Module 1

Basic Concepts and Tools

1. Introduction to Arduino IDE: -
- ❖ Overview of Arduino and its applications
- ❖ Installation and setup of Arduino IDE
- ❖ Basic programming structure
- ❖ Hands-on: Writing and uploading a simple LED blinking program

2. Introduction to Wokwi Software
- ❖ Overview of Wokwi: Online simulator for Arduino projects
- ❖ Navigating the Wokwi interface
- ❖ Hands-on: Simulating an Arduino project on Wokwi

3. Understanding ESP32 Relay
- ❖ Introduction to ESP32 and its features
- ❖ Using relays with ESP32 for switching applications
- ❖ Hands-on: Simple relay control with ESP32

4. Sensors Overview
- ❖ Types of sensors (temperature, humidity, light, etc.)
- ❖ Basic principles and interfacing with microcontrollers
- ❖ Hands-on: Reading data from a temperature sensor

5. Ultrasonic Sensor Basics
- ❖ Working principle of ultrasonic sensors
- ❖ Applications and interfacing with microcontrollers
- ❖ Hands-on: Distance measurement using an ultrasonic sensor

6. Ultrasonic Sensing and Control
- ❖ Advanced ultrasonic sensing applications
- ❖ Implementing control mechanisms based on sensor data
- ❖ Hands-on: Simple control project using an ultrasonic sensor

7. Introduction to Servomotors
- ❖ Basics of servomotors and their applications
- ❖ Interfacing servomotors with microcontrollers
- ❖ Hands-on: Controlling a servomotor with Arduino

8. Overview of Microcontrollers and Microprocessors
- ❖ Definitions and differences between microcontrollers and microprocessors
- ❖ Popular microcontrollers: Arduino, ESP32, and others
- ❖ Application areas and use cases

Module 2

Embedded Systems in Automotive Innovation

1. Role of Microcontrollers and Microprocessors in Automotive Systems
- ❖ Importance in automotive innovation
- ❖ Case studies and examples

2. Basics of Hardware Designing
- ❖ Key considerations in designing hardware for embedded systems
- ❖ Schematic design and PCB layout basics
- ❖ Tools for hardware design

3. Sensors and Actuators in Automotive Systems
- ❖ Types of sensors and actuators used in automotive applications
- ❖ Interfacing techniques and real-world applications

4. Communication Protocols

- ❖ Overview of communication protocols (CAN, LIN, I2C, SPI, UART)
- ❖ Importance in automotive systems
- ❖ Hands-on: Simple communication between microcontrollers

5. App Development for Automotive Systems
- ❖ Introduction to mobile app development
- ❖ Basics of developing an app for vehicle control
- ❖ Tools and frameworks

6. Software Development for Embedded Systems
- ❖ Introduction to embedded software development
- ❖ Writing efficient code for microcontrollers
- ❖ Debugging and testing techniques

7. Integration and Testing
- ❖ Importance of integration and testing in embedded systems
- ❖ Methods and tools for integration and testing

8. Project Implementation Using C++
❖ Basics of C++ for embedded systems
❖ Hands-on project: Writing C++ code for a home automation system
❖ Debugging and testing the C++ project

Project-Based Learning
Project 1: Home Automation System (Using C++)
❖ Developing a basic home automation system using sensors, relays, and ESP32
❖ Writing and testing the C++ code
Project 2: Voice-Controlled Car (Using C)
❖ Interfacing a voice recognition module with a microcontroller
❖ Writing the control logic in C
❖ Testing and demonstrating the project
Project 3: App Controlled Vehicle (Using Java)
❖ Developing a mobile app to control a vehicle
❖ Writing the vehicle control code in Java
❖ Integrating the app with the vehicle and testing

Q&A and Wrap-Up
❖ Open session for questions and clarifications
❖ Summary of key learning points
❖ Feedback collection

Module 3

Automatic Braking System
1. Introduction to PyCharm IDE
❖ Overview of PyCharm and its features
❖ Installation and setup
❖ Basic navigation and project setup
❖ Hands-on: Writing and running a simple Python script in PyCharm

2. Python Programming for Embedded Systems
❖ Introduction to Python syntax and basics
❖ Key libraries for embedded systems
❖ Hands-on: Writing Python code to control basic hardware components

3. Using OpenCV for Computer Vision
- ❖ Overview of OpenCV and its applications
- ❖ Installing OpenCV and setting up the environment

- ❖ Hands-on: Basic image processing and video capture
- ❖ Hands-on: Implementing face and eye detection using OpenCV

4. Integration of Computer Vision in Microprocessors and Microcontrollers
- ❖ Techniques for integrating computer vision systems with microcontrollers
- ❖ Communication protocols and data transfer methods
- ❖ Hands-on: Connecting a camera module to a microcontroller and processing images

5. Real-Time Eye Detection
- ❖ Advanced techniques for real-time eye detection
- ❖ Implementing eye detection algorithms
- ❖ Hands-on: Building a real-time eye detection system using Python and OpenCV

6. Coding Microprocessors with Python
- ❖ Introduction to MicroPython
- ❖ Writing and uploading Python scripts to microprocessors
- ❖ Hands-on: Controlling hardware components using MicroPython

7. Sending Data with ESP32 to a Local Server
- ❖ Setting up a local server for data collection
- ❖ Programming the ESP32 to send data to the server
- ❖ Hands-on: Transmitting sensor data from ESP32 to the local server

8. Controlling Servomotors
- ❖ Basics of servomotor control
- ❖ Interfacing servomotors with microcontrollers
- ❖ Hands-on: Writing Python code to control a servomotor

9. Designing a Braking Circuit (Dimmer Circuit)
- ❖ Understanding the principles of a braking circuit
- ❖ Designing and simulating a dimmer circuit for braking control
- ❖ Hands-on: Building and testing the dimmer circuit

10. Mobile App Integration for Computer Vision
- ❖ Introduction to mobile app development for computer vision
- ❖ Tools and frameworks for app development
- ❖ Hands-on: Creating a mobile app for face and eye detection

❖ Integrating the app with the local server to send data to the microprocessor

Project-Based Learning

Real-Life Project: Driver Drowsiness Detection and Automatic Braking System
❖ Project overview and objectives
❖ Step-by-step implementation:
❖ Setting up the camera and microprocessor
❖ Implementing real-time eye detection and drowsiness analysis
❖ Integrating braking control with servomotors and dimmer circuit
❖ Developing the mobile app and connecting it to the system
❖ Hands-on: Building, testing, and demonstrating the complete system

Q&A and Wrap-Up

Module 4

Pose Controlled Autonomous Light Control
1. Introduction to OpenCV and Python
   ❖ Overview of OpenCV
   ❖ Basic Image Processing
   ❖ Hands-on Practice

2. Face Detection with OpenCV
   ❖ Introduction to Haar Cascades
   ❖ Implementing Face Detection
   ❖ Hands-on Practice

3. Real-time Face Detection
   ❖ Accessing Webcam with OpenCV
   ❖ Integrating Face Detection with Webcam Feed
   ❖ Hands-on Practice

4. Introduction to Microcontrollers
   ❖ Introduction to Microcontrollers
   ❖ Controlling microcontrollers with Python

❖ Hands-on Practice

5. Integrating Face Detection with Light Control
   ❖ Combining OpenCV with microcontroller
   ❖ Creating the Complete System
   ❖ Hands-on Practice

6. Advanced Topics and Project Enhancement
   ❖ Optimizing the System
   ❖ Additional Features
   ❖ Final Project Presentation and Demonstration

7. Feedback and Future Directions
   ❖ Discussing potential improvements and extensions.
   ❖ Encouraging students to explore further applications.

Resume Building
Resume Building and LinkedIn Profile Optimization
❖ Key components of an effective resume
❖ Tailoring your resume for embedded systems and machine learning roles
❖ Hands-on: Crafting a professional resume with provided templates
❖ LinkedIn profile best practices
❖ Hands-on: Optimizing your profile to showcase your skills and projects

Q&A and Wrap-Up

❖ Open session for questions and clarifications
❖ Summary of key learning points from the day
❖ Feedback collection
❖ This detailed syllabus provides a comprehensive guide for a full-day workshop focused on developing a pose-controlled autonomous military tank using machine learning and microcontrollers.
❖ The hands-on sessions ensure practical experience and understanding of the concepts, with additional focus on resume and LinkedIn profile building