CELEBRATING
ARDUINO
DAY 2014

Rudra Pratap Suman
What is an Arduino?

- **Open Source** electronic prototyping **platform** based on flexible **easy to use** hardware and software.
Arduino Family

Arduino Uno
Arduino Leonardo
Arduino Mega ADK
Arduino Ethernet
Arduino Due
Arduino Yún
Arduino Mega 2560
Arduino Mini
The Accessories
# A Summary of Arduino power

<table>
<thead>
<tr>
<th>Name</th>
<th>Processor</th>
<th>Operating Voltage/Input Voltage</th>
<th>CPU Speed</th>
<th>Analog In/Out</th>
<th>Digital IO/PWM</th>
<th>EEPROM [KB]</th>
<th>SRAM [KB]</th>
<th>Flash [KB]</th>
<th>USB</th>
<th>UART</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uno</td>
<td>ATmega328</td>
<td>5 V/7-12 V</td>
<td>16 Mhz</td>
<td>6/0</td>
<td>14/6</td>
<td>1</td>
<td>2</td>
<td>32</td>
<td>Regular</td>
<td>1</td>
</tr>
<tr>
<td>Due</td>
<td>AT91SAM3X8E</td>
<td>3.3 V/7-12 V</td>
<td>84 Mhz</td>
<td>12/2</td>
<td>54/12</td>
<td>-</td>
<td>96</td>
<td>512</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Leonardo</td>
<td>ATmega32u4</td>
<td>5 V/7-12 V</td>
<td>16 Mhz</td>
<td>12/0</td>
<td>20/7</td>
<td>1</td>
<td>2.5</td>
<td>32</td>
<td>Micro</td>
<td>1</td>
</tr>
<tr>
<td>Mega 2560</td>
<td>ATmega2560</td>
<td>5 V/7-12 V</td>
<td>16 Mhz</td>
<td>16/0</td>
<td>54/15</td>
<td>4</td>
<td>8</td>
<td>255</td>
<td>Regular</td>
<td>4</td>
</tr>
<tr>
<td>Mega ADK</td>
<td>ATmega2560</td>
<td>5 V/7-12 V</td>
<td>16 Mhz</td>
<td>16/0</td>
<td>54/15</td>
<td>4</td>
<td>8</td>
<td>255</td>
<td>Regular</td>
<td>4</td>
</tr>
</tbody>
</table>
Who is more popular Atmega or Arduino?
Bare minimum code

```cpp
void setup() {
    // put your setup code here, to run once:
}

void loop() {
    // put your main code here, to run repeatedly:
}
```
Bare minimum code

- **setup**: It is called only when the Arduino is powered on or reset. It is used to initialize variables and pin modes.

- **loop**: The loop functions runs continuously till the device is powered off. The main logic of the code goes here. Similar to while (1) for micro-controller programming.
PinMode

• A pin on arduino can be set as input or output by using pinMode function.

• pinMode(13, OUTPUT); // sets pin 13 as output pin

• pinMode(13, INPUT); // sets pin 13 as input pin
Reading/writing digital values

• `digitalWrite(13, LOW);` // Makes the output voltage on pin 13, 0V

• `digitalWrite(13, HIGH);` // Makes the output voltage on pin 13, 5V

• `int buttonState = digitalRead(2);` // reads the value of pin 2 in buttonState
What are Libraries?

• Libraries are a collection of code that makes it easy for you to connect to a sensor, display, module, etc. For example, the built-in LiquidCrystal library makes it easy to talk to character LCD displays. There are hundreds of additional libraries available on the Internet for download.
How to use them?
How to use them?
How to use them?
Single Board Devices
Single Board Devices

• Early microcomputers typically consisted of a half dozen (or more) circuit boards--plugged into a backplane--that implemented the central processor unit (CPU), memory, disk controllers and serial/parallel port functions. These backplane-based microcomputers were used for data acquisition, process control and R&D projects, but were generally too bulky to be used as embedded systems within devices.
BeagleBone Black
1 GHz performance ready to use for $45

10/100 Ethernet
USB Host
Easily connects to almost any everyday device such as mouse or keyboard
microHDMI
Connect directly to monitors and TVs
microSD
Expansion slot for additional storage
512MB DDR3
Faster, lower power RAM for enhanced user-friendly experience

Serial Debug
DC Power
Power Button
LEDS
Reset Button
USB Client
Development interface and directly powers board from PC

1 GHz Sitara AM335X
ARM® Cortex™-A8 processor
Provides a more advanced user interface and up to 150% better performance than ARM11
Expansion headers
Enable cape hardware and include:
• 65 digital I/O
• 7 analog
• 4 serial
• 2 SPI
• 2 I2C
• 8 PWMs
• 4 timers
• And much much more!

2GB on-board storage using eMMC
• Pre-loaded with Ångström Linux Distribution
• 8-bit bus accelerates performance
• Frees the microSD slot to be used for additional storage for a less expensive solution than SD cards

Included in price:
• Power supply ~ $10
• USB network cable ~ $3
• 2GB on-board storage $5-$10
• PRU for real-time tasks typically on FPGA ~ $20
<table>
<thead>
<tr>
<th>Beagle board Family</th>
<th>BeagleBone Black</th>
<th>BeagleBone</th>
<th>BeagleBoard-xM</th>
<th>BeagleBoard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>AM3358 ARM Cortex-A8</td>
<td>AM3358 ARM Cortex-A8</td>
<td>DM3730 ARM Cortex-A8</td>
<td>OMAP3530 ARM Cortex-A8</td>
</tr>
<tr>
<td>Maximum Processor Speed</td>
<td>1GHz</td>
<td>720MHz</td>
<td>1GHz</td>
<td>720MHz</td>
</tr>
<tr>
<td>Video</td>
<td>microHDMI, cape add-ons</td>
<td>cape add-ons</td>
<td>DVI-D (via HDMI connectors), S-Video</td>
<td>DVI-D (via HDMI connectors), S-Video</td>
</tr>
<tr>
<td>Audio</td>
<td>microHDMI, cape add-ons</td>
<td>cape add-ons</td>
<td>3.5mm stereo jack</td>
<td>3.5mm stereo jack</td>
</tr>
<tr>
<td>Supported Interfaces</td>
<td>4x UART, 8x PWM, LCD, GPMC, MMC1, 2x SPI, 2x I2C, A/D Converter, 2xCAN Bus, 4 Timers</td>
<td>4x UART, 8x PWM, LCD, GPMC, MMC1, 2x SPI, 2x I2C, A/D Converter, 2xCAN Bus, 4 Timers, FTDI USB to Serial, JTAG via USB</td>
<td>McBSP, DSS, I2C, UART, LCD, McSPI, PWM, JTAG, Camera Interface</td>
<td>McBSP, DSS, I2C, UART, McSPI, PWM, JTAG</td>
</tr>
</tbody>
</table>
Software Compatibility

- Ångström Linux
- Android
- Ubuntu
- Cloud9 IDE on Node.js w/ BoneScript library
- plus much more
Pandaboard
Pandaboard

OMAP4430 Processor

Highlights:
- 1GHz Dual-Core ARM Cortex-A9 MPCore
- 1080p Video
- 3D Graphics Accelerator
- Memory: 1GB Low Power DDR2 RAM

SD/MMC Card Slot

Serial/RS-232

Camera Connector

USB 2.0 OTG

Stereo Audio in/out

Power Supply 5V

Power/Reset Buttons

JTAG

WLAN/Bluetooth

Expansion Connector

LCD Expansion

DVI Out

HDMI Out (Type A)

10/100 Ethernet & 2xUSB 2.0 Host ports

Board Dimensions: W: 4.0" (101.6 mm) X H: 4.5" (114.3 mm)
Raspberry Pi Model B

- RCA Video
- Audio
- LEDs
- USB
- LAN
- GPIO
- 512MB RAM
- CPU & GPU
- HDMI
- SD Card
- Power
## Specifications of core

<table>
<thead>
<tr>
<th></th>
<th>ARM Cortex-M0</th>
<th>ARM Cortex-M3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>ARM Cortex-M0</td>
<td>ARM Cortex-M3</td>
</tr>
<tr>
<td>Frequency</td>
<td>48MHz</td>
<td>96MHz</td>
</tr>
<tr>
<td>FLASH</td>
<td>32KB</td>
<td>512KB</td>
</tr>
<tr>
<td>RAM</td>
<td>8KB</td>
<td>32KB</td>
</tr>
<tr>
<td>Power</td>
<td>1-16mA (Vb)</td>
<td>60-120mA (Vin)</td>
</tr>
</tbody>
</table>
Any Doubts?

Thank you