

MODULE FOR SUMMER INTERNSHIP PROGRAMME 2025

(BY MANTRA ASSOCIATES & E&ICT ACADEMY IIT GUWAHATI)

on

EMBEDDED SYSTEM DESIGN FOR ROBOTICS APPLICATION USING IoT

OBJECTIVE:

1. To understand the fundamental concepts of embedded systems and their applications in robotics.
2. To design and implement microcontroller-based control systems for robotic applications.
3. To integrate sensors and actuators for real-time monitoring and control in robotic systems.
4. To explore IoT protocols and communication technologies for seamless connectivity in robotics.
5. To develop skills in programming embedded systems for data acquisition and decision-making.
6. To apply principles of robotics and IoT to build efficient and scalable robotic solutions.
7. To analyze and debug embedded hardware and software in robotic applications.

OUTCOME:

1. **Understand Embedded Systems:** Demonstrate a clear understanding of the architecture, design, and functioning of embedded systems in robotics applications.
2. **IoT Integration:** Develop skills to integrate Internet of Things (IoT) technologies into robotic systems for real-time data acquisition and communication.
3. **Sensor Interfacing:** Gain hands-on experience in interfacing various sensors (e.g., ultrasonic, infrared, temperature, and gyroscope) with embedded platforms for robotic applications.
4. **Actuator Control:** Design and implement algorithms to control actuators like motors, servos, and robotic arms using embedded systems.
5. **Microcontroller Programming:** Program microcontrollers (e.g., ARM, AVR, or 8051) for specific robotic functions, ensuring optimal performance and resource utilization.
6. **Wireless Communication:** Apply protocols like Wi-Fi, Bluetooth, or Zigbee for seamless wireless communication between robots and IoT systems.
7. **Real-Time System Development:** Develop and debug real-time embedded systems for tasks like obstacle avoidance, path planning, and environment monitoring.

DURATION: ONE MONTH (60 HOURS)

PREREQUISITES:

PRE-REQUISITES (hardware/software required by the participants):

Software	Hardware
Proteus 7.0, Keil uVision5, AVR Studio, Arduino IDE, Nuvoton Software	8051, AVR development board, Arduino UNO, Arduino NANO board, Sensor module etc.

INTERNSHIP STRUCTURE BREAKDOWN

DAY NO. & DATE	TOPICS TO BE COVERED	TIME DURATION
DAY 1 (TUESDAY) 01-07-2025	Brief introduction to embedded system, Embedded system designing tools and software.	2.5 HRS
DAY 2 (WEDNESDAY) 02-07-2025	Brief introduction to embedded system hardware and basics of electronics components.	2.5 HRS
DAY 3 (THURSDAY) 03-07-2025	Brief introduction of 16x2 LCD, Interfacing of 16x2 LCD Arduino UNO/Nano.	2.5 HRS
DAY 4 (FRIDAY) 04-07-2025	16x2 4bit and 8bit mode of operation, Interfacing of 8051 with 8051 controllers.	3.5 HRS (MCQ TEST 1)
DAY 5 (MONDAY) 07-07-2025	Brief introduction to different communication standard-Serial communication, I2C communication etc.	2.5 HRS
DAY 6 (TUESDAY) 08-07-2025	Introduction to different communication module-ZigBee, Bluetooth etc.	2.5 HRS
DAY 7 (WEDNESDAY) 09-07-2025	Brief introduction to ADC, ADC0804/0809, Interfacing of analog sensor with 8051 and Arduino.	2.5 HRS
DAY 8 (THURSDAY) 10-07-2025	Introduction to GSM communication, different AT commands of GSM, Interfacing GSM with 8051 & Arduino	2.5 HRS
DAY 9 (FRIDAY) 11-07-2025	Introduction to DC Motor, types, working of driver circuit, hay' s bridge.	3.5 HRS (MCQ TEST 2)
DAY 10 (MONDAY) 14-07-2025	Speed control of DC geared motor, Interfacing of DC motor with 8051 using LM293D driver	2.5 HRS
DAY 11 (TUESDAY) 15-07-2025	Brief introduction to 7 segment display, interfacing of 7 segment display with 8051 and Arduino.	2.5 HRS
DAY 12 (WEDNESDAY) 16-07-2025	Introduction to ultrasonic sensor- HCSR04, working, interfacing with 8051 and Arduino.	2.5 HRS
DAY 13 (THURSDAY) 17-07-2025	Brief Introduction to Hex keypad, interfacing with Arduino	2.5 HRS
DAY 14 (FRIDAY) 18-07-2025	Interfacing of hex keypad with 8051	3.5 HRS (MCQ TEST 3)
DAY 15 (MONDAY) 21-07-2025	Brief introduction of digital sensor, Interfacing of DHT11 with Arduino.	2.5 HRS
DAY 16 (TUESDAY)	Interrupt and timer of 8051, Interfacing of DHT11 with 8051.	2.5 HRS

22-07-2025		
DAY 17 (WEDNESDAY) 23-07-2025	Introduction to Internet of Things (IoT), tools and software to develop IoT based system.	2.5 HRS
DAY 18 (THURSDAY) 24-07-2025	Introduction to IoT enable device/SoC, ESP8266, ESP32 etc.	2.5 HRS
DAY 19 (FRIDAY) 25-07-2025	Practical application of IoT: Precision agriculture using IOT (Project 1)	3.5 HRS (MCQ TEST4)
DAY 20 (MONDAY) 28-07-2025	Practical application of IoT: Smart home automation system using IOT (Project 2)	2.5 HRS
DAY 21 (TUESDAY) 29-07-2025	Introduction to servomotor, Different applications, Interfacing with Arduino and 8051 controllers.	2.5 HRS
DAY 22 (WEDNESDAY) 30-07-2025	Introduction to stepper motor, applications, Interfacing with Arduino and 8051 controllers.	2.5 HRS
DAY 23 (THURSDAY) 31-07-2025	DOUBT CLEARING SESSION	1 HR & VALEDICTORY SESSION

PROJECTS TO BE ASSIGNED TO THE INTERNS (MIN. 10):

1. Design a magical lightning system using LED's and switch for festival. (Both in Arduino uno and 8051)
2. Design an automatic fire alarm system using OPAMP/Controller.
3. Design a visitor counter system for a hall using 16x2 LCD and PIR/IR sensor. (Both in Arduino uno and 8051)
4. Design a 3-phase fault detection and analysis system using 16x2 LCD.
5. Design a weather status monitoring system using Zigbee and 16x2 LCD. (Both in Arduino uno and 8051)
6. Design a home automation system using Arduino and different sensor module.
7. Design an automatic fan speed controller system using LM35 and 16x2 LCD.
8. Design a home automation system using GSM. (Both in Arduino uno and 8051)
9. Design a mobile control robot using Arduino and L293D/L298 driver.
10. Design a smart wheel chair for physically disable person using Arduino.
11. Write a program in Arduino and 8051 to display numbers in 7-segment display.
12. Design an obstacle avoiding robot using ultrasonic sensor module.
13. Write a program to interface a hex keypad with 8051/Arduino.
14. Design a password-based security system using 8051 & GSM.
15. Design a wireless system to measure humidity and temperature of air using Arduino.
16. Design a system to measure humidity and temperature of air using 16x2 LCD, DHT11 and 8051 controllers.
17. Write a program to develop a local server to dump data from real world.
18. Design an IoT based smart home automation system using ESP8266 controller.
19. Write a program to interface a servomotor with Arduino and 8051.
20. Write a program to interface a stepper motor with Arduino and 8051.