IARE
INSTITUTE OF
AERONAUTICAL ENGINEERING

HIGH IMPACT PRACTICES (HIPS)

CORNERSTONE PROJECTS:
Web systems Development
INFORMATION PACKET
2025 - 2026

INSTITUTE OF AERONAUTICAL ENGINEERING
2000 2025 25 YEARS

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 of web techniques 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 16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
SDG 17	Strengthen the means of implementation and revitalize the Global Partnershipfor 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. Inclusive Voting and Opinion Polling Web App **(SDG #10, SDG #16, SDG #9)**
2. Semantic-Aware Social Media Moderation using Emotion Recognition and Toxicity Analysis with Real-time UI Feedback **(SDG #3, SDG #10, SDG #16, SDG #9)**
3. Context-Aware Serverless Web Architectures for Low-Latency Form Processing in Large-Scale User Applications. **(SDG #9, SDG #12, SDG #11, SDG #17)**
4. Distributed Web Crawler and Indexing System **(SDG #9, SDG #4, SDG #12, SDG #17)**
5. Edge-AI Integrated Web Framework for Real-Time Anomaly Detection in Financial Transaction Logs **(SDG #8, SDG #9, SDG #16, SDG #12)**
6. Realtime Cross-Browser SSO (Single Sign-On) and Access Token Management for Multi-Page Web Applications **(SDG #9, SDG #16, SDG #10)**
7. Civic Engagement & Awareness Portal **(SDG #16, SDG #10, SDG #4, SDG #17)**
8. AI-Driven Dynamic Form Rendering for Intelligent Survey and Polling Systems in Educational Environments **(SDG #4, SDG #9, SDG #10, SDG #12)**
9. Microservices-Based Web Systems for Disaster Reporting with Live Location and Severity Mapping **(SDG #11, SDG #9, SDG #3, SDG #17)**

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!

Inclusive Voting and Opinion Polling Web App

Dr. U Sivaji, Associate Professor, IT – Faculty Mentor

GOALS

Create a scalable, secure, and accessible web application that allows users to participate in voting and opinion polls focused on SDG-related topics. The app will prioritize inclusivity by supporting multiple languages, accessibility standards, and usability on low-end devices and slow internet connections.

Ensure equal access to voting and polling for all users, regardless of gender, age, disability, literacy level, or location. Encourage citizens to voice their opinions on local and national issues, enhancing participatory governance. Guarantee the privacy, anonymity, and security of user data and votes to build public trust in digital participation.

Help governments, NGOs, and institutions gather and analyze public opinion to inform policy and decision-making. Amplify the voices of communities that are often excluded from traditional voting or opinion-sharing platforms Design the app to be usable by people with various abilities, internet access levels, and devices.

Offer clear, transparent poll results and processes to foster accountability in leadership and institutions. Provide resources and guidance to inform users about their rights, democratic responsibilities, and how to participate effectively. Develop the app with scalability and cost-efficiency in mind so it can be adopted widely by communities, schools, or local governments.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) team will focus on core methods and technologies for Polling Web App.

- Multi-language support (i18n) – To reach diverse linguistic groups
- Text-to-speech integration – For visually impaired users.
- Offline voting capability (PWA) – Progressive Web App support for low-connectivity areas
- Simple UI/UX design – For low-literate or first-time users
- Chart.js / D3.js / Recharts – For dynamic data visualization.
- HTML5, CSS3, JavaScript – Basic web structure and styling
- React.js / Vue.js – Dynamic UI development
- Tailwind CSS / Bootstrap – Fast and accessible UI design
- ARIA roles & WCAG guidelines – To ensure accessibility for screen readers and assistive devices

DESIGN & TECHNICAL ISSUES

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Challenges and Design Considerations in Polling Web App.

- Use simple, readable fonts and layouts.
- Provide clear navigation and progress indicators.
- Use icons and visuals to support text.
- The app must be usable on phones, tablets, and desktops.
- Implement mobile-first design using frameworks like Tailwind CSS or Bootstrap.
- Must handle large datasets efficiently.
- Risk of exporting personally identifiable data—privacy breach.

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

- Web development, Database systems, AI/ML for data analysis.
- UX/UI design, Accessibility technologies, Electoral systems
- Data visualization and analytics, Survey design and bias minimization
- Front-end development (HTML, CSS, JavaScript, React/Vue)
- Back-end APIs (Node.js, Django, Flask) Responsive design for mobile and desktop
- Designing and managing relational (PostgreSQL/MySQL) or NoSQL (MongoDB) databases

MENTOR CONTACT INFORMATION

Dr. U Sivaji

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Semantic-Aware Social Media Moderation using Emotion Recognition and Toxicity Analysis with Real-time UI Feedback

Ms. G Anitha, Assistant Professor, IT – Faculty Mentor

GOALS

The main goal of this project is to design an intelligent social media moderation system that uses semantic analysis**,** emotion recognition**,** and toxicity detection to evaluate user-generated content in real time. It aims to ensure safer and more respectful digital interactions by identifying harmful, emotionally charged, or offensive language before it is posted.

By integrating advanced Natural Language Processing (NLP) and machine learning models, the system can understand not only the words but the context and intent behind messages. Real-time feedback through the user interface empowers users to self-correct inappropriate messages, thus promoting digital civility and mental wellness.

This project also supports the development of ethical AI-driven moderation tools that respect freedom of expression while mitigating cyberbullying**,** hate speech, and online harassment, especially in educational and community platforms. It aligns with the goals of sustainable digital infrastructure and mental well-being in online environments.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) team will apply the following methods and technologies:

- **Semantic NLP Models** – Use of transformer-based models (e.g., BERT, RoBERTa) for contextual understanding of text beyond keyword spotting.
- **Emotion Recognition** – Classification of emotional tone (anger, sadness, joy, fear) from text using deep learning-based sentiment and emotion classifiers.
- **Toxicity Analysis** – Integration of models like Google Perspective API or custom CNN/LSTM architectures to detect toxic, insulting, and threatening content.
- **Real-Time Feedback UI** – Implementation of feedback mechanisms (color alerts, suggestions) using JavaScript frameworks (e.g., React) and RESTful APIs.
- **Explainable AI (XAI)** – Application of SHAP/LIME for transparency and interpretability of moderation decisions.
- **Cloud Deployment** – Use of AWS or Google Cloud for scalable, secure moderation processing and real-time inference.
- **Secure Data Handling** – Encryption and compliance with ethical and privacy standards (GDPR-compliant data collection and anonymization).

DESIGN & TECHNICAL ISSUES

The CoP team will address the following challenges in designing the semantic-aware moderation system:

- Accurately identifying emotional tone and toxic content in **multilingual or code-mixed text** (e.g., English-Telugu/Hinglish).
- Ensuring **semantic correctness** while filtering sensitive topics that may not contain explicit keywords.

- Handling **sarcasm, humor, or ambiguous language**, which can confuse basic moderation models.
- Providing **real-time feedback** with minimal latency during typing without disrupting the user experience.
- Ensuring **explainability** of moderation outcomes to gain trust from users and platform administrators.
- Designing an intuitive, responsive, and accessible **UI across devices** and user groups.
- **Preventing over-blocking** or unfair flagging of content, which could infringe on free speech or discourage engagement.
- Maintaining **user data privacy** and preventing misuse of flagged or emotional data.

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest:

- **Web Systems Engineering** – Modular web design, form behavior modeling, and frontend/backend synchronization.
- **Cloud Computing** – Serverless logic execution, cloud databases, and load balancing.
- **Cybersecurity** – Secure data transmission, session integrity, and authentication.
- **Human-Centered Computing** – Context-aware UI/UX design and accessibility features.
- **Data Analytics & Monitoring** – Real-time data tracking, usage trends, and admin visualizations.
- **DevOps & Deployment** – CI/CD for serverless functions, logging, and performance monitoring.

MENTOR CONTACT INFORMATION

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Context-Aware Serverless Web Architectures for Low-Latency Form Processing in Large-Scale User Applications

Ms. M.Himabindu, Assistant Professor, IT – Faculty Mentor

GOALS

The primary goal of this project is to design and implement a context-aware, serverless web architecture that supports real-time, low-latency form processing in applications serving thousands of concurrent users. These may include academic feedback portals, e-governance forms, survey platforms, or large-scale registration systems.

The system will intelligently adapt form content based on user context such as location, language, session history, or device type to optimize user experience. The architecture aims to be serverless, scalable, modular, and cost-efficient, using modern cloud-native and event-driven technologies. It will also support validation, partial autosave, and asynchronous backend workflows for high performance and fault tolerance. This project supports the broader goal of enabling fast, intelligent, and reliable data collection in diverse web applications while reducing infrastructure maintenance and improving digital accessibility.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) team will focus on core methods and technologies to build a high-performance, event-driven, serverless web architecture.

- Serverless Computing Platforms – AWS Lambda, Google Cloud Functions, or Firebase Functions for stateless backend logic execution without manual provisioning.
- Context-Aware UI Adaptation – JavaScript APIs and device metadata (e.g., geolocation, language, browser type) to dynamically modify form fields and interface behavior.
- Frontend Frameworks – React.js, Bootstrap, and Redux to create modular, interactive, and responsive form-based applications.
- Asynchronous Processing – Use of WebSockets, AJAX, or Pub/Sub systems for non-blocking form submissions and real-time user feedback.
- API Gateway & REST APIs – Connecting client-side logic with backend functions securely via AWS API Gateway or Firebase HTTPS triggers.
- Cloud Databases – Firestore, Cloud SQL, or DynamoDB for storing user inputs, form configurations, and analytics.
- Security & Validation – Input sanitization, CSRF protection, form-level validation, and session tokenization.
- Monitoring Tools – Integration of CloudWatch, Firebase Analytics, or Prometheus for monitoring latency, errors, and throughput.
- Data Visualization Tools – Dashboards using Streamlit, Chart.js, or Power BI for admin and analytics reports.

DESIGN & TECHNICAL ISSUES

Cornerstone Project (CoP) team must address the following technical and design challenges:

- Cold Start Delays – Serverless functions may introduce delays on first execution; strategies include pre-warming or regional caching.
- High Concurrency & Throughput – Ensuring scalability and consistency for thousands of users via auto-scaling and asynchronous job queues.
- Real-Time Validation – Dynamic validation of fields without degrading user experience; requires optimized frontend-backend coordination.

- User Context Sensing – Efficient use of browser/device metadata to enhance personalization without overloading the client.
- Error Handling – Graceful degradation and retry strategies for failed submissions or timeouts.
- Session Management – Statelessness of serverless systems makes custom session tracking necessary for multi-page forms.
- Security & Compliance – Protecting user data in transit and at rest; ensuring GDPR compliance for global applications.
- Cross-Device & Browser Compatibility – Ensuring consistent functionality and design across different platforms.

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest:

- **Web Systems Engineering** – Modular web design, form behavior modeling, and frontend/backend synchronization.
- **Cloud Computing** – Serverless logic execution, cloud databases, and load balancing.
- **Cybersecurity** – Secure data transmission, session integrity, and authentication.
- **Human-Centered Computing** – Context-aware UI/UX design and accessibility features.
- **Data Analytics & Monitoring** – Real-time data tracking, usage trends, and admin visualizations.
- **DevOps & Deployment** – CI/CD for serverless functions, logging, and performance monitoring.

MENTOR CONTACT INFORMATION

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Distributed Web Crawler and Indexing System

Dr. U Sivaji, Associate Professor, IT – Faculty Mentor

GOALS

Automatically crawl large volumes of web pages across multiple domains in a distributed and fault-tolerant manner. Optimize bandwidth and crawling speed using parallel processing. Automatically and rapidly collect web data from multiple sources using distributed crawling. Handle large-scale crawling tasks by distributing the load across multiple nodes or servers. Extract, process, and store relevant data in a structured, searchable format. Support continuous or periodic crawling to keep the index fresh and up to date. Eliminate irrelevant, duplicate, or malicious content before indexing. Develop a crawler capable of fetching vast amounts of web data across diverse domains without manual intervention. Implement a scalable architecture that divides tasks among multiple nodes or servers to maximize performance and reduce latency. Extract, clean, and index the most meaningful content (e.g., text, metadata, titles, keywords) for fast and accurate search or analysis. Design mechanisms to handle node failures, lost connections, and retry logic without data loss or system crash. Design the system to support multilingual content and diverse character encodings for global or regional use cases. Use smart crawling strategies (e.g., priority queues, caching, deduplication) to reduce bandwidth and storage cost. Make the system adaptable for applications like search engines, academic analysis, trend tracking, or open data platforms.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) team will focus on Web Crawler

- **Breadth-First or Depth-First Crawling** Standard strategies for exploring web pages.
- **Priority-Based Crawling** Assign priority scores to URLs based on relevance, frequency, or domain authority.
- **Crawling, Politeness Policies** Respect robots.txt, apply delays between requests, and avoid overloading servers.
- **Duplicate Detection** Use hashing (e.g., MD5, SHA-1) to avoid indexing the same content repeatedly.
- **Queue-Based Architecture**
  Use distributed queues (e.g., RabbitMQ, Kafka) to manage crawl jobs between workers.
- **Content Extraction**
  Strip HTML tags and extract meaningful data (title, body text, metadata).
- **Crawled Data Storage HDFS (Hadoop Distributed File System)** – Scalable storage of raw web pages,
- **Zookeeper, Docker & Kubernetes, Apache Kafka / RabbitMQ**
- **MongoDB / Cassandra** – For flexible, document-style storage
- **Amazon S3 / Google Cloud Storage** – Cloud-based object storage
- **Index Storage Elasticsearch / Apache Solr** – Full-text search engines, **PostgreSQL / MySQL** – For structured metadata and results
- **Python** – For writing crawlers using libraries like Scrapy, BeautifulSoup, Requests
- **Java** – Often used with Apache Nutch or Hadoop-based systems
- **Go / Rust** – For performance-intensive crawling tasks
- **JavaScript (Node.js)** – For lightweight and event-driven crawlers

RESEARCH, DESIGN, & TECHNICAL ISSUES

Cornerstone Project (CoP) team should be interested in the following majors or areas of interest: Web Crawler

- Breadth-first vs. depth-first, priority-based crawling, and adaptive strategies.
- Ensuring the crawler performs well under high loads across thousands of URLs/domains
- Natural language processing, content scoring, and metadata extraction.
- Language detection, encoding normalization, and rendering engines (e.g., headless browsers).
- Web ethics, terms of service compliance, GDPR and data privacy standards.
- The system must allow for the separate development and scaling of components (crawler, parser, indexer, storage).
- Managing and deduplicating millions of URLs in a distributed setup.
- Choosing an efficient data structure for indexing content.
- How users access the indexed content—via search bar, visual dashboard, or data API.
- crawling agents or nodes may fail during execution. Risk of executing harmful scripts or hitting malicious sites.
- Overloading target websites or violating robots.txt. Waste of resources indexing duplicate or low-quality pages.
- Keeping the index fresh as the web changes. Crawling and storing huge volumes of content can be expensive.

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Key Technical Domains and Skill Development Opportunities

- Breadth-first vs. depth-first vs. priority-based crawling
- URL deduplication and frontier management
- Crawl scheduling and politeness policies
- Adaptive or focused crawling (topical or language-specific)
- Efficient task distribution and load balancing
- Fault-tolerant system design
- Network coordination between nodes
- Message queues and synchronization (e.g., Kafka, RabbitMQ)
- Use of distributed file systems (HDFS, S3)
- Scalable deployment using Docker and Kubernetes
- Adherence to web usage policies (robots.txt, GDPR)

MENTOR CONTACT INFORMATION

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Edge-AI Integrated Web Framework for Real-Time Anomaly Detection in Financial Transaction Logs

Ms. G Anitha, Assistant Professor, IT – Faculty Mentor

GOALS

The main goal of this project is to develop an Edge-AI powered web-based framework that performs real-time anomaly detection on financial transaction logs. By leveraging edge computing, machine learning, and intelligent stream processing, the system aims to detect suspicious or fraudulent activities instantly and efficiently, even in environments with limited cloud connectivity.

This system enhances transaction security, ensures fraud prevention, and supports compliance with regulatory standards by identifying outliers and abnormal patterns in transaction data. Through a web-based interface, the system provides actionable insights, alerts, and visual feedback to stakeholders such as banks, fintech services, and auditors.

The project promotes the use of intelligent automation and privacy-preserving computing in finance, enabling secure, fast, and scalable fraud detection mechanisms. It contributes to building transparent, accountable, and resilient digital financial infrastructures for both public and private sectors.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) team will implement the following key technologies and tools:

- Edge AI Models – Lightweight neural networks or decision-tree-based models optimized to run on edge devices (e.g., NVIDIA Jetson, Raspberry Pi).
- Streaming Data Analytics – Real-time data ingestion using Apache Kafka, Apache Flink, or Spark Streaming for continuous anomaly monitoring.
- Anomaly Detection Algorithms – Use of Isolation Forest, Autoencoders, and Statistical Methods to detect unusual patterns in transaction logs.
- Secure Web Framework – Development of an interactive web UI using Django or Flask to visualize alerts, reports, and model outcomes.
- Cloud and Edge Deployment – Hybrid architecture leveraging edge devices for local inference and cloud servers (AWS, Azure) for model training and retraining.
- Explainable AI (XAI) – Integration of model interpretability layers (e.g., SHAP, LIME) to explain detected anomalies to auditors or end-users.
- Time-Series Feature Engineering – Use of temporal features (transaction frequency, time of day, user behavior profiles) to enhance model accuracy.
- Encryption & Access Control – Use of HTTPS, JWT, and role-based access control to secure sensitive financial data.

DESIGN & TECHNICAL ISSUES

Cornerstone Project (CoP) team will explore the following design and technical challenges:

- Handling large-scale, high-frequency transaction data in near real-time with low latency.
- Ensuring model accuracy while minimizing false positives/negatives, which can impact decision-making or user trust.
- Designing edge-compatible models that are both computationally efficient and accurate.
- Addressing data privacy and security requirements for sensitive financial logs during transmission and storage.
- Integrating real-time feedback mechanisms in the web UI for transparent anomaly reporting and decision support.
- Building scalable system architecture capable of switching between edge and cloud operations seamlessly.

- Interfacing with external APIs or data sources (e.g., payment gateways, banking systems) for enriched feature sets.
- Ensuring compliance with financial industry standards like PCI-DSS and GDPR in model design and deployment.

MAJORS & AREAS OF INTEREST

This project is relevant for students with backgrounds or interests in the following fields:

- Artificial Intelligence & Machine Learning – Development of lightweight anomaly detection models optimized for edge and cloud.
- Cybersecurity & Privacy Engineering – Secure data handling, encryption protocols, and audit log protection.
- Edge & Cloud Computing – System architecture design for hybrid deployment and distributed inference.
- Web Technologies & UI/UX Design – Real-time data visualization dashboards with alerting systems.
- Financial Technology (FinTech) – Understanding transaction patterns, fraud vectors, and compliance tools.
- Big Data & Streaming Analytics – Real-time pipeline creation using tools like Kafka and Spark for continuous monitoring.
- Explainable AI (XAI) – Making model outputs interpretable for regulatory and decision-making purposes.
- Data Engineering – Handling of raw financial logs, preprocessing, and structuring for efficient ingestion.

MENTOR CONTACT INFORMATION

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Realtime Cross-Browser SSO (Single Sign-On) and Access Token Management for Multi-Page Web Applications

Ms. M.Himabindu, Assistant Professor, IT – Faculty Mentor

GOALS

The primary goal of this project is to develop a secure, scalable, and real-time Single Sign-On (SSO) system that functions seamlessly across multiple web applications and browsers. It focuses on eliminating redundant login steps while ensuring consistent user session management across multi-page applications (MPAs), enhancing both user experience and system security.

This project aims to enable centralized identity verification using OAuth2, OpenID Connect, or custom token services. It will handle token issuance, validation, refresh cycles, and revocation in real time, supporting secure access to protected resources in a distributed web environment.

The system will also address the complexity of token propagation across tabs, browsers, and client devices, offering mechanisms like secure local/session storage, cookie management, and inter-tab messaging using BroadcastChannel or SharedWorker APIs.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) team will use the following core methods and technologies:

- **Authentication Protocols** – OAuth2.0, OpenID Connect (OIDC), or SAML for federated identity management.
- **Token Management** – Implementation of JSON Web Tokens (JWT), refresh tokens, token expiration tracking, and revocation lists.
- **Secure Storage Mechanisms** – Use of HttpOnly cookies, localStorage, or sessionStorage with encryption for cross-browser session handling.
- **Inter-Tab Communication** – Use of BroadcastChannel API, SharedWorker, or Service Worker to synchronize login/logout across tabs.
- **Frontend Integration** – React.js, Next.js, or plain JavaScript to inject authentication logic into MPAs and coordinate login state.
- **SSO Gateway** – Centralized login service using Node.js/Express or Django with RESTful endpoints to issue and validate tokens.
- **Backend APIs** – Middleware to intercept requests, verify tokens, and enforce authorization rules on protected routes.
- **Monitoring Tools** – Tools like Auth0 Dashboard, Firebase Auth Logs, or custom dashboards using Prometheus + Grafana.
- **CI/CD and DevOps** – Secure deployment using GitHub Actions, AWS/GCP pipelines, and TLS/HTTPS enforcement.

DESIGN & TECHNICAL ISSUES

The Cornerstone Project (CoP) team must handle the following challenges:

- **Token Lifecycle Management** – Secure handling of short-lived access tokens and refresh tokens without compromising UX or security.

- **Cross-Browser Compatibility** – Ensuring uniform authentication experience across Chrome, Firefox, Safari, and Edge.
- **Session Synchronization** – Enabling real-time sync of login/logout across multiple open tabs using reliable APIs.
- **Security Risks** – Protection against CSRF, XSS, token theft, and session hijacking.
- **Silent Reauthentication** – Managing seamless background re-login without disrupting user workflow.
- **Performance Optimization** – Minimizing authentication overhead and avoiding repeated token verification.
- **Token Revocation** – Implementing centralized revocation lists and monitoring abnormal activity.
- **Multi-Domain SSO** – Coordinating identity sessions across different web origins and domains.

MAJORS & AREAS OF INTEREST

This project is suitable for students from the following specializations:

- **Web Systems Engineering** – Integration of login systems into modern MPAs.
- **Cybersecurity** – Authentication, encryption, session hardening, token validation.
- **Cloud Computing** – Secure identity and access management (IAM) on cloud platforms.
- **DevOps & Deployment** – Token infrastructure scaling, key rotation, and CI/CD pipelines.
- **Software Architecture** – Microservices coordination and secure communication.

MENTOR CONTACT INFORMATION

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Civic Engagement & Awareness Portal

Dr. U Sivaji, Associate Professor, IT – Faculty Mentor

GOALS

A **Civic Engagement & Awareness Portal** is a digital platform designed to empower citizens by increasing their awareness, participation, and communication with government and community institutions. The portal serves as a centralized hub where users can access information about civic rights and responsibilities, public services, community events, and local initiatives. It facilitates two-way interaction through features such as feedback forms, issue reporting tools, opinion polls, and discussion forums.

The portal promotes transparency, accountability, and inclusivity by making government processes more accessible and encouraging collaboration between citizens and public officials. It supports democratic engagement and community building while aligning with Sustainable Development Goals

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) team will focus on Civic Engagement & Awareness Portal

- **Agile Development**
  Iterative approach with continuous user feedback to ensure responsiveness to community needs.
- **User-Centered Design (UCD)**
  Focused on accessibility, multilingual support, and usability for diverse user groups.
- **Modular Architecture**
  Separation of components such as user management, feedback, reporting, and analytics for easier maintenance and scalability.
- **HTML5, CSS3, JavaScript** – Core web technologies for structure and styling.
- **React / Angular / Vue.js** – Modern frameworks for dynamic and responsive user interfaces.
- **Bootstrap / Tailwind CSS** – UI libraries for responsive and accessible design.
- **Progressive Web App (PWA)** – Enables mobile-friendly offline access and notifications.
- **Node.js / Express** – JavaScript-based server for scalable backend services.
- **Python (Django / Flask)** – Popular for rapid development and API integration.
- **PHP (Laravel)** – Another option for quick deployment and content management.
- **Java (Spring Boot)** – Robust backend for large-scale enterprise portals.
- **MySQL / PostgreSQL** – Relational databases for structured civic data (users, reports, surveys).
- **MongoDB / Firebase** – NoSQL databases for flexibility and scalability.
- **Cloud Storage (e.g., AWS S3, Google Cloud Storage)** – For storing documents, images, and media files.

RESEARCH, DESIGN, & TECHNICAL ISSUES

Cornerstone Project (CoP) team should be interested in the following majors or areas of interest: Civic Engagement & Awareness Portal

- How do different groups (urban, rural, youth, elderly) engage with civic platforms?
- What types of civic issues are most reported or discussed
- What metrics define successful civic participation (e.g., report resolution, survey response rate)?

- User-Centric Interface Design present civic data (budgets, local events, reports) in an understandable and engaging way?
- Must handle a large number of users and data (e.g., survey results, issue reports).
- Push notifications, emails, or in-app alerts need to be managed efficiently.
- Requires GPS, reverse geocoding, and map APIs (e.g., Google Maps, Leaflet).

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Key Technical Domains and Skill Development Opportunities

- Web Development
- Database Management
- Cloud Computing & Hosting
- API Development & Integration
- User Authentication & Security
- Mobile-friendly and offline-capable features.
- Ensures data safety and availability.
- Cloud storage for images, documents, and media uploads.
- Google Maps, Leaflet for mapping user-submitted issues.
- For secure login and role-based access control.

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AI-Driven Dynamic Form Rendering for Intelligent Survey and Polling Systems in Educational Environments

Ms. G Anitha, Assistant Professor, IT – Faculty Mentor

GOALS

The primary goal of this project is to design an AI-powered dynamic form rendering system that intelligently adapts survey and polling interfaces in real-time based on user responses, context, and inferred intent. This technology enables more relevant, personalized, and engaging forms for students, educators, and administrators in academic environments.

By leveraging Natural Language Processing (NLP) and machine learning techniques, the system identifies user profiles and dynamically generates follow-up questions or alters survey flow accordingly. It facilitates efficient feedback collection, targeted assessments, and adaptive educational analytics, supporting data-driven decision-making across educational institutions.

This project promotes innovation in EdTech infrastructure by streamlining how surveys, feedback forms, and polling systems operate. It enhances user engagement and response quality while minimizing fatigue or bias—thereby contributing to inclusive, transparent, and intelligent educational systems.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) team will focus on the following core technologies and methodologies:

- Dynamic Form Generation Algorithms – Use of rule-based systems, decision trees, and AI models to adapt questions based on user input.
- Natural Language Processing (NLP) – Contextual analysis of user responses using BERT, GPT, or spaCy to infer sentiment and intent.
- User Profiling & Personalization – Clustering techniques and recommendation models to personalize survey paths based on user attributes and interaction history.
- Web Technologies – Development of interactive front-end forms using React or Angular, with Flask or Django-based backend logic.
- Database & Storage Solutions – Use of NoSQL or Firebase for real-time response storage, retrieval, and rendering control.
- Real-Time UI Adaptation – JavaScript and AJAX-based implementations for seamless rendering of questions without page reloads.
- Cloud Platforms – Deployment on AWS, Heroku, or Google Cloud to support scalable survey delivery and analytics.
- Analytics & Visualization – Integration with tools like Streamlit, Dash, or Power BI to interpret collected data and display meaningful insights.
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DESIGN & TECHNICAL ISSUES

The CoP team will address the following design challenges and implementation constraints:

- Designing a modular survey engine that supports real-time logic, branching, and conditional rendering.
- Ensuring compatibility across devices (desktop, mobile, tablet) and platforms (browser-based, LMS-integrated).
- Maintaining data integrity and session tracking during dynamic question flow transitions.
- Creating adaptive scoring and response analysis mechanisms to generate intelligent recommendations.
- Ensuring accessibility for diverse user groups including students with disabilities.
- Securing form data and user responses using encryption, secure APIs, and authentication.
- Handling language diversity and cultural sensitivity in NLP-based question inference.
- Ensuring low-latency performance even with real-time question regeneration.

MAJORS & AREAS OF INTEREST

This project offers hands-on exposure to students from the following disciplines and interest areas:

- Artificial Intelligence & Machine Learning – Design of decision systems, NLP models, and smart recommendation engines.
- Natural Language Processing (NLP) – Sentence interpretation, sentiment tagging, and dialogue-based flow control.
- Web Development & UI/UX Design – Development of dynamic, responsive, and user-centric interfaces.
- Educational Technology (EdTech) – Application of intelligent systems in pedagogy and learning management systems.
- Cloud & Backend Systems – Deployment, hosting, and performance tuning of serverless survey applications.
- Data Science & Educational Analytics – Mining feedback data for trends, participation analysis, and impact reporting.
- Cybersecurity & Privacy Engineering – Secure handling and anonymization of survey data, especially in academic settings.
- Human-Centered Computing – Designing inclusive interfaces that align with educational psychology and learning behavior.

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Microservices-Based Web Systems for Disaster Reporting with Live Location and Severity Mapping

Ms. M.Himabindu, Assistant Professor, IT – Faculty Mentor

GOALS

The goal of this project is to design and implement a scalable microservices-based web system that facilitates real-time disaster reporting, live location sharing, and severity classification during natural or man-made emergencies. The system will allow users (citizens, emergency responders, volunteers) to report incidents via a responsive web interface, which will be processed and visualized through integrated services on a live disaster map.

This platform will enhance emergency response efficiency by capturing crowd-sourced data, mapping affected areas, and providing situation awareness to authorities and the public. The project aims to demonstrate how web systems engineering, microservices architecture, and geospatial data visualization can be combined to support crisis communication, resource allocation, and data transparency.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) team will build the system using modern distributed technologies:

- **Microservices Architecture** – Separation of functions into independent services (e.g., User Service, Report Service, Location Service, Notification Service) deployed individually.
- **Frontend Web Interface** – React.js and Bootstrap for a mobile-friendly and dynamic user interface that supports form-based disaster reporting.
- **Backend Services** – Node.js with Express or Spring Boot for developing REST APIs supporting scalable interactions.
- **Geolocation & Mapping APIs** – Google Maps API or Leaflet.js for capturing user location and mapping incident coordinates.
- **Severity Classification** – Integration of AI/ML models for automatic tagging or ranking of disaster severity based on text input and user-uploaded media.
- **Database Systems** – MongoDB or PostgreSQL with PostGIS for spatial data handling and persistent storage of reports.
- **Asynchronous Communication** – Use of message brokers like RabbitMQ or Kafka for inter-service communication and event-driven workflows.
- **Containerization & Deployment** – Docker and Kubernetes (or Docker Compose) for service orchestration and scalable deployment.
- **Notification Services** – Integration with SMS/email APIs (e.g., Twilio, SendGrid) for sending alerts or confirmations to users or responders.

DESIGN & TECHNICAL ISSUES

Key design and technical challenges include:

- **Service Discovery & Load Balancing** – Managing distributed services with dynamic routing, registry, and gateway APIs.
- **Real-Time Location Tracking** – Capturing accurate location data with device permission handling and data precision filtering.
- **Severity Evaluation** – Building or integrating a reliable classifier model to assess urgency of reported incidents.
- **Data Consistency** – Maintaining synchronization and eventual consistency across microservices using shared IDs and timestamped logs.
- **Security and Authentication** – Protecting user data using JWT-based access tokens and encrypted transmission (HTTPS).
- **Scalability & Fault Tolerance** – Designing each service to scale independently and recover from failures without affecting others.
- **User Accessibility & Offline Support** – Designing for low-connectivity regions with minimal UI fallback and local data caching.

MAJORS & AREAS OF INTEREST

This project is suitable for students from the following specializations:

- **Web Systems Engineering** – Distributed web service design and frontend development.
- **Cloud Computing & DevOps** – Microservice deployment, containerization, and monitoring.
- **GIS & Location-Based Services** – Mapping APIs, geospatial queries, and visual analytics.
- **Cybersecurity** – Secure data handling in real-time applications.
- **AI/ML** – Severity classification based on structured/unstructured user input.
- **Humanitarian Informatics** – Technology in crisis response and civic communication.

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