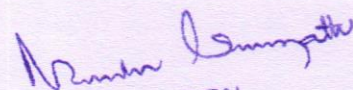


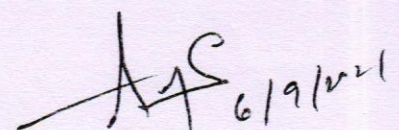
The Arduino Platform and C Programming

The Arduino is an open-source computer hardware/software platform for building digital devices and interactive objects that can sense and control the physical world around them. In this class you will learn how the Arduino platform works in terms of the physical board and libraries and the IDE (integrated development environment). You will also learn about shields, which are smaller boards that plug into the main Arduino board to perform other functions such as sensing light, heat, GPS tracking, or providing a user interface display. The course will also cover programming the Arduino using C code and accessing the pins on the board via the software to control external devices. Please note that this course does not include discussion forums.

Upon completing this course, you will be able to:

1. Outline the composition of the Arduino development board
2. Describe what it means to program the board's firmware
3. Read board schematics
4. Install Arduino IDE
5. Describe what "shields" are and how they are used
6. Specify the role of libraries in the use of shields
7. Compile and run a program
8. Name C Variables and Types
9. Name common C operators
10. Use conditionals and loops
11. Explain functions, their definition and invocation
12. Explain the implications of global variables
13. Undertake the Arduino build process
14. Describe the role of the tools behind the IDE
15. Describe how to invoke functions in classes
16. Explain the structure of an Arduino sketch
17. Access the pins of the Arduino


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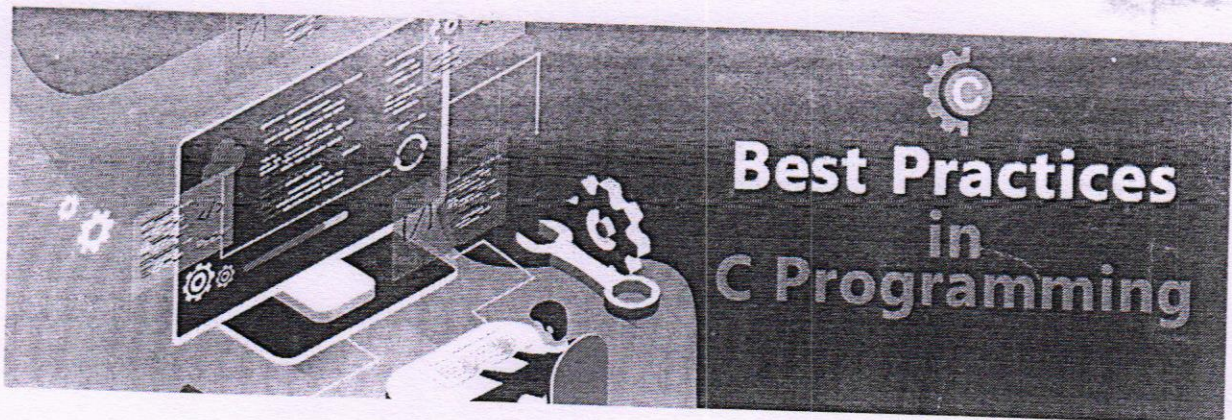

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18. Differentiate between digital and analog pin
19. Debug embedded software
20. Explain the importance of controllability and observability in the debugging process
21. Describe common debugging architectures for embedded systems
22. Explain how the UART Serial communication protocol works
23. Describe how the Arduino Serial library performs serial communication

Arduino Environment

This module provides an introduction to the Arduino environment which is composed of three things: the Arduino board, the Arduino IDE, and the Arduino-compatible shields together with their libraries. We first investigate the board, discussing all of its main components, inputs, and outputs. We discuss how each component is used and we examine the board schematic to see how they are connected. We then discuss the Arduino Integrated Development Environment (IDE) which is used primarily to write, compile, and upload code. We survey the interface of the IDE and discuss how to install and use it. We also examine the use of shields to extend the functionality of an Arduino-based system. We discuss how shield libraries provide a useful abstraction to facilitate programming.

C Programming



This module covers the basics of the C programming language which will be used to write code for the Arduino. The course first covers basic syntax, variables, and types. Most of the basic C operators are presented. Conditional statements (if, switch) and loops (while, for) are described. The concept of functions is presented together with how to define and call functions. Creation and use of global variables is explained.

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Arduino Programs

This module describes the composition of an Arduino program, or sketch, and the process by which it is compiled and uploaded. The Arduino IDE is a user interface for the software tools which actually compile and upload the program. We outline the use of these tools in the build process. We describe the basic structure of a sketch, including the use of the `setup()` and `loop()` functions. The main interface of an Arduino is through its pins, so we describe how to access those pins from a sketch.

Module 4

This module is an introduction on debugging embedded software on an Arduino. We discuss the basic debugging requirements: controllability and observability. The debugging environment available for an Arduino UNO is limited, so we describe how to use the UART communication protocol to gain controllability and observability. We present the use of the Serial library to communicate with the Arduino through the serial monitor.

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