



Microcontrollers Programming Contents

Contents

- Introduction to Embedded Systems (4 hrs)
- C Programming (36 hrs)
- Embedded C & Interfacing (72 hrs)
- Introduction to RTOS (4 hrs)

Introduction to Embedded Systems

- What is “Embedded Systems”?
- Embedded Systems Applications.
- Microcontrollers and Microprocessors.
- Computer Systems. (Types and Components)
- CPU Architecture.
- Types of Memory.
- Numbering Systems.
- Microcontrollers Families.
- Microcontrollers Peripherals.

C Programming

- Variables, Types and I/O Functions.
- Control Flow (Branching and Loops).
- Functions (Iterative and Recursive).
- C Preprocessor.
- Building Process.
- Bit-wise Operations.
- Pointers and Arrays.
- Dynamic Memory Allocation
- Structures .
- Debugging Techniques and Error Types
- Data Structures (Linked Lists)
- Final Project (**Employees Database**)

Embedded C

- Preprocessor Directives.
- Memory Segmentation
- Variables scope and lifetime (Keywords in C).
- Functions scope in multi-files project.
- A Deeper look on the building process.
- Layered Architecture.
- Call back Functions.
- Memory Alignment.
- Bit-Fields.
- Startup code and Boot loader.

Interfacing

- Introduction to ATMEGA32.
- How to read a datasheet.
- Digital Input/Output (DIO)
 - Led
 - Seven Segment
 - Motors
 - Electrical Switches (Relays and Transistors)
 - Mechanical Switches (Push buttons)
 - Keypad
 - LCD
- Device Drivers

Interfacing_(cont.)

- ADC → Temperature Sensor
- Interrupts → External Interrupts
- Serial Peripheral Interface (SPI) → Communicating with other MC
- Inter-Integrated Circuit (I2C) → Interfacing with EEPROM
- Universal Asynchronous Receiver Transmitter (UART) → Bluetooth
- Timers
 - General Purpose Timers (GPT)
 - Output Compare Mode (OCM)
 - Input Capture Unit (ICU)
 - Pulse Width Modulation (PWM)
 - Watchdog Timer
- Final Project (**Simple Smart Home hardware implementation**)

RTOS

- Introduction to RTOS
- Real time Concepts
- Race Conditions
- Synchronization and Mutual Exclusion
- Inter-task Communication
- ISR and Events

Thank
You