

Automation Engineers AB Pvt Ltd, NOIDA

Crash-Course on AVR Microcontrollers

Course Syllabus:

Duration: 4/6 Weeks (40/60 Hours)

	Topic Covered
1	Introduction to Embedded Systems <ul style="list-style-type: none">• What is an Embedded system?• History of Embedded• Need of Embedded System• How do they work?• Classification of Embedded Systems• How Embedded System works• Common characteristics
2	Computational Devices <ul style="list-style-type: none">• What is Computational Devices?• Transistors• Logic Gates• Microprocessor vs. Microcontroller• Types of Embedded Processors
3	AVR Microcontroller <ul style="list-style-type: none">• What is AVR?• RISC vs. CISC Architecture• Harvard vs. Von-Neumann Architecture• Features of the AVR Family• Atmel ATmega16A• ATmega16A Pin Description and Explanation• ATmega16A Block Design Explanation
4	Registers & Memory of ATmega16 <ul style="list-style-type: none">• AVR Registers• General Purpose Registers• Special Purpose Registers• AVR Memory (Flash & RAM & ROM)• AVR I/O

AN ISO 9001:2015 CERTIFIED

5	<p>Programming Embedded Systems in C</p> <ul style="list-style-type: none"> • Introduction to Embedded C • C vs. Embedded C • Basics of an Embedded C Program <ul style="list-style-type: none"> ○ Operators and Data Types ○ Conditional statements & Loop constructs ○ Arrays, Strings, Functions ○ Pointers • AVR Studio + WinAVR Software Suite <ul style="list-style-type: none"> ○ Creating projects ○ Configuring the simulator ○ Building the target ○ Running the simulation
6	<p>Interfacing with an LED</p> <ul style="list-style-type: none"> • LED Basics • Interfacing Circuit of an LED • Programming the LED interface • Mini Projects <ul style="list-style-type: none"> ○ Blink an LED ○ LED Waterfall or Status Bar ○ Creating custom LED patterns
7	<p>Interfacing with a Seven-Segment Display</p> <ul style="list-style-type: none"> • Seven-Segment Display Basics • Interface Circuit • Programming the 7 Segment Display interface • Mini Projects <ul style="list-style-type: none"> ○ Show all Hexadecimal numbers
8	<p>Interfacing with an LCD</p> <ul style="list-style-type: none"> • 16x2 LCD Basics • How to communicate with 16x2 LCD? • Interfacing 16x2 LCD with ATmega16 • How to Program the 16x2 LCD? • Mini Projects <ul style="list-style-type: none"> ○ Displaying your Name on LCD ○ Blinking Text on LCD ○ Scrolling/running Text on LCD ○ Automatic Counting of Numbers using LCD
9	<p>Interfacing with Switches & Keyboard Matrix</p> <ul style="list-style-type: none"> • Switch & Key Matrix Basics <ul style="list-style-type: none"> ○ Interface Circuit ○ Debouncing basics ○ How to debounce a pushbutton? • Programming with Switches/Key Matrix • Mini Projects <ul style="list-style-type: none"> ○ Toggle logic using Button ○ Change lighting effects using button ○ Counting numbers using key matrix

10	<p>Driving Motors/Actuators</p> <ul style="list-style-type: none"> • Introduction to Motors • Types of Motors • Interfacing with Motors • Interfacing with Motors using ATmega16 • L293D Dual H-Bridge Motor Driver • Programming a Motor • Mini Projects <ul style="list-style-type: none"> ○ Program a dual-motor robot car
11	<p>Interfacing Sensors</p> <ul style="list-style-type: none"> • What are Sensors? • Sensor Categories • Analog vs. Digital Sensors • Interfacing with Infrared (IR) Sensor • Interfacing with Light Sensor (LDR) • Interfacing with Temperature sensor • Interfacing with Sound Sensor • Interfacing with PIR Motion Detector
12	<p>Programming Timers & Counters</p> <ul style="list-style-type: none"> • Introduction to Timer & Counter • Timer/Counters in ATmega16 • Special Flag Registers <ul style="list-style-type: none"> ○ Output Compare Register (OCRn) ○ Timer/Counter Control Register (TCCR) ○ Timer/Counter register (TCNTn) ○ Timer/Counter interrupt flag register (TIFR) • Programming of Timer & Counter • Mini Projects <ul style="list-style-type: none"> ○ Flash an LED periodically using counter
13	<p>Writing a Program for Serial Communication Programming</p> <ul style="list-style-type: none"> • Introduction to Serial Communication • Types of Serial Communication • Serial Communication in ATmega16 • SPI/I2C Protocol • USART in ATmega16 • USART Registers • Programming of USART
14	<p>Using Interrupts in ATmega16</p> <ul style="list-style-type: none"> • Introduction to Interrupts • Type of Interrupts • Interrupt Registers • Programming Software & Hardware Interrupts

15	Interfacing with an Analog to Digital Converter (ADC) <ul style="list-style-type: none"> • Introduction to ADC • On-board ADC of ATmega16 • ADC Registers • Programming with an ADC • Practice Session
16	Using the Watchdog Timer in ATmega16 <ul style="list-style-type: none"> • Introduction to Watchdog timer • Watchdog Timer Control Register • How to configure WDT in ATmega16 • How to use WDT in a program? • Practice Session
17	Interfacing of External Memory <ul style="list-style-type: none"> • Introduction to External Memory Interfacing • Introduction to I2C Protocol • Using I2C library to read/write External Memory
18	Interfacing with Advanced Sensors <ul style="list-style-type: none"> • Ultrasonic sensors • Gyroscope • Accelerometer • DTMF



AN ISO 9001:2015 CERTIFIED