Course Title: Hands-on IoT(AI) Advance Training
Duration: 8 Weeks
Sessions: 3 per week × 3 hours each = 72 hours
Format: Intensive hands-on labs with advanced IoT and AI concepts

Week 1: IoT Hardware Foundations

Session 1: Introduction to Raspberry Pi 4

- Setting up Raspberry Pi, SSH access, GPIO basics
- Python programming for GPIO control
- **Hands-on:** Blink LED, read basic input

Session 2: Advanced ESP Boards (ESP32 vs ESP8266)

- Deep sleep & low-power modes
- Bluetooth capabilities of ESP32
- **Hands-on:** ESP power mode demo & Bluetooth sensor data

Session 3: Sensor Calibration (pH, EC, DO, Turbidity)

- Importance of calibration in IoT systems
- Step-by-step calibration methods
- **Hands-on:** Calibrate pH, EC, DO, and turbidity sensors

Week 2: Edge AI & Data Handling

Session 4: Edge AI with TensorFlow Lite on Raspberry Pi

- Basics of Edge AI
- Installing TensorFlow Lite
- **Hands-on:** Run a simple ML model on Pi

Session 5: Collecting Datasets from IoT Sensors

- Dataset creation process for AI training
- Structured data storage methods
- **Hands-on:** Collect environmental data (MQ, pH, NPK, DO, EC)

Session 6: AI Classification – Air Quality Prediction

- Basics of classification models
- Training a simple air quality model

- **Hands-on:** Predict air quality using Raspberry Pi + MQ sensors

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Week 3: IoT Vision Systems

Session 7: ESP32-CAM Image Capture & Streaming

- Camera module setup
- Streaming video over WiFi
- **Hands-on:** Live video streaming

Session 8: Raspberry Pi HQ Camera + OpenCV

- Computer vision basics
- Object detection & tracking
- **Hands-on:** Track objects using OpenCV

Session 9: MLX90640 IR Thermal Camera Visualization

- Infrared thermal imaging
- Data processing & heatmap visualization
- **Hands-on:** Generate real-time thermal heatmaps

Week 4: Smart Applications

Session 10: Smart Health Monitoring

- Biosensors overview
- Measuring temperature, weight, dissolved oxygen
- **Hands-on:** Build simple health monitoring setup

Session 11: Smart Agriculture 2.0

- Soil & water monitoring
- Automated irrigation
- **Hands-on:** AI-based irrigation control system

Session 12: Water Quality Monitoring

- pH, turbidity, DO, EC measurement
- Real-time logging with NodeMCU
- **Hands-on:** IoT-enabled water quality station

Week 5: Robotics & Control

Session 13: Servo & Motor Control with PCA9685

- PWM motor control basics
- Driving multiple motors/servos
- **Hands-on:** Control robotic arm joints

Session 14: Object Tracking with Camera + Servo

- Pan-tilt mechanism design
- Real-time servo control from camera input
- **Hands-on:** Build object-tracking pan-tilt system

Session 15: IoT + Robotics Integration

- Combining IoT communication with robotics
- ESP32 & Raspberry Pi integration
- **Hands-on:** IoT-controlled robotic prototype

Week 6: Connectivity & Security

Session 16: IoT Security 2.0

- JWT tokens & HTTPS
- Best practices in IoT security
- **Hands-on:** Secure IoT data transmission

Session 17: GSM/GPRS IoT with SIM900A

- GSM module setup
- IoT applications in remote areas
- **Hands-on:** Send sensor data via GSM network

Session 18: Mini Project Showcase

- Apply Week 1–5 learnings
- Prototype design & demo
- **Hands-on:** Small IoT + AI project presentation

Week 7: Cloud & AI Integration

Session 19: Cloud AI (Google Cloud / AWS IoT)

- Cloud ML service basics
- IoT cloud integration steps
- **Hands-on:** Connect device to cloud AI service

Session 20: AI-based Predictive Maintenance

- Vibration & current monitoring
- Predicting failures with AI models
- **Hands-on:** Equipment health prediction

Session 21: Voice Recognition for IoT

- Offline vs online voice AI
- ESP32 + microphone module
- **Hands-on:** Voice-controlled IoT devices

Week 8: Security & Capstone

Session 22: AI Security System (Face Recognition)

- Face detection & recognition basics
- ESP32-CAM for access control
- **Hands-on:** Build face-recognition based lock

Session 23: Thermal + Camera Fusion System

- Combining thermal & visual data
- Applications in surveillance & safety
- **Hands-on:** Real-time fusion monitoring system

Session 24: Final AI Project Demo

- Teams present full projects
- Peer review & evaluation
- **Hands-on:** AI-enabled IoT capstone demo

Key Deliverables:

- **Labs and Exercises** for each advanced topic.
- **Mini-Projects** for Smart Health, Agriculture, and Security.
- **Final Capstone Project:** A functional, advanced AI+IoT system.
- **Certificate of Completion** for successful students.

Tools & Platforms Required:

- **Hardware:** Raspberry Pi 4, ESP32, ESP32-CAM, Pi HQ Camera, MLX90640, various sensors (pH, EC, DO, Turbidity, NPK, MQ, Vibration), PCA9685, Servos, Motors, SIM900A.
- **Software:** Python, TensorFlow Lite, OpenCV, Arduino IDE, AWS IoT/Google Cloud.