Internet of Things

Introduction

What is IoT?

The broad idea behind the IoT is "that a whole constellation of inanimate objects is being designed with built-in wireless connectivity, so that they can be monitored, controlled and linked over the Internet via a mobile app."

Features

- IoT essentially makes devices smart by connecting them together over networks and to the Internet.
- These devices will not only be able to send data to the Internet but they will also be controlled over the Internet.
- Key - sensors,network,embedded systems(hardware), platform and apps(software)
- Advantages - Most optimized use of technology, comfort and ease to customers, better data collection and tracking facilities.
- Disadvantages - issues against security and privacy, initial complexity in setting up the system
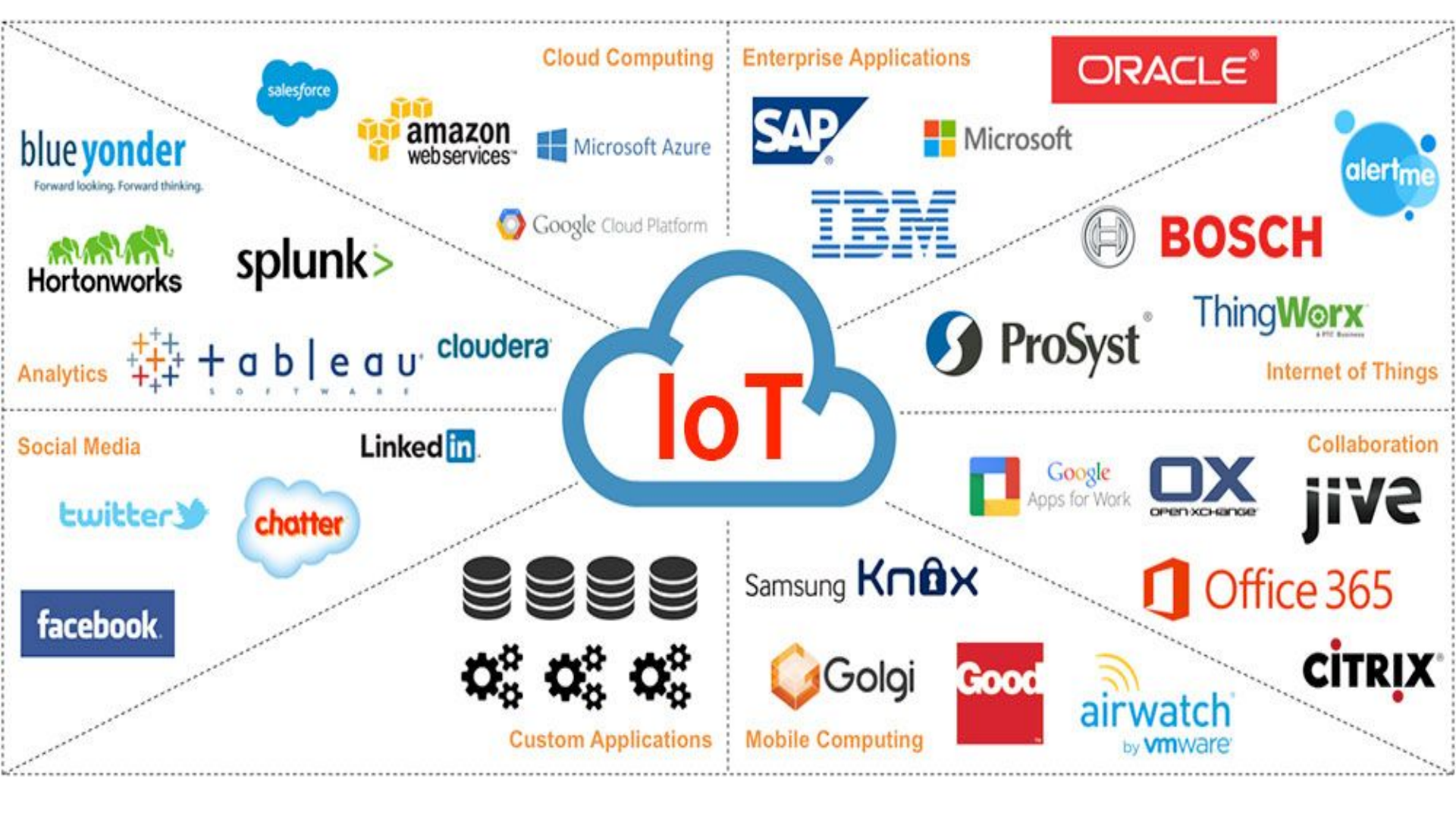
The Hardware

- Major components - Platforms and Sensors
- Platforms - Low power, low cost, wireless hardware with network connectivity
- Sensors - components with very small size and high efficiency of reading data from surrounding
- Major platforms used include Arduino, Raspberry Pi, ESP8266, Node MCU kit, Beagle Board.
- Commonly used sensors include infrared, ultrasonic, temperature and humidity, light and pressure sensors and accelerometers.

Arduino

- Single board-microcontroller for building digital circuitry and interactive objects that can sense and control objects of real world.
- Programmed using C++
- Based on 8-bit ATmega328P microcontroller.
- Consists other components such as crystal oscillator, serial communication, voltage regulator,a USB connection, a power barrel jack, an ICSP header and a reset button.
- 5V regulated power supply, 3.3V supply generated by on-board voltage regulator, 6 analog, 14 digital pins(6 PWM pins)
- https://www.arduino.cc
- https://components101.com/microcontrollers/arduino-uno

- ICSP means 'in circuit serial programmer. It is a way of programming a PIC while it is still attached to the application circuit. It is one of the methods of programming an Arduino board Ordinarily, an Arduino bootloader program is used to program an Arduino board, but if the bootloader is missing or damaged, ICSP can be used instead. ICSP can be used to restore a missing or damaged bootloader.
- The ATmega328 microcontroller is the main component that does all of the work. When an Arduino sketch is loaded to the Arduino it is actually loaded to memory inside the microcontroller chip. The microcontroller then runs or executes the sketch when the Arduino is powered up or reset after programming.

Arduino Uno
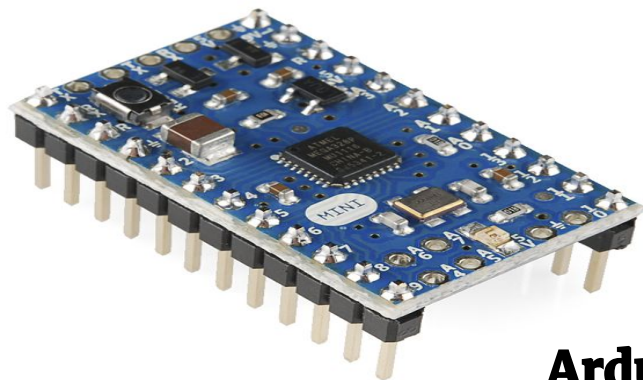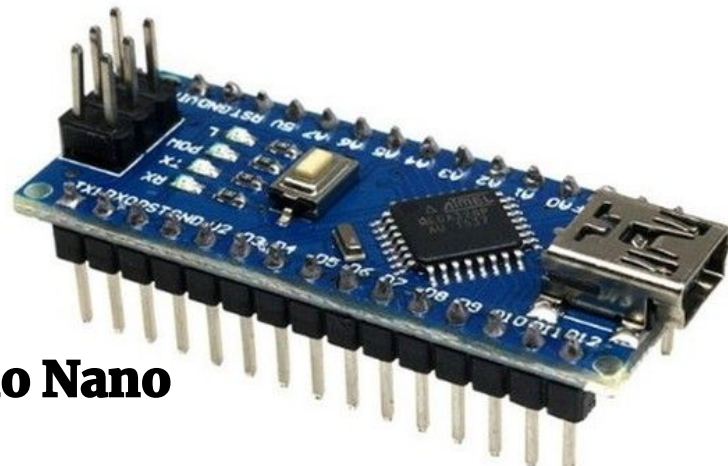
Arduino Nano

Arduino pro

Arduino mini
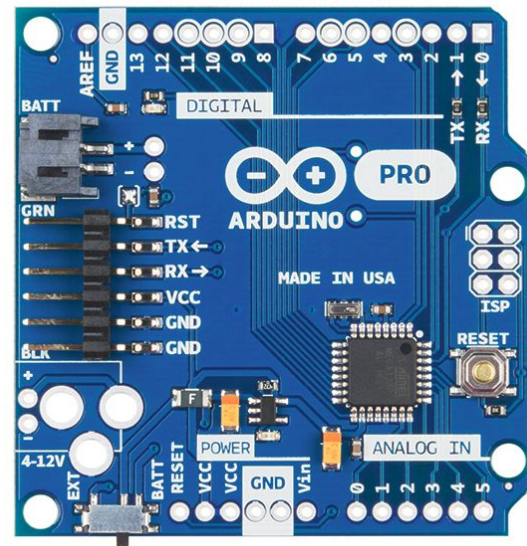
ESP8266

- Low-power, highly-integrated,complete and self-contained Wi-Fi solution.
- Most often used with Arduino like microcontrollers which do not already have built-in WiFi modules.
- Provides capabilities for 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2), general-purpose input/output (16 GPIO), analog-to-digital conversion (10-bit ADC), Serial Peripheral Interface (SPI)
- Used specifically for mobile devices, wearable electronics and networking applications design and make the machine to achieve the lowest energy consumption.
- https://www.hackster.io/PatelDarshil/things-you-should-know-before-using-esp8266-wifi-module-784001

ESP-01

ESP-02

ESP-03

ESP-04

ESP-05

ESP-06

ESP-07

ESP-08

ESP-09

ESP-10

ESP-11

Node MCU

- The NodeMCU (Node MicroController Unit) is an open source software and hardware development environment that is built around a very inexpensive System-on-a-Chip (SoC) called the ESP8266.
- Aims to simplify ESP8266 development through a DEVKIT board that incorporates the ESP8266 chip on a standard circuit board. The board has a built-in USB port that is already wired up with the chip, a hardware reset button, wifi antenna, LED lights, and standard-sized GPIO (General Purpose Input Output) pins that can plug into a breadboard.
- https://www.hackster.io/Aritro/getting-started-with-esp-nodemcu-using-arduino ide-aa7267
- https://www.ibm.com/developerworks/library/iot-nodemcu-open-why-use/index .html

ESP8266 NodeMCU Pinout

Left side (top to bottom):
- TOUT — ADC 00 — 02 — A0
- RESERVADO — RSV
- RESERVADO — RSV
- SDIO DATA3 — GPIO 10 — 12 — SD3
- SDIO DATA2 — 11 — SD2
- SDIO DATA1 — SPI MOSI — 13 — SD1
- SDIO CMD — SPI CS — 09 — CMD
- SDIO DATA0 — SPI MISO — 10 — SD0
- SDIO CLK — SPI CLK — 14 — CLK
- GND — GND
- 3.3V — 3V3
- EN — 01 — EN
- RESET — 03 — RST
- GND — GND
- Vin — Vin

Right side (top to bottom):
- D0 — 04 — GPIO 16 — USER — WAKE
- D1 — 20 — GPIO 05
- D2 — 19 — GPIO 04
- D3 — 18 — GPIO 00 — FLASH
- D4 — 17 — GPIO 02 — TX D1
- 3V3 — 3.3V
- GND — GND
- D5 — 05 — GPIO 14 — HSPI CLK
- D6 — 06 — GPIO 12 — HSPI MISO
- D7 — 07 — GPIO 13 — RX D2 — HSPI MOSI
- D8 — 16 — GPIO 15 — TX D2 — HSPI CS
- RX — 21 — GPIO 03 — RX D0
- TX — 22 — GPIO 01 — TX D0
- GND — GND
- 3V3 — 3.3V

Board labels: MODEL VENDOR ESP8266MOD AI-THINKER ISM 2.4GHz PA+25dBm 802.11b/g/n — FC — WiFi — AMS1117 — SILABS CP2102 — RST — FLASH

Raspberry Pi

- A single-board, low-cost, high-performance computer loaded with chips and I/O facility.
- Features a Broadcom system on a chip (System on a Chip) with an integrated ARM compatible central processing unit (CPU) and on-chip graphics processing unit (GPU), processor speed ranges from 700 MHz to 1.4 GHz for the Pi 3 Model B+; on-board memory ranges from 256 MB to 1 GB RAM.
- Features SD card and USB facilities.
- Slower than a modern laptop or desktop but is still a complete Linux computer and can provide all the expected abilities that implies, at a low-power consumption level.

microSD Card

40 Pin Unpopulated GPIO Header

Dimensions: 65mm x 30mm x 5mm

Raspberry Pi Zero

RUN Pins for Reset Switch

RCA Composite Video Output

Micro USB 5V Power Input

Micro USB Data Port

Mini-HDMI 1080P Video & Audio Output

Broadcom BCM2835 SoC Runs at up to 1GHz Dual Core VideoCore IV GPU 512MB Onboard RAM

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