DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Syllabus

Course Code	Course Name	L	T	P	C
Value Added Course	AI-Driven Intelligent Systems: From Data Acquisition to Decision Making	15	0	30	2

Course Objectives

- To understand the end-to-end architecture of AI-driven intelligent systems, including IoT communication protocols, data acquisition mechanisms, and data design principles for reliable decision-making.

- To analyze and implement MQTT-based communication models using simulators and brokers (such as CrystalMQ) to enable efficient, lightweight, and real-time data exchange in IoT environments.

- To develop edge-level IoT applications using development boards and real-time sensor data, emphasizing low-latency processing and intelligent data handling at the edge.

- To design and manage centralized IoT platforms by implementing secure device authentication, rule engines, and data orchestration techniques to support intelligent automation.

- To integrate MQTT broker extensions with visualization and data storage mechanisms to transform raw IoT data into actionable insights and propose AI-enabled project solutions for real-world decision-making scenarios.

Unit I: Foundations of Intelligent IoT Systems and Data Design(9)

Overview of AI-Driven Intelligent SystemsEvolution of IoT and AI convergence-Intelligent system architecture: sensors, edge, cloud, and decision layers-Introduction to IoT communication protocols-HTTP, CoAP, AMQP, MQTT (overview and comparison)-MQTT architecture and publish–subscribe model-IoT data characteristics: volume, velocity, variety, veracity-Understanding IoT data formats (JSON, CSV, sensor streams)-Designing IoT data pipelines for AI readiness-Challenges in data acquisition for intelligent decision making

Unit II: MQTT Communication, Simulation, and Broker Technologies(9)

Deep dive into MQTT protocol-Topics, payloads, QoS levels-Retained messages and Last Will and Testament (LWT)-MQTT message flow and session management-MQTT security fundamentals-IoT simulation concepts and need for simulators-Introduction to IoT simulators-Hands-on with IoT Simulator for data generation-CrystalMQ architecture and features-Configuring and deploying CrystalMQ broker-Publishing and subscribing real-time simulated data-Performance considerations in MQTT-based systems

Unit III: Edge Intelligence and Real-Time Sensor Data Acquisition(9)

Edge computing concepts in intelligent systems-Role of edge intelligence in AI-driven decision making-Overview of IoT development boards-ESP8266, ESP32, Raspberry Pi

(comparative study)-Interfacing sensors for real-time data acquisition-Sensor data preprocessing at the edge-Edge-level analytics and filtering-Real-time data streaming using MQTT from edge devices-Latency, bandwidth, and energy optimization-Case studies on edge-based intelligent systems

Unit IV: Centralized IoT Platforms and Intelligent Rule Engines(9)

Centralized vs distributed IoT platforms-Architecture of centralized IoT platforms-Device onboarding and lifecycle management-Device authentication and authorization mechanisms-Secure communication in IoT platforms-Introduction to rule engines-Designing rules for event-driven intelligence-Rule-based decision making in IoT systems-Integration of edge and cloud platforms-Monitoring, logging, and system management

Unit V: Data Visualization, Storage, and Intelligent Project Design(9)

MQTT broker extensions and plugins-Data ingestion pipelines from brokers to storage-Time-series data storage concepts-Visualization tools and dashboards for IoT data-Transforming IoT data into actionable insights-Basics of AI-ready data preparation-Decision-making workflows using IoT data-End-to-end intelligent system design methodology-Project ideation and problem identification-Discussion of real-world AI-enabled IoT project ideas

Course Outcomes

At the end of the course, students will be able to:

CO. No.	Course Outcome	Knowledge Level
CO1	Explain the architecture and core components of AI-driven intelligent systems, including IoT communication protocols and data design principles required for effective data acquisition.	K3
CO2	Implement MQTT-based communication models using simulators and brokers to enable reliable, real-time data exchange in intelligent IoT systems.	K3
CO3	Develop edge-level applications using IoT development boards and sensors to acquire, preprocess, and transmit real-time data for intelligent processing.	K3
CO4	Design and manage centralized IoT platforms by configuring secure device authentication mechanisms and rule engines for event-driven decision making.	K3
CO5	Integrate data visualization, storage, and MQTT broker extensions to transform IoT data into actionable insights and propose AI-enabled intelligent system solutions.	K3

CO - PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	H	M	M	L	M	L	L	L	L	L	M	M	M
CO2	H	H	M	M	H	L	L	M	L	L	M	H	H
CO3	H	H	H	M	H	M	L	M	L	M	M	H	H
CO4	H	H	H	H	H	M	M	M	L	M	M	H	H
CO5	H	H	H	H	H	M	M	H	M	H	H	H	H

SDG Mapping

CO's	SDG mapping with CO's	
CO1	**SDG 4** – Quality Education	**SDG 9** – Industry, Innovation and Infrastructure
CO2	**SDG 9** – Industry, Innovation and Infrastructure	
CO3	**SDG 8** – Decent Work and Economic Growth	**SDG 9** – Industry, Innovation and Infrastructure
CO4	**SDG 9** – Industry, Innovation and Infrastructure	**SDG 11** – Sustainable Cities and Communities
CO5	**SDG 4** – Quality Education, **SDG 8** – Decent Work and Economic Growth **SDG 9** – Industry, Innovation and Infrastructure	**SDG 11** – Sustainable Cities and Communities **SDG 12** – Responsible Consumption and Production