

# Automation Engineers AB Pvt Ltd, NOIDA

## Crash-Course on Arduino Microcontrollers

Course Syllabus:

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

	Topic Covered
1	<b>Introduction to Embedded Systems</b> <ul style="list-style-type: none"><li>• What is an Embedded system?</li><li>• History of Embedded</li><li>• Need of Embedded System</li><li>• How do they work?</li><li>• Classification of Embedded Systems</li><li>• How Embedded System works</li><li>• Common characteristics</li></ul>
2	<b>Computational Devices</b> <ul style="list-style-type: none"><li>• What is Computational Devices?</li><li>• Transistors</li><li>• Logic Gates</li><li>• Microprocessor vs. Microcontroller</li><li>• Types of Embedded Processors</li></ul>
3	<b>Arduino Microcontroller</b> <ul style="list-style-type: none"><li>• What is Arduino?</li><li>• RISC vs. CISC Architecture</li><li>• Harvard vs. Von-Neumann Architecture</li><li>• Features of the AVR Family</li><li>• Atmel ATmega328P</li><li>• ATmega328P Pin Description and Explanation</li><li>• ATmega328P Block Design Explanation</li></ul>
4	<b>Registers &amp; Memory of ATmega328</b> <ul style="list-style-type: none"><li>• ATmega328 Registers</li><li>• General Purpose Registers</li><li>• Special Purpose Registers</li><li>• ATmega328 Memory (Flash &amp; RAM &amp; ROM)</li><li>• Arduino I/O</li></ul>
5	<b>Programming Embedded Systems in C</b> <ul style="list-style-type: none"><li>• Introduction to Embedded C</li><li>• C vs. Embedded C</li><li>• Basics of an Embedded C Program<ul style="list-style-type: none"><li>○ Operators and Data Types</li><li>○ Conditional statements &amp; Loop constructs</li><li>○ Arrays, Strings, Functions</li><li>○ Pointers</li></ul></li></ul>

	<ul style="list-style-type: none"> <li>• Arduino Software Suite <ul style="list-style-type: none"> <li>○ Creating projects</li> <li>○ Building the target</li> <li>○ Basic structure of an Arduino Program</li> </ul> </li> </ul>
6	<p><b>Interfacing with Sensors</b></p> <ul style="list-style-type: none"> <li>• Sensor Basics</li> <li>• Interfacing Circuit of an LED <ul style="list-style-type: none"> <li>○ Programming the LED interface</li> </ul> </li> <li>• Interfacing Circuit of a Switch <ul style="list-style-type: none"> <li>○ Debouncing basics</li> <li>○ How to debounce a pushbutton?</li> </ul> </li> <li>• Digital vs Analog Sensors</li> <li>• Interfacing Circuit of a Buzzer <ul style="list-style-type: none"> <li>○ Programming a Buzzer</li> </ul> </li> <li>• Mini Projects <ul style="list-style-type: none"> <li>○ Blink an LED</li> <li>○ LED Waterfall or Status Bar</li> <li>○ Creating custom LED patterns</li> </ul> </li> </ul>
7	<p><b>Interfacing with Transducers</b></p> <ul style="list-style-type: none"> <li>• Transducers vs Sensors</li> <li>• Relay Basics <ul style="list-style-type: none"> <li>○ Interface circuit of a relay</li> <li>○ Programming a relay</li> </ul> </li> <li>• Motor Basics <ul style="list-style-type: none"> <li>○ Types of Motors</li> <li>○ Interfacing with Motors using Arduino</li> <li>○ L293D Dual H-Bridge Motor Driver</li> <li>○ Programming a Motor</li> </ul> </li> <li>• Mini Projects <ul style="list-style-type: none"> <li>○ Program a dual-motor robot car</li> </ul> </li> </ul>
8	<p><b>Interfacing with an LCD</b></p> <ul style="list-style-type: none"> <li>• 16x2 LCD Basics</li> <li>• How to communicate with 16x2 LCD?</li> <li>• Interfacing 16x2 LCD with Arduino</li> <li>• How to Program the 16x2 LCD?</li> <li>• Mini Projects <ul style="list-style-type: none"> <li>○ Displaying your Name on LCD</li> <li>○ Blinking Text on LCD</li> <li>○ Scrolling/running Text on LCD</li> <li>○ Automatic Counting of Numbers using LCD</li> </ul> </li> </ul>
9	<p><b>Programming Timers &amp; Counters</b></p> <ul style="list-style-type: none"> <li>• Introduction to Timer &amp; Counter</li> <li>• Timer/Counters in ATmega328</li> <li>• Special Flag Registers <ul style="list-style-type: none"> <li>○ Output Compare Register (OCRn)</li> <li>○ Timer/Counter Control Register (TCCR)</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ Timer/Counter register (TCNTn)</li> <li>○ Timer/Counter interrupt flag register (TIFR)</li> <li>● Programming of Timer &amp; Counter</li> <li>● Mini Projects <ul style="list-style-type: none"> <li>○ Flash an LED periodically using counter</li> </ul> </li> </ul>
10	<p><b>Writing a Program for Serial Communication Programming</b></p> <ul style="list-style-type: none"> <li>● Introduction to Serial Communication</li> <li>● Types of Serial Communication</li> <li>● Serial Communication in ATmega328</li> <li>● SPI/I2C Protocol</li> <li>● USART in ATmega328</li> <li>● USART Registers</li> <li>● Programming of USART</li> </ul>
11	<p><b>Interfacing with Advanced Sensors</b></p> <ul style="list-style-type: none"> <li>● Interfacing with Infrared (IR) Sensor</li> <li>● Interfacing with Light Sensor (LDR)</li> <li>● Interfacing with Temperature sensor</li> <li>● Interfacing with Sound Sensor</li> <li>● Interfacing with PIR Motion Detector</li> <li>● Interfacing with Ultrasonic Sensor</li> <li>● Interfacing with Gyroscope</li> <li>● Interfacing with Accelerometer</li> </ul>
12	<p><b>Using Interrupts in ATmega328</b></p> <ul style="list-style-type: none"> <li>● Introduction to Interrupts</li> <li>● Type of Interrupts</li> <li>● Interrupt Registers</li> <li>● Programming Software &amp; Hardware Interrupts</li> </ul>
13	<p><b>Interfacing with an Analog to Digital Converter (ADC)</b></p> <ul style="list-style-type: none"> <li>● Introduction to ADC</li> <li>● On-board ADC of ATmega328</li> <li>● ADC Registers</li> <li>● Programming with an ADC</li> <li>● Practice Session</li> </ul>
14	<p><b>Using the Watchdog Timer in Arduino</b></p> <ul style="list-style-type: none"> <li>● Introduction to Watchdog timer</li> <li>● Watchdog Timer Control Register</li> <li>● How to configure WDT in Arduino</li> <li>● How to use WDT in a program?</li> <li>● Practice Session</li> </ul>
15	<p><b>Interfacing of External Memory</b></p> <ul style="list-style-type: none"> <li>● Introduction to External Memory Interfacing</li> <li>● Introduction to I2C Protocol</li> <li>● Using I2C library to read/write External Memory</li> </ul>