL schema with relational integrity.  
Developed REST API modules for all clinical domains with authentication/session handling.  
Implemented patient search, unified record retrieval, and date-filtered queries.  
Built React pages for data entry, navigation, and aggregated record display.  
Fixed schema inconsistencies, optimized queries, and validated cross-module workflows.  
Prepared SQL schema, documentation, and a demo-ready deployment.
- TOOLS USED**  
Frontend: React, React Router, Vite, JavaScript  
Backend: Node.js, Express.js, MySQL2, express-session  
Database: MySQL, SQL

## Practicum Outcomes – Learning Objectives

- Strengthened full-stack technical confidence through hands-on development, debugging, and system integration.
- Improved analytical and sense-making skills by structuring messy clinical data and interpreting complex system behavior.
- Built stronger professional habits in goal-setting, initiative, and completing iterative milestones with accuracy.
- Enhanced communication and collaboration skills through clear documentation, architectural explanation, and problem-solving.



## Preceptor Details

- Organization Description:**  
GTechnologies Pty Ltd is an Australian digital-health company focused on developing secure, interoperable, and scalable EMR solutions that improve clinical workflows.
- Worksite:**  
Intern works remotely within the Smart EMR Development Unit, contributing to frontend, backend, and database components of the system.
- Administrative Structure:**  
Intern reports to the project technical lead as part of the EMR development team.

## Learning Objectives

- Design a full-stack EMR architecture connecting React, Express.js, and MySQL.
- Model relational clinical data using normalized schemas and SQL workflows.
- Build REST-style APIs for secure and structured patient data exchange.
- Develop responsive clinical interfaces for documentation and retrieval.
- Test, integrate, and document the system for reliable end-to-end EMR functionality.

## Conclusion

This practicum delivered a functional Smart EMR system that met all core objectives, including a normalized relational database, modular REST API, and responsive multi-module frontend supporting comprehensive patient workflows. The unified patient\_id structure enabled consistent data integration across clinical domains, demonstrating how structured models and API-driven design enhance data quality and workflow efficiency. I thank Professor Gary Schwebach for his guidance, and Rajesh, Director at GTechnologies Pty Ltd, for mentorship and support throughout the project.