

# Lesson 5

## Arduino Prototype Development Platforms

# Arduino Boards, Modules And Shields

- Popular AVR® MCU based products
- Each board has clear markings on the connection pins, sockets and in-circuit connections
- Thus, Arduino boards easy to work for DIY (do-it-yourself)
- Simplifies the prototyping an embedded platform for the IoTs.

# Development Board Types for the IoT devices

- Arduino Ethernet, Arduino Wi-Fi and Arduino GSM shields
- Development boards for the wearable devices, Arduino Gemma, LilyPad, LilyPad Simple/SimpleSnap and LilyPad USB.

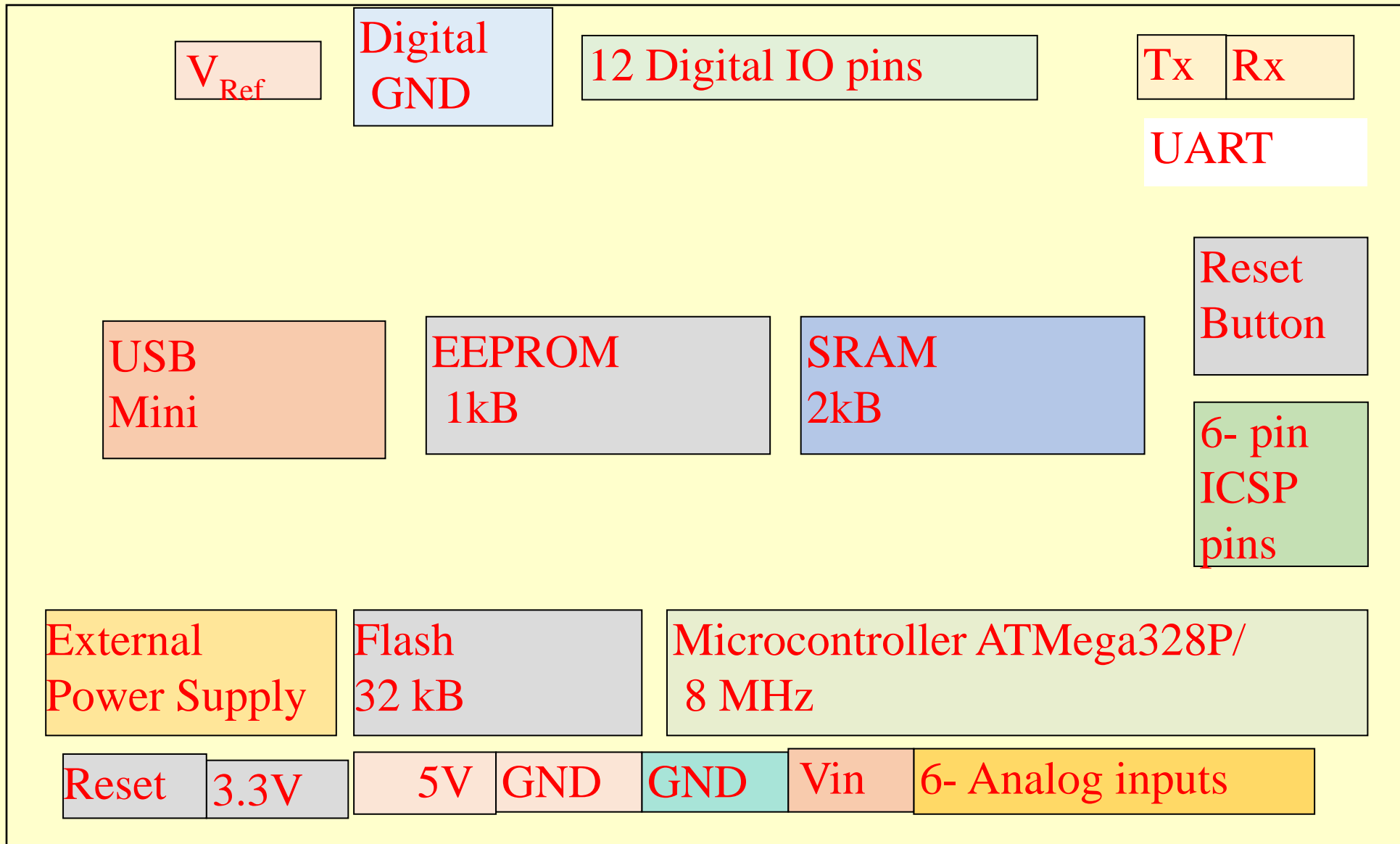


Fig. 8.2 Architecture of Arduino Fio board for development IoT devices development

# Arduino UNO Specifications

- Getting started with electronics and coding
- ATmega328/ 16 MHz MCU
- Operating 5 V Input 7 V–12 V
- EPROM 0 kB/ SRAM 2 kB/ Flash 32 kB
- Analog In 6 /Out 0 / Digital IOs 14 / *n-bit* PWM 6  
USB standard UART 1
- **Ethernet 0/ Wi-Fi 0/ GSM 0**

# Board Pins

- The board analog input pins and PWM pins can connect sensors, actuators and analog circuits
- The board digital I/O pins connect On-Off states, set of On-Off states, digital inputs from sensors, digital outputs to actuators and other digital circuits
- A board with a shield inserted into that makes a wireless connection to a ZigBee, Bluetooth LE, WiFi, GSM, or RF module or a wired connection to Ethernet LAN for Internet.

# ICSP 6-pin header

- Enables for embedding (burning) of programs
- Burning, a process of programming an EEPROM/ROM
- ICSP is in-circuit serial programming, which means burning the code through connectivity with the ICSP header.

# Board Initial Start Programming

- Pre-programmed bootloader in the MCU
- Bootloader program embeds onto the AVR® MCU chip.
- Can also be downloaded using USB connection to a computer or tablet
- Enables use of the AVR platform with the Arduino IDE.
- Enables the board functions.
- The board needs no OS after bootloading by default.



# Board Programming with embedded OS

- An OS can be embedded when required
- System needs to do multiple tasks or need to run multiple threads or processes

# Programmer Code development using Arduino IDE

- A programmer develops the codes using editor in an IDE.
- Downloaded onto the board, tested and debugged, constituting a cycle.

# Programmer Code development using Arduino IDE

- The codes pushed after developing-testing-debugging cycle (s).
- USB port interconnecting the board and external computer or tablet with an IDE for download.
- The cycle repeated till the codes finalized for a prototype.

# Features Of Arduino Boards

1. Prototyping ease
2. Flexibility and ease of assembling modules on the board
3. Hardware open source and extensible using the modules, shields and other circuits with open version of IDE, software modules and codes from other designers

# Features Of Arduino Boards

4. Open extensible source code, schematics, software, middleware and IDE

5 AVR-C codes extend on coding in C++, and the libraries can be added with additional programs.

AVR-C codes means C commands and statements for using AVR ports, serial interfaces and other functional units of the MCU

# Features Of Arduino Boards

- 6. IDE latest version and appropriate OS are open source3 IDE and software runs on multiple environments, Linux, Windows and Mac OS-X
- 7. Number of times programmability of the board during the editing-testing-debugging cycles, and for development of number of new prototype using the same

# Arduino board applications

- Where the device does not require intensive computing and graphics
- The applications using *things which are light*
- emitting devices, wearable devices, health monitoring or fitness devices, watches, sensors and actuators connected smartly through the Internet

# Arduino board applications

- The developments tools; open sources and that use the computer with Windows, Arduino Linux distribution or a MAC.



# Summary

We learnt

- Arduino Prototype Development Board Types
- Board Hardware types and Pins
- Board Initial Programming
- Board IDE and OS
- Board Features
- Board AVR C++ and library

# End of Lesson 5 on Arduino Prototype Development Platforms