Lesson 2
Prototyping Embedded Software on Arduino on Arduino boards

Prototyping Embedded Software

- Develop the codes, design and test the embedded devices for IoT and M2M using the IDEs and development platforms

First and Second levels in IoT architectural concept

- Gathering (data from devices/sensors) + consolidating (enriching)
- Connection to Internet

Use of IDE

- An IDE enables development of software for functions at first and second levels
- IDE may also enable usages of the OS or RTOS functions at an embedded device

Bootloader firmware and IDE

- Stores at flash/ROM of microcontroller in a device and enables communication with computer having an IDE
- The IDE, in general, consists of the APIs, libraries, compilers, RTOS, simulator, editor, assembler, debugger, emulators, logic analyser, code burner, and other software for integrated development of the system

IDE

- Enables the development of codes on a computer, and later on downloading
- (pushing) of codes on to embedded device, such as Arduino or microcontroller board
- A code-burner places codes into flash memory or EEROM or EPROM
- The specific application codes thus embed into the device

Arduino board programming

- The Arduino board has a pre-installed bootloader embedded into firmware
- Program development in C++ using avr-gcc tools
- Arduino programmer develops the codes using a graphical cross-platform IDE.

Arduino board programming

- Arduino provides simplicity
- IDE of Arduino board simplicity of beed of two functions
- Based on processing language

Arduino board programming

- The board connects to a computer which runs the IDE
- Bootloader program handovers the control and enables running of loader, which loads the required OS functions and software into the system hardware and networking capabilities into the board

The Arduino Bootloader Provisions For Multitasking

- Usage of interrupt (analogous to eventing) handing functions for each task
- Multitasking done by assigning multiple values of a number n for the tasks (n > 0)
- When an instruction for interrupt, INT n executes, then interrupt-handing function *n* is called for execution
- Each task or thread can have the number n associated with it

The Arduino IDE Provisions For Multitasking

- First, a computer downloads an appropriate IDE version, as per the computer OS.
- A computer usually runs Windows or Mac OS X or Linux.
- The IDE consists of a set of software modules, which provide the software and hardware environment for developing and prototyping the software for the specific device platform.

The Arduino IDE

- Available from website of Arduino
- The Arduino IDE includes a C/C++ library
- The library is called Wiring for a project of the same name with open source module at a website.
- The Wiring library functions make coding easy for the Arduino IO operations

Simplicity of Arduino IDE

- Only two functions are necessary to define executable program functions for the board
- setup() and loop()
- The function setup() runs at the start and is used for initialising settings,
- function loop() has a program in endless loop using statement ‘while (true) *{statements ;}’ which runs till* power off.

Serial Monitor At The IDE

- Enables messages from the embedded software for microcontroller into the computer screen where IDE is setup
- The messages required during testing and debugging the downloaded software during test stages

Summary

We learnt

- Prototyping Embedded Software
- Bootloader facilitates handover the control and enables running of loader, which loads the required OS
- IDE enables development of software and use of the OS
- IDE available from website of Arduino

Summary

We learnt

- Two functions simplicity; Setup ( ) and loop ( )
- Serial Monitor provides the messages required during testing and debugging the downloaded software during test stages

End of Lesson 2 on Prototyping Embedded Software on Arduino boards