IARE
INSTITUTE OF
AERONAUTICAL ENGINEERING

HIGH IMPACT PRACTICES (HIPS)

CORNERSTONE PROJECTS: Database Applications and Tools

INFORMATION PACKET

2025 - 2026

INSTITUTE OF AERONAUTICAL ENGINEERING
25 YEARS 2000 2025

I appreciate your interest in the Cornerstone Project (CoP), Department of Information Technology at the Institute of Aeronautical Engineering!

A **cornerstone project (CoP)** is typically introduced during the early or middle stages of an academic program at the Institute of Aeronautical Engineering. It focuses on helping students build foundational skills and understand how to apply basic concepts to real-world scenarios. These projects are usually smaller in scope, moderately complex, and designed to strengthen practical understanding of core subjects.

These projects encourage students to connect theoretical learning to data-centric applications, such as developing the data learning model, performing simple data analysis, or creating prototype engineering solutions. Emphasis is placed on learning by doing, helping students build confidence in applying methods like data preprocessing, statistical analysis, basic modeling, and reporting results. By working on these projects, students begin to understand how engineering and data science principles apply in real-world scenarios. Ultimately, cornerstone projects act as the foundation of experiential learning at IARE, transitioning students from passive learners to active problem-solvers, equipped with both technical skills and professional behaviors necessary for the challenges of advanced engineering education.

Cornerstone Project (CoP) teams are:

- Collaborative Project – This is an excellent opportunity for students who are committed to working towards social developments and emerging needs.
- Project Activity – The project coordinator listed current working areas for offering cornerstone projects with a team size of at least two students. The coordinator allotted mentors based on the work area and facilitated exclusive project laboratories for selected cornerstone project (CoP)students. This cornerstone project (CoP)bridges the gap between academic learning and real-world social applications. It helps enhance the professional development
- Short-term - Each undergraduate student may participate in a project for an assigned period.

The primary goal of cornerstone projects is to provide a level of moderate complexity, expertise, and diversity of thought in social data-centric areas that will allow them to gain hands-on experience with the cornerstone projects.

- Simulate real-world project work environments - Familiarize students with the structure, expectations, and deliverables typical of data-driven and software development projects.
- Encourage interdisciplinary thinking - Promote the application database methods to diverse domains such as healthcare, finance, education, environment, and smart cities.
- Promote ethical and responsible data use - Instil awareness of data ethics, privacy, security, and responsible AI practices during project planning and execution.
- Support data-driven decision making - Enable students to create data solutions that drive actionable insights, support evidence-based decisions, and add value to stakeholders.
- Foster hands-on project experience - Engage students in comprehensive, real-world data science project work that integrates the full data lifecycle from collection to insight generation and emerging technologies like AutoML, NLP, and LLMs.
- Build strong project portfolios - To enable students to create social and industry-ready project portfolios that demonstrate technical depth, innovation, and impact on careers.
- Bridge academic learning and practical application - Apply theoretical knowledge to practical challenges involving data analysis, machine learning, and visualization using real datasets.

Cornerstone Projects (CoPs) focuses on the challenges presented by the Sustainable Development Goals (SDGs)

Sustainability Development Goals (SDGs) for the Dept. of IT, IARE	
SDG 3	Ensure healthy lives and promote well-being for all at all ages
SDG 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
SDG 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
SDG 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
SDG 10	Reduce inequality within and among countries
SDG 12	Ensure sustainable consumption and production patterns
SDG 17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

Themes of Cornerstone Projects (CoPs) for the Information Technology:

The following project domains are recommended for cornerstone projects (CoPs), and the students should frame the problem statements from any one of the following themes:

1. Intelligent Query Optimization in Modern Database Systems **(SDG #9, SDG #12, SDG #17)**
2. Virtual and Remote Guidance Counselling System Database Design **(SDG #3, SDG #4, SDG #9)**
3. Inventory Management System. **(SDG #9, SDG #12, SDG #11, SDG #8)**
4. Distributed and Federated Database Systems for Scalable Applications **(SDG #9, SDG #12, SDG #17)**
5. Healthcare Informatics – Patient Data Systems & Electronic Health Records (EHR) **(SDG #3, SDG #9, SDG #10, SDG #16)**
6. Blockchain-Integrated Databases for Secure and Transparent Transactions **(SDG #9, SDG #12, SDG #17)**
7. Voice-based Transport Enquiry System **(SDG #9, SDG #10, SDG #11)**
8. Hospital Management System **(SDG #3, SDG #9, SDG #12)**
9. Smart Library Management System with Book Recommendation and Usage Analytics **(SDG #4, SDG #9, SDG #12)**

In order to participate in cornerstone projects, you must formally apply and be accepted by the project coordinator. To proceed, please mail to the project coordinator, Mr. N Rajasekhar (rajasekharnennuri@iare.ac.in), Head of Information Technology. This will bring up all available open positions tagged as cornerstone projects.

Please note that participation by the cornerstone project (CoP)team requires registration for the accompanying project work from any of the specified domains. More information will be provided to all selected cornerstone project (CoP)applicants who have been offered a position.

If you have any questions about a particular team, please contact the faculty mentor.
We encourage you to contemplate this fascinating new opportunity. We look forward to receiving your application submission!

Intelligent Query Optimization in Modern Database Systems

Ms. B Pravalika, Assistant Professor, Information Technology – Faculty Mentor

GOALS

This domain is centered around improving the performance of database systems by developing intelligent query optimization techniques. Traditional optimizers often rely on static rules and cost models, which become ineffective in dynamic and large-scale environments. This research area explores adaptive and machine learning-based optimizers that can self-tune by analyzing historical workloads, runtime statistics, and query patterns. The goal is to reduce query execution time, improve system throughput, and enable efficient use of hardware resources across both relational and non-relational systems.
This aligns with industries requiring high-performance analytics, such as e-commerce, finance, and real-time monitoring systems.

METHODS & TECHNOLOGIES

- **Cost-Based and Rule-Based Optimization**: Traditional foundations used for estimating query costs and execution paths.
- **Machine Learning & Reinforcement Learning**: Models that predict efficient execution plans based on training from workload logs.
- **Adaptive Query Execution**: Systems that dynamically adjust execution strategies based on runtime feedback.
- **Heuristic Techniques (Genetic Algorithms, Simulated Annealing)**: Search-based approaches for large and complex query optimization spaces.
- **Workload-Aware Indexing**: Automated selection of indexes based on frequent access patterns and performance metrics.

MAJORS & AREAS OF INTEREST

- **Intelligent Query Plan Generation**: Developing learning-based optimizers that outperform static rule engines.
- **Self-Healing Database Systems**: Databases that adapt their execution strategies in real-time to system behavior.
- **Cross-Model Optimization**: Optimization techniques suitable for hybrid systems (e.g., relational + document stores).
- **Cloud-Optimized Execution**: Efficient resource allocation and execution planning for queries running in cloud environments.
- **Energy-Efficient Query Processing**: Designing optimizers that balance performance and power consumption.

MENTOR CONTACT INFORMATION

Ms. B Pravalika

Email: b.pravalika@iare.ac.in

Virtual and Remote Guidance Counselling System Database Design

Mrs. Akula Rajitha, Assistant Professor, Information Technology – Faculty Mentor

GOALS

This project is to develop a data-driven, virtual counselling platform that enables remote access to academic, career, and psychological guidance services through a robust and scalable database design. With the increasing demand for accessible mental health support and career planning tools, especially in remote or underserved regions, this system aims to bridge the gap between counsellors and users by digitizing the counselling process.

The database will serve as the foundation for managing sensitive and structured data, including user profiles, appointment schedules, session logs, feedback reports, and guidance materials. By implementing an intelligent and secure schema, the system ensures confidentiality, efficient query performance, and real-time data access for both counsellors and users.

The platform will allow counsellors to track user history, personalize guidance based on recorded progress, and automate recommendations for resources or next steps using rule-based analytics. For students and individuals seeking career or emotional guidance, the system offers a self-service model that includes session booking, virtual assessments, and access to curated content libraries.

Additionally, the project incorporates features such as mood tracking, early detection of distress signals, and timely alerts to prevent psychological burnout, especially in academic environments. These insights will be derived from behaviour patterns, assessment responses, and historical counselling data.

.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) team will focus on core methods and technologies for Database Management Systems.

- Technology-- MySQL / PostgreSQL / MongoDB
- Database Design & Management– To store and manage student records, counselor data, session logs, schedules, messages, feedback,
- Remote Communication– Enable live video/audio/text-based counselling.
- Chat and messaging systems-- for asynchronous communication.
- Security & Privacy– Protect sensitive user data
- Cloud Hosting & Deployment– Deploy application, store media files securely
- Analytics & Reporting– Monitor usage, user satisfaction, session effectiveness.

DESIGN, & TECHNICAL ISSUES

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Challenges and Design Considerations in Database Management Systems.

- Role-based entity-relationship design, with normalized tables for users, sessions, chat logs, feedback, and scheduling.
- Managing large volumes of chat records and video session metadata across distributed systems.
- Use of cloud-based databases (e.g., AWS RDS, Firebase), caching for performance (Redis), and modular API-driven backends (RESTful/GraphQL).
- Designing APIs and database schemas that log session metadata, store auth tokens securely, and track third-party meeting IDs.
- Ensuring the system works reliably in areas with limited internet connectivity.

- Optimize for low data usage, allow offline session booking, and use lightweight frontends (PWA/mobile apps) with local data
- Implement strong consistency mechanisms in DB
- Scalable NoSQL or hybrid databases (e.g., MongoDB for chat logs), optimized for read/write performance and searchability.

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest:
Relevant Fields and Skills Development Through Project Execution

- Development of relational and NoSQL databases for securely storing and managing user profiles, session logs, communication history, and scheduling data
- Cybersecurity & Privacy Engineering– Ensuring secure storage and transmission of sensitive mental health and personal data using encryption
- Software Development– Building modular, scalable applications with frontend (React, Angular), backend (Node.js, Django), and database integration
- Privacy Engineering– Ensuring secure storage and transmission of sensitive mental health and personal data using encryption, secure authentication, and access control mechanisms
- Full-Stack Application Design– Real-time chat, video conferencing integration, and notification systems.

MENTOR CONTACT INFORMATION

Mrs. Akula Rajitha

Email: a.rajitha@iare.ac.in

Inventory Management System

Mr. R Suvarna Rao, Assistant Professor & IT_ Faculty Mentor

GOALS

Understand the fundamentals of database design and management using hospital management systems by analyzing real-world healthcare workflows, including patient admissions, diagnostics, treatment, and discharge processes. Develop skills in entity-relationship modeling, normalization techniques, and SQL query design to create a structured, scalable, and secure relational database for managing hospital operations. Implement a real-time hospital management system with complete CRUD (Create, Read, Update, Delete) functionalities across multiple modules such as patient records, appointment scheduling, doctor availability, pharmacy inventory, billing, and lab reporting. Integrate dynamic reporting features to assist in administrative decision-making and resource optimization. Promote collaborative problem-solving, critical thinking, and professional communication through group-based system design, coding, testing, and deployment activities. Gain awareness of data integrity, access control, cybersecurity, and system reliability requirements in handling sensitive healthcare data within a mission-critical business application environment.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) team will focus on core methods and technologies for Database Management Systems.

- Methods Analyze business inventory requirements and user roles.
- Design ER diagrams and relational schema based on use-case analysis.
- Normalize tables to remove redundancy and improve efficiency.
- Write SQL scripts for creation, manipulation, and retrieval of inventory data.
- Conduct testing using realistic data sets and edge cases.
- Prepare final presentation, technical documentation, and reflective report.
- DBMS: MySQL / SQLite / PostgreSQL / Oracle
- Design Tools: dbdiagram.io, Lucidchart, Draw.io
- Programming: SQL, Python, PHP, Java (optional interfaces)
- Tools: VS Code, DBeaver, MySQL Workbench
- Version Control: GitHub

DESIGN & TECHNICAL ISSUES

Cornerstone Project (CoP) team interested in from the following majors or areas of interest:
Challenges and Design Considerations in Database Management Systems.

- Modeling entities like products, suppliers, orders, categories, and inventory logs.
- Establishing primary and foreign keys for relational integrity.
- Creating efficient schema for stock tracking, restocking alerts, and reporting.
- Managing real-time updates in stock levels with transaction safety.
- Preventing data anomalies during concurrent user access.
- Securing inventory data with role-based access control.
- Optimizing SQL queries for high-volume data retrieval.
- Implementing audit trails for inventory changes.

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Relevant Fields and Skills Development Through Project Execution

- Computer Science & Engineering (CSE)
- Information Technology (IT)
- Business Information Systems
- Software Engineering
- Data Analytics
- Business database solutions and ERP systems
- Supply chain and logistics data management
- Real-time stock monitoring systems
- Reporting and inventory analytics
- Inventory fraud detection and control systems

MENTOR CONTACT INFORMATION

Mr. R Suvarna Rao
Email: r.suvarnarao@iare.ac.in

Distributed and Federated Database Systems for Scalable Applications

Ms. B Pravalika, Assistant Professor, Information Technology – Faculty Mentor

GOALS

This research area addresses the architectural and algorithmic challenges of managing data across multiple servers, cloud nodes, or even different organizations. Distributed and federated databases aim to provide scalability, fault tolerance, and high availability while maintaining query correctness and consistency. The focus is on ensuring seamless data access, load balancing, and transparent query processing across heterogeneous sources. This is crucial for global-scale applications like content delivery networks, e-governance platforms, and enterprise-level cloud systems. It aligns with modern digital infrastructure demands and supports smart collaboration between decentralized services.

METHODS & TECHNOLOGIES

- **Sharding and Partitioning Strategies**: Dividing large datasets across nodes to enable parallel processing and load distribution.
- **Consistency and Replication Mechanisms**: Implementing CAP-aware algorithms to ensure data integrity across replicas (e.g., quorum-based consensus).
- **Federated Query Engines**: Systems that allow unified queries over multiple, autonomous databases with differing schemas.
- **Conflict Resolution Algorithms**: Mechanisms to detect and resolve data conflicts in eventual consistency models.
- **Cloud-Native NoSQL/NewSQL Databases**: Tools such as Google Spanner, Amazon Aurora, and CockroachDB supporting distributed transactional processing.

MAJORS & AREAS OF INTEREST

- **Global-Scale Data Management**: Architecting systems for multinational data infrastructure and geo-distributed applications.
- **Federated Health and Finance Databases**: Secure integration of databases from hospitals, banks, or government agencies.
- **Low-Latency Distributed Analytics**: Real-time query processing over distributed logs, events, and telemetry data.
- **Multi-Cloud Data Federation**: Unified data access and control across multiple cloud providers.
- **Resilient and Fault-Tolerant Architectures**: Ensuring data availability and service continuity during node failures.

MENTOR CONTACT INFORMATION

Ms. B Pravalika

Email: b.pravalika@iare.ac.in

Healthcare Informatics – Patient Data Systems & Electronic Health Records (EHR)

Mr. R Suvarna Rao, Assistant Professor & IT_ Faculty Mentor

GOALS

Understand the principles of healthcare informatics through the design and management of patient data systems and electronic health records. Develop proficiency in data modeling, normalization, and secure SQL query design tailored for healthcare data. Implement an electronic health record (EHR) system with features such as patient registration, medical history tracking, appointment scheduling, prescription management, and lab result integration. Integrate CRUD operations and data visualization tools to support clinical decision-making and administrative reporting. Promote collaborative development, critical analysis, and professional communication through team-based system design and implementation activities. Gain awareness of healthcare data standards (e.g., HL7, FHIR), data privacy regulations (e.g., HIPAA), and system reliability in clinical environments.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) team will focus on core methods and technologies for Database Management Systems.

- Research hospital data workflows and EHR systems
- Analyze and design the ER model for patient data and medical history
- Normalize tables to avoid redundancy and ensure efficient queries
- Implement with SQL including triggers, views, and procedures
- Perform collaborative development with version control
- Present and document project outcomes with reflection on healthcare ethics
- DBMS: PostgreSQL / MySQL / Oracle
- Design Tools: dbdiagram.io, Draw.io, Lucidchart
- Programming Languages: SQL, Python (data handling), Java (optional UI), PHP (optional web interface)
- IDEs & Tools: VS Code, MySQL Workbench, DBeaver
- Data Privacy Tools: Access controls, user authentication (basic level)
- Version Control: GitHub or GitLab

DESIGN & TECHNICAL ISSUES

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Challenges and Design Considerations in Database Management Systems.

- Modeling patients, doctors, diagnoses, prescriptions, and visits accurately
- Ensuring data integrity and avoiding anomalies through normalization
- Structuring tables for ease of future extension (labs, imaging, referrals)
- Protecting patient confidentiality using access roles and constraints
- Handling concurrent access to medical records in multi-user environments
- Ensuring backup, recovery, and minimal downtime for critical data
- Mitigating risks of SQL injection or unauthorized access
- Query optimization for reports (e.g., patient history, visit logs)

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Relevant Fields and Skills Development Through Project Execution

- Computer Science & Engineering (CSE)
- Information Technology (IT)
- Health Informatics
- Biomedical Engineering
- Data Science
- Electronic Health Records (EHR) design and compliance
- Clinical decision support systems
- Secure healthcare data architecture
- Data analytics and predictive modeling in healthcare
- Healthcare data interoperability and integration

MENTOR CONTACT INFORMATION
Mr R Suvarna Rao
Email: r.suvarnarao@iare.ac.in

Blockchain-Integrated Databases for Secure and Transparent Transactions

Ms. B Pravalika, Assistant Professor, Information Technology – Faculty Mentor

GOALS

This domain combines the strengths of conventional database management systems with blockchain technologies to offer secure, tamper-proof, and verifiable data storage. The aim is to integrate decentralized trust, smart contracts, and immutable logging into traditional database environments for critical applications such as identity verification, voting systems, supply chain tracking, and audit trails. This research bridges the gap between the flexibility of databases and the trustworthiness of blockchain. It contributes to digital governance, financial transparency, and integrity in record-keeping.

METHODS & TECHNOLOGIES

- **Smart Contracts**: Code embedded in blockchain that automatically executes transactions when conditions are met.
- **Hybrid Database-Blockchain Models**: Architecture combining a fast, queryable database with blockchain-based audit trails.
- **Consensus Protocols (PoS, PBFT, Raft)**: Algorithms to ensure that only verified data is committed across distributed ledgers.
- **Interoperability Layers**: Middleware to allow queries and updates across database and blockchain environments.
- **Immutable Log and Versioning Systems**: Append-only data structures for audit compliance and history tracking.

MAJORS & AREAS OF INTEREST

- **Secure Transactional Systems**: Systems where financial or legal transactions must be provably authentic and immutable.
- **Blockchain-Backed E-Governance**: Land record registries, birth/death certificates, and voter IDs with secure provenance.
- **Decentralized Identity Management**: Storing and verifying identities without centralized control.
- **Supply Chain & Asset Tracking**: Ensuring transparent movement of goods and commodities with trusted timestamping.
- **Regulatory-Compliant Audit Trails**: Logs that meet regulatory standards and withstand third-party verification.

MENTOR CONTACT INFORMATION

Ms. B Pravalika

Email: b.pravalika@iare.ac.in

Voice-based Transport Enquiry System

Mrs. Akula Rajitha, Assistant Professor, Information Technology – Faculty Mentor

GOALS

This project aims to develop a voice-enabled, data-driven transport enquiry platform that provides seamless, real-time access to public transportation information through natural voice interaction. The system is designed to enhance commuter convenience, accessibility, and inclusivity, particularly benefiting users in regions with limited digital literacy or physical access to transport information.

At its core, the platform will leverage speech recognition, natural language processing (NLP), and structured database systems to interpret user queries and respond with accurate transport data such as schedules, routes, delays, ticket availability, and fare details. By integrating voice interfaces with robust backend databases and real-time APIs, the system will support hands-free and user-friendly access to transport services across multiple channels.

The backend database will manage structured data including route maps, vehicle locations, station metadata, service alerts, and user preferences. It will be designed with normalization, indexing, and ER modeling to optimize performance, enable scalability, and ensure quick retrieval of information. Intelligent query handling will allow for dynamic response generation based on context, location, and historical usage patterns.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) team will focus on core methods and technologies for Database Design Management.

- Database Design & Management – MySQL / PostgreSQL / MongoDB
- Natural Language Processing (NLP) – spaCy / NLTK / Dialogflow / Rasa,
- Text-to-Speech (TTS) – Google Text-to-Speech / Amazon Polly / pyttsx3.
- Multilingual Support – Language Models / Regional NLP Libraries.
- Real-Time Data Integration – Transport APIs
- Cloud Hosting & Deployment – AWS / Google Cloud

DESIGN, & TECHNICAL ISSUES

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Challenges and Design Considerations in Database Management Systems.

- Managing large volumes of user interactions, including voice inputs, processed transcripts, and system responses, with efficient storage and indexing mechanisms
- Managing large volumes of chat Designing APIs and data pipelines to fetch and cache data from public transport services (e.g., city bus systems, Indian Railways APIs) while ensuring consistency and low-latency access.
- Dealing with diverse accents, background noise, and multilingual inputs, requiring robust voice recognition models and NLP tuning for high accuracy in real-world conditions.
- Design of backend schemas that track user session metadata, voice query history, location data (with consent), and frequent routes for personalization and analytics

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Relevant Fields and Skills Development Through Project Execution

- Design and implementation of relational and NoSQL databases to manage transport schedules, voice query logs, user interaction histories, and real-time route data.
- Development of voice recognition and natural language understanding components to interpret user queries and provide intelligent, context-aware responses
- Ensuring secure handling of voice inputs, location data, and user preferences using encryption, access control, and secure APIs to prevent data leaks or misuse.
- Application Design– Real-time chat, video conferencing integration, and notification systems.
- Use of speech-to-text, text-to-speech, and multilingual voice processing tools for accurate and natural communication between users and the system.

MENTOR CONTACT INFORMATION

Mrs. Akula Rajitha

Email: a.rajitha@jare.ac.in

Hospital Management System

Mr. R Suvarna Rao, Assistant Professor & IT_ Faculty Mentor

GOALS

Understand the fundamentals of database design and management using hospital management systems. Develop skills in entity-relationship modeling, normalization, and SQL query design. Implement a role-based hospital information system with real-time patient data management, CRUD operations, and reporting features. Promote collaborative problem-solving and professional communication through group-based project work. Gain awareness of data integrity, privacy, and system reliability in healthcare applications.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) team will focus on core methods and technologies for Database Management Systems.

- Requirements analysis of hospital operations
- Design of ER diagram and schema
- Normalization (1NF, 2NF, 3NF)
- SQL implementation: DDL, DML, queries, joins, views, triggers
- Testing: data insertion, query optimization, handling large datasets
- Group presentations and documentation
- DBMS: MySQL / PostgreSQL / Oracle
- Design Tools: Lucidchart / dbdiagram.io / Draw.io
- Languages: SQL, Python (for scripting), PHP (if web-based), Java (if GUI)
- IDE/Tools: MySQL Workbench, DBeaver, VS Code
- Optional Frontend: HTML, CSS, JavaScript
- Version Control: GitHub

DESIGN & TECHNICAL ISSUES

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Challenges and Design Considerations in Database Management Systems.

- Mapping real-world entities (patients, doctors, appointments, rooms, billing) into table
- Ensuring proper normalization to avoid data duplication
- Designing relationships (one-to-many: doctor to patient, many-to-many: doctor to department)
- Managing simultaneous appointments and concurrent access (ACID compliance)
- Securing patient data using access roles and privileges
- Efficient retrieval of historical medical records
- Handling cascading updates and deletes in foreign key relations
- Backup and recovery of sensitive data

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Relevant Fields and Skills Development Through Project Execution

- Computer Science & Engineering (CSE)
- Information Technology (IT)
- Data Science
- Health Informatics

- Software Engineering
- Healthcare Informatics – patient data systems, electronic health records (EHR)
- Cybersecurity – data protection, user roles, encryption
- UI/UX Design – building a simple interface for hospital staff (optional)
- Data Analytics – analyzing patient trends and hospital usage
- AI/ML (Future Scope) – patient diagnosis prediction models (extension idea)

MENTOR CONTACT INFORMATION
Mr. R Suvarna Rao
Email: r.suvarnarao@iare.ac.in

Smart Library Management System with Book Recommendation and Usage Analytics

Mrs. Akula Rajitha, Assistant Professor, Information Technology – Faculty Mentor

GOALS

This project aims to develop a smart, data-driven library management system that enables efficient organization, real-time tracking, and personalized user engagement through intelligent recommendation and usage analytics. The system is designed to streamline library operations, enhance the user experience, and promote informed reading habits through the integration of advanced database systems and analytical models.

The backend database will store structured information such as book metadata, user profiles, transaction histories, borrowing limits, and reservation data. Designed using normalization, indexing, and entity-relationship modeling, the system will ensure data consistency, scalability, and high-performance query execution.

The system will incorporate machine learning techniques to analyze borrowing history and reading trends, enabling the platform to offer automated book recommendations and highlight trending titles. Additionally, usage analytics will provide librarians with insights into book demand, user engagement levels, and resource allocation effectiveness.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) team will focus on core methods and technologies for Database Management System.

- Technology – MySQL / PostgreSQL / MongoDB
- Recommendation Engine – Content-Based & Collaborative Filtering,
- User Interface & Access Systems – Web / Mobile Platforms
- Multilingual Support – Language Models / Regional NLP Libraries.
- Notification System – Email/SMS/App Alerts

DESIGN, & TECHNICAL ISSUES

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Challenges and Design Considerations in Database Management Systems.

- Balancing between content-based and collaborative filtering methods, handling cold-start problems for new users or new books, and continuously updating recommendations based on user activity.
- Implementing locking mechanisms or transaction isolation levels to prevent conflicts in real-time book reservations, especially under high user load.
- Ensuring responsive and consistent user experiences across web, tablet, and mobile devices, including accessibility features like font adjustment and dark mode
- Developing lightweight data pipelines or event loggers to capture borrowing patterns and reading trends without affecting system performance

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Relevant Fields and Skills Development Through Project Execution

- Design and Implementation of Relational and NoSQL Databases
- Development of Recommendation Systems and Data Mining Techniques
- Application of User-Centric Design Principles
- Data Analytics and Visualization.
- Security and Privacy in Library Information Systems
- Application of User-Centric Design Principles

MENTOR CONTACT INFORMATION

Mrs. Akula Rajitha

Email: a.rajitha@iare.ac.in