Arduino UNO Microcontroller
Internet of Things

• Sensors and actuators embedded in physical objects are linked through wired and wireless networks

• The **Internet of things** is the internetworking of physical devices, vehicles, buildings and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data.
Requirements of IOT

• Hardware Requirements
  – Microcontroller
  – Sensors
  – GSM Module
  – Bluetooth

• Software Requirements
  – Arduino IDE
Microcontroller

• A microcontroller is a complete computer system, including a CPU, memory, a clock oscillator, and I/O on a single integrated circuit chip.
Arduino UNO Microcontroller

- Arduino is an open-source electronics platform based on easy-to-use hardware and software.
- Arduino boards are able to read inputs and turn it into an output.
- By using the Arduino API we can tell the microcontroller board what to do by send the set of instructions to it.
- Arduino can interact with buttons, LEDs, motors, speakers, GPS units, cameras, the internet, and even your smart-phone or your TV.
Arduino UNO Architecture
Components of Arduino UNO Microcontroller

- Power (Barrel Jack)
- Power USB
- Crystal Oscillator
- Arduino Reset
- Analog pins
- Power LED indicator
- TX and RX LEDs
- Digital I/O
- AREF
- Vcc, GND, Vin
- Main microcontroller
<table>
<thead>
<tr>
<th>Arduino function</th>
<th>Pin</th>
<th>Arduino function</th>
</tr>
</thead>
<tbody>
<tr>
<td>reset</td>
<td>PC6</td>
<td>PC5 analog input 5</td>
</tr>
<tr>
<td>digital pin 0 RX</td>
<td>PD0</td>
<td>PC4 analog input 4</td>
</tr>
<tr>
<td>digital pin 1 TX</td>
<td>PD1</td>
<td>PC3 analog input 3</td>
</tr>
<tr>
<td>digital pin 2</td>
<td>PD2</td>
<td>PC2 analog input 2</td>
</tr>
<tr>
<td>digital pin 3 PWM</td>
<td>PD3</td>
<td>PC1 analog input 1</td>
</tr>
<tr>
<td>digital pin 4 VCC</td>
<td>PD4</td>
<td>PC0 analog input 0</td>
</tr>
<tr>
<td>GND</td>
<td>PD5</td>
<td>GND analog reference</td>
</tr>
<tr>
<td>crystal</td>
<td>PB6</td>
<td>AVCC digital pin 13</td>
</tr>
<tr>
<td>crystal</td>
<td>PB7</td>
<td>SCK digital pin 12</td>
</tr>
<tr>
<td>digital pin 5 PWM</td>
<td>PD6</td>
<td>PB5 digital pin 11</td>
</tr>
<tr>
<td>digital pin 6 PWM</td>
<td>PD7</td>
<td>PB4 digital pin 10</td>
</tr>
<tr>
<td>digital pin 7</td>
<td>PB0</td>
<td>PB3 PWM digital pin 9</td>
</tr>
<tr>
<td>digital pin 8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Features of Arduino UNO

- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- Flash Memory: 32 KB
- SRAM: 2 KB
- EEPROM: 1 KB
Arduino Boards

• Various kinds of Arduino boards are available depending on different microcontrollers used.
• Boards differ in Operating Voltage, clock speed, and number of Digital I/O, Analog & PWM pins.
• all Arduino boards have one thing in common: they are programed through the Arduino IDE.
Arduino Boards

![Arduino Boards Diagram](image-url)
Arduino boards
Intel Galileo Gen2 Board
# Features of Intel Galileo Gen2

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microcontroller</td>
<td>SoC Quark X1000</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>3.3V / 5V</td>
</tr>
<tr>
<td>Digital I/O Pins</td>
<td>14 (of which 6 provide 8/12-bit PWM output)</td>
</tr>
<tr>
<td>Analog Input Pins</td>
<td>6</td>
</tr>
<tr>
<td>Flash Memory</td>
<td>512 kB</td>
</tr>
<tr>
<td>SRAM</td>
<td>512 kB</td>
</tr>
<tr>
<td>EEPROM</td>
<td>8kB</td>
</tr>
<tr>
<td>Clock Speed</td>
<td>400MHz</td>
</tr>
</tbody>
</table>
Sensors

- A sensor is a device that detects and responds to some type of input from the physical environment.
- A sensor is a device that sense the data from physical environment and converts real world data (Analog) into data that a computer can understand.
Sensors

• **Analog sensors**—produce continuous analog output signal and these sensors are considered as analog sensors
  
  • Ex: light sensors, sound sensors, temperature sensors

• **Digital sensors**—an electronic or electrochemical sensor, where data conversion and data transmission are done digitally.
  
  • It has two discrete values. It is on, or it is off.
  
  • Ex: Push button, LED sensors
Sensors
GSM Module
Bluetooth
Set up the Arduino IDE

**Step 1** – First you must have your board (you can choose your favorite board) and a USB cable.

**Step 2** – Download Arduino IDE Software from the Arduino website and run the file.
Step 3 – Power up your board and Connect the Arduino board to your computer.
Step 4 – Launch Arduino IDE.
Step 5 – Open your first project.

To create a new project, select File → **New**.
To open an existing project example, select File → Example → Basics → Blink.
Step 6-Select your Board

Go to Tools → Board and select your board.
Step 7-Select your serial port
Step 8- Compile & Upload the program to your board

A – Used to check if there is any compilation error.
B – Used to upload a program to the Arduino board.
C – Shortcut used to create a new sketch.
D – Used to directly open one of the example sketch.
E – Used to save your sketch.
F – Serial monitor used to receive serial data from the board and send the serial data to the board.