EMBEDDED SYSTEM USING C PROGRAMMING

Description:

This program is designed to prepare an aspirants for a career as an Embedded Systems professional. In this course, the fundamentals of embedded system hardware and firmware design will be explored. Issues such as embedded processor selection, hardware/firmware partitioning, circuit design, circuit layout, circuit debugging, development tools, firmware architecture, firmware design, and firmware debugging will be discussed. The architecture and instruction set of the microcontroller will be discussed, and a wire wrapped microcontroller board will be built and debugged by each student.

Course Objectives:

On completion of this course, successful participants will be able to:

- Perform effectively as an entry level Embedded Systems professional.
- Develop and maintain applications written using Embedded C.
- Independently design and develop a hardware platform encompassing a microcontroller and peripherals

Course Contents:

Module 1: Basic Electronics and PCB Software Overview

- Number Systems
- Boolean Algebra
- About Basic Electronic Components
- Data sheets, power supplies, voltage regulators. Thermal considerations, heat sinks, parts kits.
- Introduction to Embedded Systems Laboratory and equipment.
- Logic probes, voltmeters and oscilloscopes; Debugging using logic analyzers, state and timing information.
- Designing with tolerances and margins, part variations and substitutions, reliability/part count.
- Interfacing different logic families, fan out, signal buffering, noise margins, pull ups/pull downs.
- Overview of board development process, wire wrapping and soldering.
- Schematics and wiring diagrams, recommended practices, CAD tools.

- Board layout considerations, signal integrity (noise, crosstalk, etc.) and decoupling techniques.
- Manufacturing and test engineering, PCB design, ground and power planes, EMI, EMC.

Module 2: Embedded C Programming

- C Basic data types
- Programming constructs
- Functions in C
- Data Structures
- Advanced topics
- Overview of the C standard library
- Embedded System Oriented Topics
- MISRA C — Designing Safer C Programs
- Basics of event driven programming

Module 3: Microcontroller Architecture

- Embedded systems descriptions, definitions, and vocabulary.
- Embedded system design considerations and requirements.
- Processor selection and tradeoffs.
- Microprocessor/microcontroller architectures and instruction sets, 8051 architecture.
- Design cycle, planning a development project, derivation of requirements, tradeoffs.
- Oscillators and reset circuits. Microprocessor supervisory circuits, watchdog timers.
- Microcontroller peripherals, selection and interfacing. Core component circuitry (CPU, ROM, RAM).
- 8051 timing diagrams, program read, data read, data write.
- Port pin structure. Controlling port pins in asm. User interface design, human factors. Driving LEDs.
- Timing requirements, propagation delay, setup, hold, rise/fall times, timing analysis. Clock skew.
- Memory selection and interface, SRAM, NVRAM, DRAM, EPROM, EEPROM, Flash.
- Switch debouncing in hardware and firmware, keypad decoding.
- 8051 timers/counters. Interrupts and Interrupt Service Routines (ISRs).

- Serial communication, RS-232/485, line drivers/receivers, charge pumps, terminal emulation, USB.
- EEPROMs, I2C and synchronous serial communication.
- LCDs
- Analog-to-Digital Converters (ADCs), Digital-to-Analog Converters (DACs).
- Motor control, stepper motors, DC motors, PWM, H-Bridges. Case study: hard disk drive.