Automation with Embedded C

Learn the technology that meets operational excellence

"The principal goal of education is to create men and women who are capable of doing new things, not simply repeating what other generations have done."

-Jean Piaget

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"Automation with Embedded C" is the first of its kind workshop in India by Technophilia Systems. This workshop aims at giving hands-on the microcontroller programming using embedded, PLC programming concepts to implement different Automation techniques that are used for supreme efficiency and productivity at various levels of different industries & home automation systems. This workshop will help you in understanding different automation technologies used from traditional to the cutting edge new technologies, where you will find different ways to automate different tasks/process we are going through/using in our day to day life.

Think about any modern convenience or necessity e.g. cell phone, computer you use every day to do your job, car you drive, food you prepare, clothes you wear, video games you play, buildings you stay/visit, anything you can think of is the result of complex processes. Without talented individuals to design, build, improve, and maintain these automation processes, technological advances would never have occurred and future innovations would be impossible. Without automation professionals, our World and our future would be very different, so to make a career/succeed in the field of automation; you need the right training provider, the right technologies to learn from the people have right expertise in this field. Join this workshop, **Technophilia** will provide it all and more!

What would you learn?

- Revolution in the field of Home & Industrial automation
- Automation using microcontroller, PLC & SCADA
- Understanding the interfacing technique of different automation devices & tools e.g. Sensors, Motors, Actuators, Valves, switching devices e.g. MOSFET, SCR, TRIAC, Relay, PLC, SCADA, LabView etc
- Understanding Allen Bradley, Rockwell automation & PLCLogix simulator for PLC programming
- Programming the microcontroller using Embedded C
- Use of optical sensors to make different automation applications e.g. light ON/OFF based on person/visitors count, detection of obstacle, light, fire etc
- Interfacing Relay board to ON/OFF home electric appliances
- **Projects:**
  - Timer based automatic ON/OFF of home appliances
  - Number of visitors based ON/OFF of home appliances
  - Automatic street light control

DETAILED COURSE CONTENT:

Session 1: (4hrs)

Understanding embedded systems, home & industrial automation system & recent trends in this field:

- What are Embedded Systems & their characteristics?
- Hard Real Time System & Soft Seal Time System
- Different types of home & industrial control mechanism:
  - Microcontroller
  - PLC
  - SCADA
- Area of use, advantages & disadvantages

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Understanding Microcontrollers & its programming using Embedded C:

- Need of microcontrollers
- Microprocessors Vs Microcontrollers
- Microcontrollers classification & selection criteria for different automated applications
- AVR Microcontroller
- DDR, PORT & PIN registers
- Basic circuit diagram of AVR microcontroller
- Setting the Embedded C programming environment
- Input & Output programming techniques
- Writing code in embedded C
- Accessing various functions of microcontroller using embedded C
- Basic I/O device interfacing:
  - LED
    - Glowing of LEDs
    - Blinking of LEDs
    - Running of LEDs
  - Switch interface
    - Circuit/connection details of the switches
    - Development & testing of various switch based programs

Session 2: (4hrs)

Understanding automation basics using PLC & SCADA:

- What is PLC, evolution of PLC system, purpose of use & recent developments?
- Basic concepts of PLC:
  - PLC I/O basics
  - Scan cycle
  - Overhead
  - Input scan
  - Logic execution
  - Output scan
- Ladder programming basics:
  - Ladder logic
  - Ladder diagram features
  - Basic instructions
- Overview of different PLC systems:
  - Allen Bradley & Rockwell Automations
  - PLCLogix simulator programming overview
- What is SCADA, evolution of SCADA, purpose of use & recent developments?
- Basic concepts of SCADA:
  - SCADA components: HMI, Supervisory system, RTU, PLC & communication infrastructure
  - Understanding a simple SCADA system with single computer through block diagram
- Integration of PLC & SCADA for automation in industries

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Session 3: (4hrs)

Interfacing & development of applications using Optical sensor:

- Basic type of sensors
- Concepts of Light sensor using LDR, photo transistor, IR LED and photo diode
- Working principle of the Digital MPOS (Multi-Purpose Optical Sensor) & its interfacing
- Real world embedded/automation applications using optical sensor:
  - Obstacle detection
  - Person count
  - Detection of fire

Analog to Digital Conversion (ADC)

- What is ADC, its importance in automation to measuring analog quantities e.g. intensity of light, sound etc
- ADC features
- ADC channel & resolution
- Getting data from different channels
- Understanding the working principle of different analog sensors
- Writing program & developing ADC based applications

Session 4: (4hrs)

Industrial switching devices used in Automation:

- Switching devices to drive electric load:
  - Electromagnetic Relay
  - Transistor acts as a switch & H-Bridge using transistors
  - H-Bridge ICs
  - MOSFET
  - SCR & SCS
  - DIAC
  - TRIAC
- Understanding & working with Electromagnetic Relay:
  - Construction, working principle & types of Relay
  - Understanding & testing the working of relay board

PROJECTS development & testing:

- Understanding home electric wiring, wiring of Relay to automatic ON/OFF of appliances
- Timer based: Automatic/time based on/off of home appliances
- Building automatic street light control system using light sensor
- Sensor based ON/OFF of home appliances
- Counting no. of people entering into a room/hall & turning ON no. of lights accordingly

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The Training kit contents:-

1. Microcontroller development board with the following features: (1)

- Built with popular Atmel's AVR Microcontroller
- On-board LCD interface option (it can also be used for any other general purpose application)
- Option of Motor Driver for connecting 2 DC motors or 1 Stepper motors
- On-board 5v regulated power supply
- Onboard 12MHz external crystal connection
- Onboard 2-tact switches for external input and reset
- Onboard 4 test LEDs for status and debugging purpose
- Onboard 2 supply indicator LEDs
- Onboard dual power supply option through DC source (6V to 16V) or USB power
- On board USB programming feature
- Onboard exposed ISP pins for ISP programming
- Onboard exposed I/O pins
- Onboard exposed I/O pins for ADC and sensors with 5V/1A power supply

2. Dual relay board (1)
3. Electric bulb holder (2)
4. 2-pin top & electric wire (1)
5. Digital Optical Sensor (1)
6. USB cable (1)
7. Batteries for power supply (1)
8. Battery Snappers (1)
9. Sensor Connectors/cables (3)
10. Screw Driver (1)
11. CD containing study materials, sample codes, software etc (1)

Duration: We conduct a workshop on 2 consecutive days, each day 8 hour's session, so in total 16 hours properly divided into theory and hands on sessions.

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