IARE
INSTITUTE OF
AERONAUTICAL ENGINEERING

HIGH IMPACT PRACTICES (HIPS)

CORNERSTONE PROJECTS: Cloud Computing Services

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 of cloud applications 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 2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
SDG 6	Ensure availability and sustainable management of water and sanitation for all
SDG 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
SDG 11	Make cities and human settlements inclusive, safe, resilient and sustainable
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 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. Cloud computing Applications: Online File Storage System using AWS S3, Weather App with Real-Time Data (API + Cloud Hosting) **(#SDG 9, #SDG 12, SDG 17)**
2. Cloud-Native Intelligence and Resilient Infrastructure for Scalable Digital Ecosystems **(#SDG 9, #SDG 11)**
3. Real-Time Traffic Monitoring Using Cloud and Big Data **(#SDG 9, #SDG 11)**
4. Cloud Computing Application: Cloud-Based Attendance Management **(#SDG 9, #SDG 11, #SDG 13)**
5. Confidential and Privacy-Preserving Cloud Architectures for Secure Digital Services **(#SDG 4, #SDG 8, #SDG 9)**
6. Secure File Storage and Sharing System Using Cloud **(#SDG 9, #SDG 16)**
7. Cloud Computing Application: Serverless Chat Application **(#SDG 9, #SDG 11)**
8. AI-Powered Cloud Platforms for Intelligent Automation and Decision Support **(#SDG 8, #SDG 9)**
9. Smart Irrigation Prediction System **(#SDG 2, #SDG 6)**
10. Cloud-Based Predictive Analytics for Real-Time Traffic Monitoring **(#SDG 9, #SDG 11)**
11. Implementing cloud-based access management system that enforces Zero-Trust Security principles **(#SDG 9, #SDG 16)**

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!

Cloud computing Applications: Online File Storage System using AWS S3, Weather App with Real-Time Data (API + Cloud Hosting)

Dr.Basetty Mallikarjuna, Professor, Department of IT-Faculty Member

GOALS

Cloud computing has revolutionized the way organizations and individuals store, access, and manage data and applications. It enables the delivery of computing services—such as servers, storage, databases, networking, software, and analytics—over the Internet ("the cloud"). This model allows users to access resources on-demand without the need to invest in and maintain physical infrastructure.

Cloud computing applications are widely adopted across various domains such as education, healthcare, finance, e-commerce, entertainment, and enterprise software. These applications leverage the scalability, flexibility, and cost-effectiveness of cloud platforms to deliver robust and reliable services to users around the world.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) team will focus on core methods and technologies for cloud computing applications.

- Scalability and Flexibility– Ensure that applications can dynamically scale resources up or down based on demand without service interruption.
- Cost Efficiency– Optimize resource usage and reduce capital expenditure by adopting a pay-as-you-go pricing model.
- Accessibility and Mobility– Enable users to access applications and data from anywhere, on any device, at any time.
- High Availability and Reliability– Maintain continuous service availability with minimal downtime through distributed and redundant cloud infrastructure.

DESIGN, & TECHNICAL ISSUES

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Challenges and design considerations in Building cloud computing Applications

- Security and Privacy: Protecting data from unauthorized access, breaches, and leaks during storage and transmission.

- Multi-Tenancy and Isolation: Multiple users (tenants) share the same resources in a cloud environment.
- Scalability and Elasticity: Cloud apps must scale based on changing demand.
- Reliability and Availability: Maintaining continuous service and data access.

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

- Predictive analytics, supervised learning, image classification
- Performance and Latency– Ensuring high performance for global users.
- Cloud & Edge Computing – Scalable deployment of models and services
- Geospatial Analytics – Spatial analysis using satellite and GIS data
- Software Development – Full-stack implementation of intelligent applications
- Sustainable Computing – Technology for environment-friendly, efficient agriculture

MENTOR CONTACT INFORMATION

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Cloud-Native Intelligence and Resilient Infrastructure for Scalable Digital Ecosystems

Mr. N Rajashekar, Assistant Professor, Information Technology – Faculty Mentor

GOALS

The central goal of the Cloud-Native Intelligence and Resilient Infrastructure for Scalable Digital Ecosystems research domain is to architect and optimize cloud platforms that are intelligent, elastic, secure, and highly available—supporting next-generation applications and services. As organizations transition from monolithic systems to decentralized and dynamic architectures, cloud computing plays a critical role in enabling digital scalability, innovation, and sustainability.

This domain focuses on developing intelligent cloud-native systems that integrate automation, real-time analytics, and AI-driven orchestration. Emphasis is placed on self-healing infrastructures, elastic scaling, hybrid-cloud integration, and energy-efficient deployments. These systems must be designed for resilience, performance, and adaptability to handle diverse workloads across edge, fog, and cloud environments.

Aligned with SDG 9 (Industry, Innovation, and Infrastructure), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action), this research domain contributes to building secure, green, and globally distributed cloud platforms.

METHODS & TECHNOLOGIES

This research integrates cloud-native computing, intelligent orchestration, and infrastructure-as-code principles. Key methods and technologies include:

- **Cloud-Native Architecture**: Kubernetes, Docker, and service mesh frameworks to build modular, scalable, and containerized systems.
- **Infrastructure as Code (IaC)**: Tools like Terraform, Ansible, and Pulumi for automating cloud resource provisioning and management.
- **Serverless and Function-as-a-Service (FaaS)**: Reducing operational overhead by abstracting infrastructure and focusing on event-driven compute models.
- **AI-Driven Resource Optimization**: Using machine learning for predictive autoscaling, load balancing, and cost-aware resource utilization.
- **Edge and Fog Computing**: Extending cloud capabilities closer to data sources for low-latency and real-time processing.
- **Cloud Security & Zero Trust Architectures**: Implementing encryption, identity management, and continuous compliance in multi-cloud environments.
- **Energy-Aware Cloud Systems**: Designing green cloud frameworks that minimize carbon footprints via dynamic workload migration and energy profiling.
- **Disaster Recovery & Resilience Engineering**: Ensuring high availability and business continuity using geo-distributed replication, failover strategies, and chaos testing.

MAJORS & AREAS OF INTEREST

This research area is especially relevant to students in Cloud Computing, Artificial Intelligence, Cybersecurity, Software Engineering, Data Engineering, and Computer Networks. It is also interdisciplinary, attracting interest from Environmental Informatics, IoT Systems, and Smart Infrastructure domains.

Core areas of specialization include:

- Intelligent cloud orchestration and workload migration
- Secure and compliant multi-cloud deployments
- Real-time analytics pipelines in cloud environments
- Energy-efficient and sustainable cloud architectures
- Hybrid and federated cloud frameworks
- Cloud-based edge-AI deployments
- Disaster-tolerant and fault-resilient infrastructures
- By merging intelligent orchestration, resilient design, and sustainable computing principles, this domain supports the creation of next-generation digital infrastructures that power smart cities, autonomous systems, and global-scale platforms.

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Real-Time Traffic Monitoring Using Cloud and Big Data

Ms. Nagineni Venkata Sireesha, Assistant Professor & IT_Faculty Mentor

GOALS

To design and develop a real-time traffic monitoring and analytics platform leveraging cloud infrastructure and big data technologies. This system aims to enhance urban traffic management, reduce congestion, and improve transportation efficiency through continuous data collection, cloud-based processing, and intelligent analytics.

By integrating live data feeds from road sensors, GPS devices, surveillance cameras, and mobile applications, the platform will provide a unified view of traffic conditions across various routes and intersections. It will support real-time vehicle tracking, congestion detection, and predictive traffic flow modeling using historical and current datasets.

The system will employ big data frameworks and scalable cloud services to process large volumes of traffic data efficiently, enabling city administrators and commuters to make timely and informed decisions. Additionally, machine learning algorithms will be incorporated to predict traffic jams, estimate travel times, and suggest alternate routes dynamically.

METHODS & TECHNOLOGIES

Methods

- Analyze traffic management requirements including real-time data sources, congestion patterns, and route optimization.
- Design ER diagrams and system architecture for scalable cloud-based data ingestion and storage.
- Implement APIs and data pipelines to integrate live traffic feeds from GPS, cameras, sensors, and mobile applications.
- Develop front-end and back-end modules for real-time traffic dashboards, alerts, and route suggestion interfaces.
- Integrate big data processing frameworks and machine learning models for traffic forecasting and anomaly detection.
- Conduct testing with live traffic datasets, simulated congestion events, and varied network conditions.
- Prepare final system demonstration, technical documentation, and performance evaluation report.

Technologies

- Databases: Apache Cassandra, MongoDB Atlas, Amazon RDS (cloud-hosted)
- Big Data Frameworks: Apache Kafka, Apache Spark, Hadoop
- Cloud Platforms: AWS (Lambda, EC2, S3), Google Cloud, Azure
- Design Tools: Lucidchart, Draw.io, dbdiagram.io
- AI & ML Libraries: TensorFlow, Scikit-learn, PyTorch (for congestion prediction and route analysis)
- Tools: VS Code, Postman, Docker, GitHub

DESIGN & TECHNICAL ISSUES

Design Issues

- Modeling entities such as vehicles, sensors, traffic signals, congestion zones, and route histories.
- Establishing primary and foreign keys to link location data, timestamps, vehicle identifiers, and road segments.
- Designing a scalable schema and data lake structure for handling real-time and historical traffic data.
- Structuring geospatial data for compatibility with mapping and visualization services (e.g., OpenStreetMap, Google Maps APIs).
- Technical Issues
- Handling high-throughput data streams from multiple sources using message brokers like Apache Kafka.
- Maintaining data accuracy and consistency in dynamic, real-time environments with fluctuating traffic conditions.
- Ensuring low-latency processing and visualization for real-time congestion alerts and route updates.
- Implementing robust API security and access control to protect system endpoints and sensitive data.
- Managing system scalability during peak traffic hours and unexpected surges in data volume.

MAJORS & AREAS OF INTEREST

- Predictive Analytics – Traffic congestion forecasting, route optimization, and anomaly detection
- Geospatial Data Science – Real-time mapping, heatmaps, and spatial analytics using GPS and satellite data
- Cloud & Edge Computing – Scalable deployment for traffic data processing and distributed sensor integration
- Cybersecurity in Smart Cities – Securing traffic data pipelines, device authentication, and data privacy
- Software Development – Full-stack web and mobile apps for traffic dashboards and commuter tools
- AI & Machine Learning for Smart Mobility – Pattern recognition for traffic prediction and incident detection

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Cloud Computing Application: Cloud-Based Attendance Management

Dr.Basetty Mallikarjuna, Professor, Department of IT-Faculty Member

GOALS

Face recognition with database in the cloud use Google Cloud Vision API or Azure Face API. Cloud computing has revolutionized the way organizations and individuals store, access, and manage data and applications. A Cloud-Based Attendance Management System provides a scalable, secure, and efficient method for tracking attendance using modern cloud services. Integration with mobile apps, biometrics, and cloud storage enhances usability, while serverless functions improve maintenance and cost-efficiency

It enables the delivery of computing services—such as servers, storage, databases, networking, software, and analytics over the Internet ("the cloud"). This model allows users to access resources on-demand without the need to invest in and maintain physical infrastructure.

Cloud computing applications are widely adopted across various domains such as education, healthcare, finance, e-commerce, entertainment, and enterprise software. These applications leverage the scalability, flexibility, and cost-effectiveness of cloud platforms to deliver robust and reliable services to users around the world.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) team will focus on core methods and technologies for cloud computing applications.

- Compute: AWS Lambda / Azure Functions / Google Cloud Functions
- API Management: AWS API Gateway / Azure API Management
- Database: Amazon RDS / Firebase Firestore / MongoDB Atlas / MySQL
- Authentication: AWS Cognito / Firebase Authentication / Auth0
- Device Integration (Biometric/RFID): IoT Core Services (AWS IoT / Azure IoT Hub)
- Storage (for logs & photos): Amazon S3 / Google Cloud Storage

DESIGN, & TECHNICAL ISSUES

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Challenges and design considerations in Building cloud computing Applications.

- Internet Dependency: Offline syncing options via local caching or mobile sync queues
- Authentication Failures: Use MFA, JWT refresh tokens, and secure password policies
- Clock In/Out Fraud: Integrate face recognition or geofencing (GPS check)
- Data Consistency: Use atomic DB transactions, especially in biometric integrations
- Scalability Challenges: Use auto-scaling serverless compute and managed DBs
- Latency in IoT Device Sync: Use MQTT or WebSocket for efficient, real-time communication
- Data Privacy & Compliance: Ensure GDPR, HIPAA (if applicable) compliance for data storage
- Biometric Device Failures: Backup methods like manual OTP or PIN attendance marking
- Report Generation Lag: Use async processing (queues) for heavy reporting tasks

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

- Predictive analytics, supervised learning, image classification
- Performance and Latency– Ensuring high performance for global users.
- Cloud & Edge Computing – Scalable deployment of models and services
- Geospatial Analytics – Spatial analysis using satellite and GIS data
- Software Development – Full-stack implementation of intelligent applications
- Sustainable Computing – Technology for environment-friendly, efficient agriculture

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Confidential and Privacy-Preserving Cloud Architectures for Secure Digital Services

Mr. N Rajashekar, Assistant Professor, Information Technology – Faculty Mentor

GOALS

The goal of the Confidential and Privacy-Preserving Cloud Architectures domain is to build cloud systems that ensure data privacy, confidentiality, and regulatory compliance while maintaining scalability and accessibility. As data sovereignty and cybersecurity concerns intensify, this domain addresses the critical need for secure-by-design cloud infrastructure for sensitive applications such as healthcare, finance, and governance.

This research focuses on the integration of privacy-preserving technologies such as homomorphic encryption, secure multi-party computation, and confidential computing (e.g., using Trusted Execution Environments). The systems must protect data throughout its lifecycle—during storage, transit, and processing—across distributed, hybrid, and multi-tenant cloud environments.

Aligned with SDG 16 (Peace, Justice, and Strong Institutions) and SDG 9 (Industry, Innovation, and Infrastructure), this domain promotes ethical data usage and secure access to digital services.

METHODS & TECHNOLOGIES

Key technologies and frameworks used include:

- Confidential Computing: Leveraging hardware-based TEEs (e.g., Intel SGX, AMD SEV) to protect data during processing.
- Homomorphic Encryption & SMPC: Performing computations on encrypted data or in multi-party environments without revealing raw data.
- Zero-Knowledge Proofs & Federated Learning: Enabling secure authentication and collaborative learning without exposing private information.
- Privacy-Aware Cloud Storage: Encryption-at-rest and secure key management solutions integrated with CSPs.
- Policy-Driven Access Control Models: Attribute-based access control (ABAC), identity federation, and OAuth2/OIDC mechanisms.
- Data Provenance & Auditing: Ensuring traceability, non-repudiation, and forensic readiness in sensitive cloud applications.

MAJORS & AREAS OF INTEREST

This research is vital for students specializing in Cloud Security, Cryptography, Data Privacy, Blockchain, and Legal Informatics, and is of strong interest to Cyber Law, HealthTech, and FinTech sectors.
Key research specializations include:

- Secure cloud platforms for healthcare and e-governance
- End-to-end encrypted data pipelines
- Privacy-preserving AI-as-a-Service
- Identity and access management in hybrid clouds
- Secure edge-cloud data offloading
- Regulatory compliance in cloud deployments (e.g., GDPR, HIPAA)

MENTOR CONTACT INFORMATION

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Secure File Storage and Sharing System Using Cloud

Ms. Nagineni Venkata Sireesha, Assistant Professor & IT_ Faculty Mentor

GOALS

To design and develop a secure, cloud-based file storage and sharing platform that enables users to upload, manage, and share digital documents safely and efficiently. This system aims to address growing concerns around data security, accessibility, and collaboration in cloud environments, particularly for sensitive or confidential information.

By leveraging cloud storage solutions and secure access protocols, the platform will support real-time file uploads, permission-based sharing, and cross-platform accessibility. The system will be designed to handle various file types and sizes while ensuring data integrity and high availability through distributed storage mechanisms.

The project will incorporate advanced encryption standards, user authentication mechanisms, and role-based access controls to safeguard data throughout the storage and transmission process. Additionally, logging and audit trails will be implemented to monitor file access and changes, ensuring accountability and compliance with organizational or regulatory policies.

METHODS & TECHNOLOGIES

Methods

- Analyze user and organizational requirements for secure file storage, access levels, and sharing workflows.
- Design ER diagrams and cloud architecture to support scalable, encrypted file management and metadata storage.
- Implement APIs for file upload, download, sharing links, and permission-based access control
- Develop front-end and back-end modules to support user registration, authentication, and file management interface.
- Conduct testing using varied file types, large datasets, and multiple user access scenarios to validate performance and security.

Technologies

- Databases: Firebase, MongoDB Atlas, Amazon S3 (with metadata indexing), PostgreSQL (cloud-hosted)
- Cloud Platforms: AWS (S3, Lambda, Cognito), Microsoft Azure Blob Storage, Google Cloud Storage
- Security Frameworks: AES-256 encryption, RSA, OAuth 2.0, JWT for secure file transmission and authentication
- Design Tools: Lucidchart, Draw.io, dbdiagram.io
- Programming: Python, JavaScript, Node.js, React, Flask/Django
- Tools: VS Code, Postman, Docker, GitHub
- AI & ML Libraries: TensorFlow, Scikit-learn, PyTorch (for congestion prediction and route analysis)
- Tools: VS Code, Postman, Docker, GitHub

DESIGN & TECHNICAL ISSUES

Design Issues

- Modeling entities such as users, files, folders, sharing permissions, access logs, and encryption keys.
- Establishing primary and foreign keys to maintain relationships between users, files, and sharing activities.
- Designing a scalable schema for secure file storage, metadata indexing, and efficient retrieval.
- Integrating file versioning, access expiration, and audit trails into the database and application logic.
- Structuring a user interface for secure upload, download, sharing, and permission management workflows.

Technical Issues

- Implementing secure file transmission and storage using encryption algorithms (e.g., AES-256, RSA).
- Maintaining data integrity and access control during concurrent uploads/downloads by multiple users.
- Ensuring robust authentication and authorization using OAuth 2.0, JWT, or multi-factor authentication.
- Managing storage scalability and performance with cloud services under varying usage loads.

- Implementing audit logs and activity monitoring for compliance, security auditing, and traceability.

MAJORS & AREAS OF INTEREST

- Cybersecurity & Information Assurance – Secure data transmission, encryption, and access control mechanisms
- Cloud & Edge Computing – Scalable, distributed storage and serverless file access solutions
- Software Development – Full-stack web and mobile interfaces for file management and secure sharing
- Data Privacy & Compliance – Implementation of GDPR, HIPAA-like policies for sensitive document storage

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Cloud Computing Application: Serverless Chat Application

Dr.Basetty Mallikarjuna, Professor, Department of IT-Faculty Member

GOALS

A Serverless Chat Application offers fast, scalable, and cost-effective deployment using cloud services. Choosing the right tools, addressing real-time needs, and mitigating design issues ensures a robust, production-ready app.

Cloud computing has revolutionized the way organizations and individuals store, access, and manage data and applications. It enables the delivery of computing services such as servers, storage, databases, networking, software, and analytics—over the Internet ("the cloud"). This model allows users to access resources on-demand without the need to invest in and maintain physical infrastructure.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) team will focus on core methods and technologies for cloud computing applications.

- Compute: AWS Lambda / Azure Functions / Google Cloud Functions
- API Gateway: AWS API Gateway / Azure API Management
- Database: Amazon DynamoDB / Firebase Realtime DB / MongoDB Atlas
- Messaging WebSocket (via API Gateway) / Firebase Cloud Messaging
- Authentication: AWS Cognito / Firebase Auth / Auth0
- Storage (media/files) Amazon S3 / Google Cloud Storage

DESIGN, & TECHNICAL ISSUES

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Challenges and design considerations in Building cloud computing Applications

- Cold Start Latency: Lambda functions may delay on first call. Use warm-up plugins or provisioned concurrency.
- WebSocket Limitations: Limited simultaneous connections in serverless model. Use managed WebSocket gateways.
- Data Consistency: NoSQL eventual consistency can affect sync. Use versioning or timestamp checks.
- Security Concerns Ensure JWT tokens are verified and use HTTPS & WAF.
- Vendor Lock-in: Serverless is often tied to one provider. Abstract logic in case of migration.
- Limited Execution Time: Serverless functions have max timeouts (e.g., 15 mins AWS). Split long tasks.

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

- Predictive analytics, supervised learning, image classification
- Performance and Latency– Ensuring high performance for global users.
- Cloud & Edge Computing – Scalable deployment of models and services
- Geospatial Analytics – Spatial analysis using satellite and GIS data
- Software Development – Full-stack implementation of intelligent applications
- Sustainable Computing – Technology for environment-friendly, efficient agriculture

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AI-Powered Cloud Platforms for Intelligent Automation and Decision Support

Mr. N Rajashekar, Assistant Professor, Information Technology – Faculty Mentor

GOALS

The aim of this domain is to create AI-integrated cloud platforms that provide intelligent automation, proactive system management, and context-aware decision support for enterprise and industrial applications. Cloud platforms infused with AI enable adaptive behavior, self-monitoring, workload prediction, and operational excellence at scale.

This domain is focused on building cloud systems that analyze telemetry data, user behavior, and operational metrics in real-time to optimize performance and resource utilization. The cloud becomes not just a delivery platform but a cognitive layer powering business insights and intelligent orchestration.

Aligned with SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure), this area enables smarter businesses and sustainable growth through automation.

METHODS & TECHNOLOGIES

This area integrates:

- **AIOps Platforms**: AI-driven operations using ML for anomaly detection, predictive alerting, and incident response automation.
- **MLOps Pipelines in Cloud**: Continuous training, deployment, and monitoring of AI/ML models at scale.
- **Reinforcement Learning for Cloud Scheduling**: Optimizing VM/container placement, autoscaling, and energy usage.
- **Conversational AI Services**: Intelligent assistants and chatbot services deployed over scalable cloud APIs.
- **Knowledge Graphs and Context Modeling**: Enhancing cloud platforms with semantic reasoning and contextual insights.
- **Cloud Event-Driven Architectures**: Real-time reaction to business events using AI-driven workflows and decision engines.

MAJORS & AREAS OF INTEREST

Highly relevant to students of AI & ML, Cloud Engineering, Data Engineering, Business Analytics, and DevOps, and also attracts interest from Industrial Automation and Digital Twins.

Core research themes:

- AI-powered cloud monitoring and governance
- Predictive resource scaling and failure recovery
- Business intelligence-as-a-service
- Adaptive workflow engines and automation pipelines
- Human-in-the-loop AI in cloud environments
- Integration of NLP with cloud services for decision-making

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Smart Irrigation Prediction System

Mrs.S.Swarna Keerthi, Assistant Professor, Dept. of IT – Faculty Mentor

GOALS

The objective of this project is to design an intelligent, cloud-enabled Smart Irrigation Prediction System that optimizes water usage for agricultural applications by leveraging real-time environmental data and predictive analytics. Traditional irrigation practices are often inefficient, leading to water waste, inconsistent crop yields, and increased operational costs. This project addresses those challenges by developing a data-driven, automated system that enables precision irrigation based on weather forecasts, soil moisture levels, crop type, and historical data trends.

The system will integrate Internet of Things (IoT) sensors to monitor critical parameters such as temperature, humidity, soil moisture, and rainfall. These data points will be processed through machine learning algorithms hosted on a cloud platform to predict optimal irrigation schedules tailored to specific agricultural conditions. The architecture will support dynamic, location-aware decision-making that adjusts irrigation timing and volume based on real-time inputs and predictive models.

A key objective is to develop a scalable, user-friendly platform that supports remote monitoring and control via web or mobile interfaces. The solution will include features such as automated alerts, resource usage analytics, and AI-driven recommendations to empower farmers and agricultural operators with actionable insights. The system will also incorporate API integrations with weather services, edge computing for latency reduction, and cloud-based data storage for long-term analysis and auditability.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) Team – Zero-Trust Access Management System Using Cloud Computing

- IoT Sensor Integration – Deployment of soil moisture, temperature, humidity, and rainfall sensors using platforms like Arduino, Raspberry Pi, or ESP32 with MQTT/HTTP protocols.
- Cloud-Based Data Aggregation – Real-time data streaming and storage using cloud platforms such as AWS IoT Core, Azure IoT Hub, or Google Cloud IoT Core.
- Machine Learning Models – Predictive analytics for irrigation scheduling using scikit-learn, TensorFlow, or Azure ML Studio to train models on environmental and crop-specific datasets.
- Weather API Integration – External API services such as OpenWeatherMap, AccuWeather, or Climacell to provide dynamic weather forecasts that inform irrigation decisions.
- Edge Computing – On-device data preprocessing and initial decision-making using Edge AI tools and TinyML, minimizing latency and cloud dependency in remote agricultural areas.
- Cloud-Based Dashboards – Visualization and user interaction via Power BI, Grafana, or Google Data Studio, providing insights into water usage, predictions, and system status.
- Mobile/Web Application – Farmer-friendly interfaces built with React Native, Flutter, or Progressive Web Apps (PWA) for remote monitoring and control.
- Automated Actuation System – Smart control of irrigation valves and pumps using relay modules, solenoid valves, and integration with microcontroller-based automation logic.
- Secure Communication – Encrypted data transfer via TLS, with authentication using JWT tokens or OAuth 2.0, ensuring secure end-to-end system operations.
- Data Storage & Logging – Structured storage using Firebase Realtime Database, Amazon DynamoDB, or Azure Cosmos DB, with logging for auditability and analysis.
- Sustainability Metrics – Built-in analytics to measure water savings, irrigation efficiency, and crop yield impact using integrated KPI dashboards.

DESIGN, & TECHNICAL ISSUES

Cornerstone Project (CoP) – Design & Technical Issues in Building a Zero-Trust Access Management System

- Sensor Accuracy & Calibration – Ensuring environmental sensors (soil moisture, temperature, etc.) are accurate, reliable, and consistently calibrated across different field conditions.
- Real-Time Data Reliability – Managing the consistency and latency of sensor data transmission, especially in remote or low-connectivity agricultural areas.
- Predictive Model Precision – Designing machine learning models that can accurately predict irrigation needs while handling noisy, incomplete, or seasonal data variations.
- Integration with Weather APIs – Aligning external weather forecasts with local sensor data to make cohesive and context-aware irrigation decisions.
- Edge vs. Cloud Processing Tradeoffs – Balancing between real-time edge computing (for latency-sensitive tasks) and cloud-based analytics (for scalability and long-term analysis).
- Automated Actuation Reliability – Ensuring accurate, fail-safe operation of irrigation control systems (valves, pumps) under changing weather and soil conditions.
- Power Management in Field Devices – Designing energy-efficient systems for sensor nodes and actuators, especially in areas without stable power infrastructure (e.g., solar power integration).
- Scalability Across Crop Types & Locations – Building a flexible system architecture that can adapt to different crops, climates, and geographical requirements.
- Secure IoT Communication – Ensuring encrypted, authenticated data exchange between field devices and cloud platforms to prevent tampering or unauthorized access.

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) Team – Relevant Fields and Skills Development Through Project Execution

- Agricultural Engineering & Precision Farming – Application of technology in optimizing irrigation and crop yield through sensor-based decision-making.
- IoT & Embedded Systems – Designing and programming sensor nodes, microcontrollers (e.g., Arduino, ESP32), and communication modules for real-time environmental monitoring.
- Artificial Intelligence & Machine Learning – Developing and training predictive models for irrigation scheduling using historical and real-time data.
- Cloud Computing & Big Data – Handling large-scale environmental datasets, cloud-based storage, and real-time data processing using platforms like AWS, Azure, or Google Cloud.
- Environmental Science & Water Resource Management – Understanding soil-water-plant relationships, evapotranspiration, and sustainable water usage in agriculture.
- Software Engineering – Building scalable, modular, and secure applications for data visualization, user control, and system integration.
- Web & Mobile Application Development – Creating intuitive user interfaces for farmers and agronomists to monitor and manage irrigation systems remotely.
- Data Analytics & Visualization – Analyzing trends, usage patterns, and irrigation effectiveness using tools like Power BI, Grafana, or custom dashboards.
- Cybersecurity in IoT – Securing field communication and data transmission against tampering, eavesdropping, and unauthorized access.
- Renewable Energy & Power Systems – Implementing solar-powered IoT devices and designing energy-efficient field solutions.
- Geospatial Technology & Remote Sensing – Using satellite data or GIS tools to enhance decision-making and regional crop monitoring.
- Information Technology & Computer Science – Foundational skills in programming, databases, networking, and system integration critical for full-stack development of smart agriculture solutions.

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Cloud-Based Predictive Analytics for Real-Time Traffic Monitoring

Mr. Vinesh Gone, Assistant Professor & IT_ Faculty Mentor

GOALS

Design and Deploy a Real-Time Traffic Monitoring System: Collect live traffic data from sources like sensors, APIs (e.g., Google Maps, HERE, or simulated data). Use cloud infrastructure (AWS, Azure, GCP) to ingest, store, and process this data.

Implement Predictive Analytics for Traffic Flow: Apply machine learning models (e.g., time-series forecasting, regression, or LSTM) to predict congestion and travel times. Use historical and real-time data to train and fine-tune the models.

Build a Real-Time Dashboard for Visualization: Display current traffic conditions and future predictions using tools like Power BI, Grafana, or a custom web app. Use cloud-hosted APIs to update the dashboard dynamically.

Enable Alerting and Decision Support: Set up automatic alerts for traffic congestion, route recommendations, or anomaly detection. Provide insights for city planners or emergency response teams.

METHODS & TECHNOLOGIES

Methods

- Data Acquisition: Collect real-time traffic data from: Public traffic APIs (e.g., Google Maps, HERE, Open Traffic). Simulated sensor data (using Python scripts or IoT devices)
- Data Ingestion and Storage: Use a real-time data streaming service to capture incoming data. Store raw and processed data in cloud storage and databases.
- Data Pre-processing: Clean, filter, and normalize data for consistency. Use batch or stream processing techniques.
- Predictive Modelling: Use time-series forecasting models: ARIMA, Prophet, or LSTM (for deep learning) Train on historical traffic patterns to predict future traffic states.
- Model Deployment: Host models using cloud ML services. Expose prediction services via REST APIs.
- Visualization & Dashboard: Real-time display of traffic flow, congestion levels, and forecasts. Use dashboards or web applications for user interaction.
- Alerting System: Set threshold-based alerts for congestion or incidents. Use notifications via email, SMS, or in-app popups.

Technologies

- Machine Learning Libraries: Scikit-learn, TensorFlow / Keras (for LSTM models), Facebook Prophet (time-series) XG Boost / Light GBM (if using tree-based models)
- Backend/Frontend Technologies: Backend: Python (Flask/ Fast API), Node.js, Frontend: React.js, Chart.js, Bootstrap, Visualization: Power BI, Grafana, or custom dashboard.
- DevOps & Other Tools: Docker (for containerized deployment), Git/GitHub (version control) CI/CD Pipelines (GitHub Actions, AWS Code Pipeline), Monitoring: CloudWatch, Azure Monitor, GCP Operations.

DESIGN & TECHNICAL ISSUES

Design Issues

- Designing a low-latency, scalable architecture for continuous data ingestion and analytics. Real-time traffic data can be incomplete, noisy, or delayed.
- Predicting traffic flow is a time-series forecasting problem with high variability.
- High-frequency data and ML operations may lead to excessive cloud billing.
- Deploying a multi-component system (API, model, dashboard) requires complex configuration.
- Displaying frequent updates without UI lag or overload.
- Handling possibly sensitive location data in the cloud.
- Any service disruption can halt data flow or prediction accuracy.

Technical Issues

- Difficulty in handling large volumes of traffic data streams from APIs or sensors.
- Latency issues when processing data in real time.
- Risk of **packet loss**, API downtime, or inconsistent data feeds.
- Raw traffic data may contain missing values, noise, or anomalies.
- Requires efficient **data cleaning**, **interpolation**, and **validation** logic.
- Processing delays can affect prediction accuracy.
- Choosing the right model: Regression vs. Time-Series (ARIMA, LSTM).
- Managing **model accuracy** in highly dynamic environments like urban traffic.
- High-frequency data and continuous model serving can drive up **cloud service costs**.
- Difficulty in optimizing use of services like **Kinesis**, **S3**, **SageMaker**, etc.
- Balancing performance and cost is a major technical trade-off.

MAJORS & AREAS OF INTEREST

- Cloud Computing **-**Cloud architecture, Serverless infrastructure,Cloud storage and data streaming, Cloud-based ML deployment (AWS, Azure, GCP)

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Implementing cloud-based access management system that enforces Zero-Trust Security principles

Mrs.S.Swarna Keerthi, Assistant Professor, Dept. of IT – Faculty Mentor

GOALS

The objective of this project is to design a **cloud-based access management system** that enforces **Zero-Trust Security principles** to protect sensitive digital assets and applications in modern, distributed environments. Traditional perimeter-based security models are no longer sufficient in cloud-native architectures, where users and devices access systems from anywhere. This project addresses those limitations by implementing a **Zero-Trust model**, which assumes no user or device is trusted by default, regardless of network location.

The system will continuously verify user identities, enforce **least-privilege access**, and apply **context-aware authentication** to ensure secure interactions with cloud resources. Leveraging cloud-native technologies, the solution will integrate **real-time policy enforcement**, **multi-factor authentication (MFA)**, and **dynamic access controls** to minimize risk. Additionally, it will utilize **identity and access management (IAM)** tools, **policy-as-code frameworks**, and **behavioral analytics** to detect anomalies such as unauthorized access attempts, lateral movement, or privilege escalation.

A key objective is to create a scalable and automated security infrastructure that supports **real-time monitoring**, **incident response**, and **auditability**. This includes building secure CI/CD pipelines, protecting APIs, and ensuring that every access request is authenticated, authorized, and logged. The system is designed to serve organizations across sectors such as **finance**, **healthcare**, **government**, and **enterprise IT**, where regulatory compliance and security are critical. By combining **Zero-Trust architecture**, **cloud computing**, and **automation**, the project aims to establish a robust, adaptive security posture for the modern digital enterprise.

METHODS & TECHNOLOGIES

Cornerstone Project (CoP) Team – Zero-Trust Access Management System Using Cloud Computing

- **Zero-Trust Architecture** – Identity-aware, least-privilege access enforcement with AWS IAM, Azure AD, and GCP IAM
- **Multi-Factor Authentication (MFA)** – Integration of OTP-based MFA and biometric authentication using cloud identity providers
- **Policy-as-Code** – Access rules defined and enforced using Open Policy Agent (OPA), HashiCorp Sentinel, and Azure Policy
- **Real-Time Access Monitoring** – Centralized event logging and threat detection using AWS CloudTrail, Azure Monitor, and GCP Logging
- **Security Automation** – Auto-remediation of threats and misconfigurations with AWS Lambda, Azure Functions, and GCP Cloud Functions
- **SIEM Integration** – Security event analysis and alerting with AWS GuardDuty, Azure Sentinel, and Google Chronicle
- **Infrastructure as Code (IaC)** – Secure cloud provisioning using Terraform, AWS CloudFormation, and Azure Bicep
- **Container & API Security** – Runtime protection with tools like Falco, Trivy, and hardened API gateways with WAF integration
- **Secrets Management** – Encrypted key and credential storage using AWS Secrets Manager, Azure Key Vault, and HashiCorp Vault

- **DevSecOps Pipelines** – CI/CD with integrated security testing using GitHub Actions, GitLab CI, and Jenkins
- **Cloud Platforms** – Scalable deployment and access management across AWS, Azure, and Google Cloud

DESIGN, & TECHNICAL ISSUES

Cornerstone Project (CoP) – Design & Technical Issues in Building a Zero-Trust Access Management System

- **Establishing Identity Trust Boundaries** – Managing user/device trust without relying on traditional network perimeters
- **Continuous Authentication** – Ensuring low-friction, secure re-authentication mechanisms without compromising user experience
- **Dynamic Policy Enforcement** – Designing real-time access decisions based on context (location, time, device risk level)
- **Integrating Multi-Cloud IAM Systems** – Aligning access control models across AWS, Azure, and GCP environments.
- **Securing APIs & Microservices** – Protecting service-to-service communication with fine-grained access control and mutual TLS.
- **Minimizing Latency in Access Validation** – Ensuring rapid response for access requests while enforcing Zero-Trust principles.
- **Scalability of Policy Engines** – Supporting a growing number of identities, devices, and services without performance degradation
- **Logging, Auditing & Incident Response** – Creating secure, tamper-proof audit trails while enabling real-time threat detection.
- **User Access Visibility & Governance –** Providing admins with clear insights into who accessed what, when, and why.
- **Regulatory Compliance & Data Protection** – Adhering to data privacy laws (e.g., GDPR, HIPAA) in identity verification and access control
- **Secure DevSecOps Integration** – Embedding security checks into CI/CD pipelines without slowing down development workflows.

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

- Cybersecurity & Network Security – Zero-trust architecture, threat modeling, and secure communication protocols
- Cloud Computing & DevOps – Cloud-native security practices, CI/CD pipelines, and secure deployment across AWS, Azure, GCP
- Identity & Access Management (IAM) – Role-based access, authentication protocols, and federated identity systems
- Software Engineering – Developing scalable, secure backend systems with access control and monitoring
- Security Automation – Scripting remediation workflows, compliance checks, and auto-policy enforcement
- Data Privacy & Governance – Ensuring secure handling of user data and compliance with regulations like GDPR, HIPAA
- Systems Engineering – Designing distributed architectures for real-time monitoring, logging, and access control
- Ethical Hacking & Penetration Testing – Validating system security against real-world threats and access violations

- Policy-as-Code & Infrastructure-as-Code (IaC) – Declarative access controls, automated security rule management
- Computer Science & Information Technology – Foundations in OS, networking, databases, and cloud services

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