

# Building the IoT, the DIY way

- Introduction and Group Organization





# Introduction

## About Us

Korea Institute of Science and Technology(KISTI)  
- Internet of Things Data Research Team(Since 2017)



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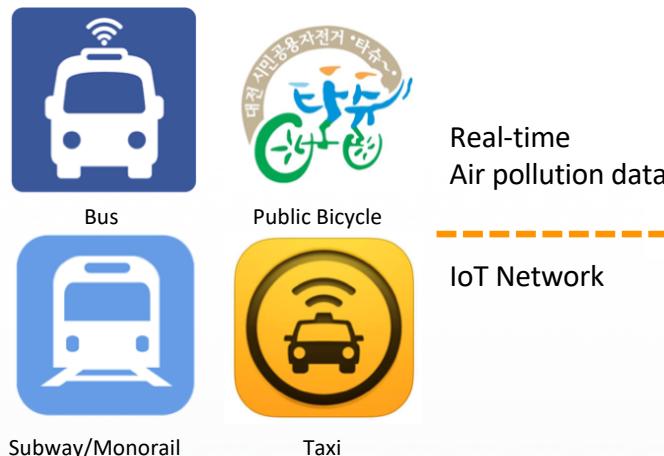
We are focus on to develop core technology of IoT Data Analysis,

To do this, we needed an infrastructure to collect data...



# Mobile Sensor Network

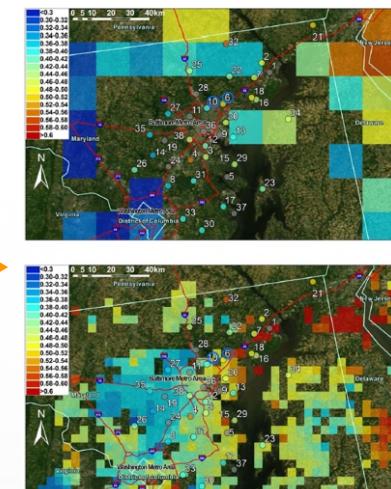
May, 2017



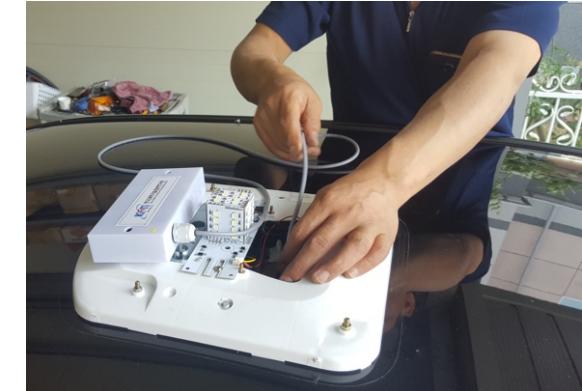
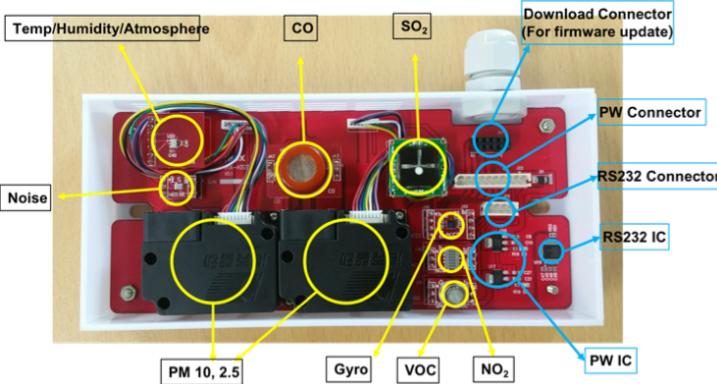
July, 2017



Sep, 2017



# Taxis with Urban Sensing Capability



- Sensors attached: PM, Temperature, Humidity, Pressure, NO<sub>2</sub>, SO<sub>2</sub>, CO, VOC, Noise, and Accelerometer
- Frequency: 10 seconds
- Data Opened via API / DB

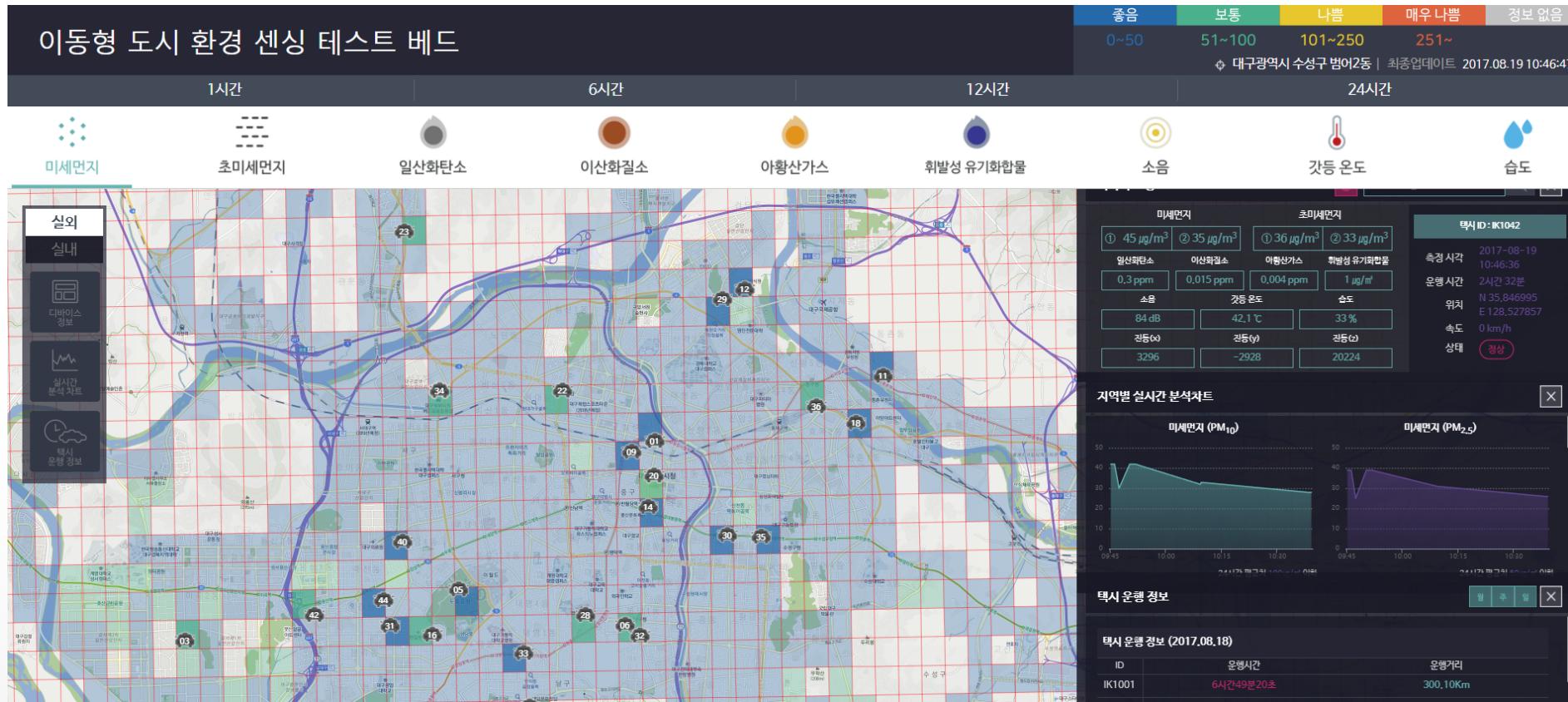


- Started Taxi-sensor Deployment, up to 40 taxis
- Practical Issues to consider:
  - High temperature, water/humidity, etc.
  - Air Flow Changes by Driving Status
  - Life time of sensors and management

# Introduction



# Taxis with Urban Sensing Capability





# Indoor Testbed

- PM Diffusion Simulation
- Real-time Stream Data Visualization
- Four Sensor Boxes (PM, Temperature, Humidity, Pressure, and CO<sub>2</sub>) are attached





# Outdoor Testbed

- Over 30 Kinds of Sensors,
- 158 GB / Day(2 Cars, Operated 8 hr, Includes 4 Webcams, 4 Blackboxes)



(Air) PM<sub>10</sub>, PM<sub>2.5</sub>, PM<sub>1.0</sub>, NO<sub>2</sub>, SO<sub>2</sub>, CO, CO<sub>2</sub>, O<sub>2</sub>, O<sub>3</sub>, NH<sub>3</sub>, CH<sub>4</sub>, H<sub>2</sub>, VOC, Pressure, Temperature, Humidity, Rainfall

(Traffic) Time, GPS, Acceleration, Gyro, Vibration, OBD (RPM, Speed, Distance, Running Time, Temperature, Battery, Engine Load)

(Living) Sound, UV, LUX

(Floating Population) Web Cam, Black Box

(Health) Smart Band (Heartbeat)



# Pause...

Before we move any further, let's make sure that we all know each other in this room?

Please introduce yourself to the person(s) sitting in your general vicinity. Tell them a few things about yourself, maybe:

- where you're from
- what is your major
- where is your UST campus

# Please let me know

- Who's campus is KISTI, ETRI, KIST
- Who's major is related to
  - Computer Science
  - Electricity Engineering
  - Mechatronics Engineering
- Who has experience about any kinds of programming languages
- Who has experience about microcontrollers (Arduino, Raspberry Pi, and so on..)

# Final Goal:

## Create Your Own IoT Application





# Make your IoT application



IoT Home Assistant



Self-watering Flower Pot



Remote Light Switch

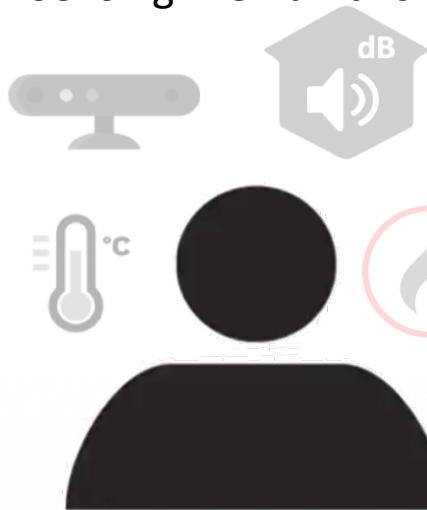


Smart Window Opener



# Make your IoT application

Sensing like humans



Thinking like humans



Microcontroller  
(MCU)



Acting like humans



Remote monitoring and control

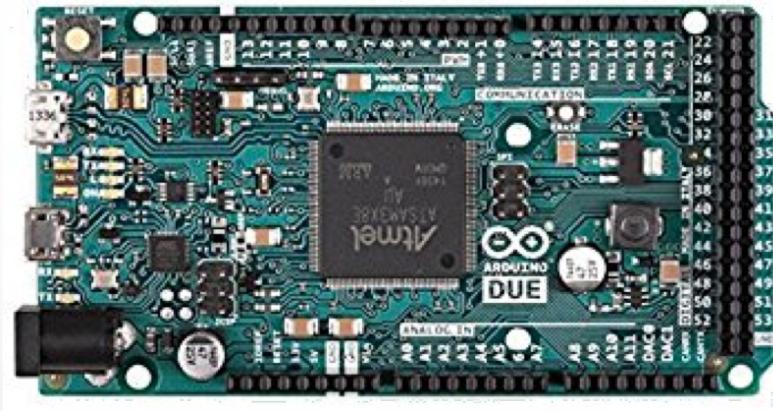


# Open Source electronic prototyping platform

Arduino



Uno



Due



Tre



# Open Source electronic prototyping platform

Arduino

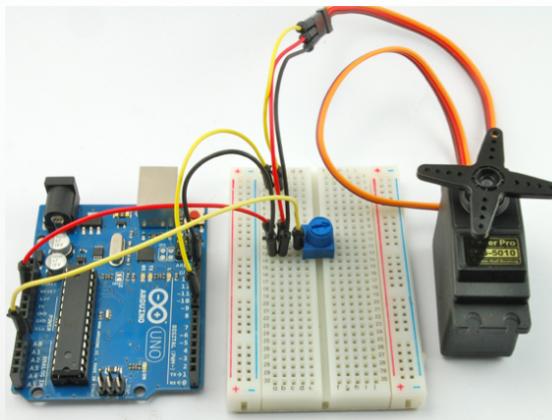


Small 8 bit Computer

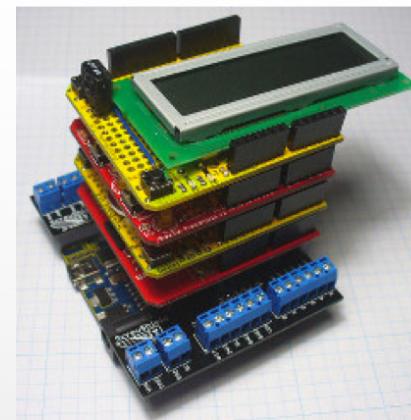
Pins that can attach “Shields”

Easy programing

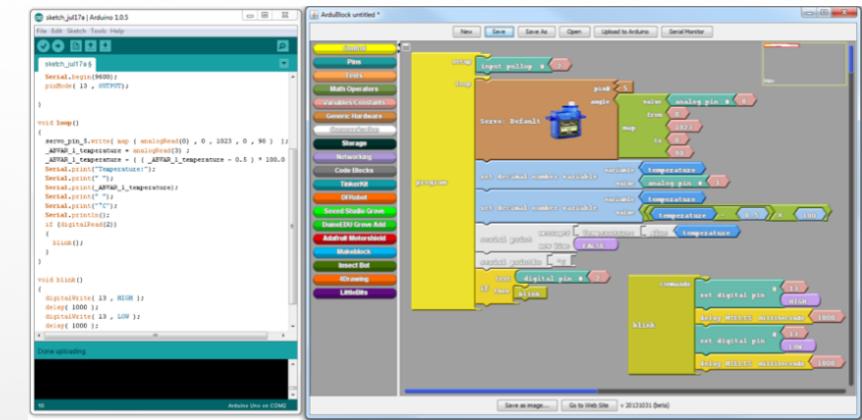
Solderless



Solderless circuit



Shields for Arduino

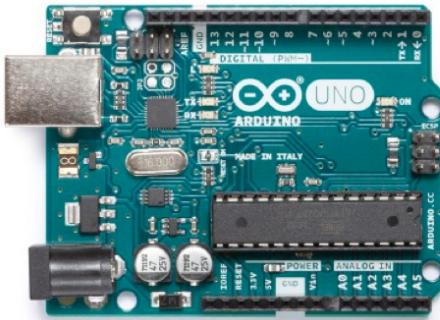


Block programming



# Open Source electronic prototyping platform

Arduino Uno

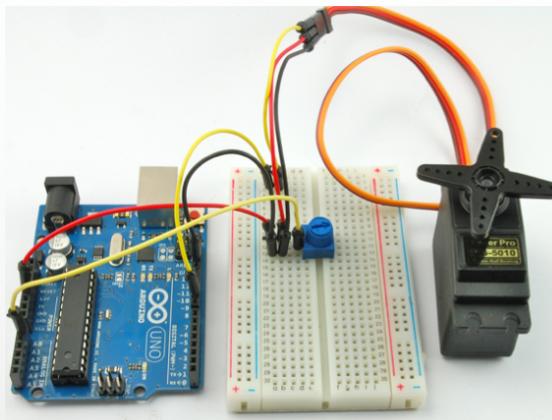


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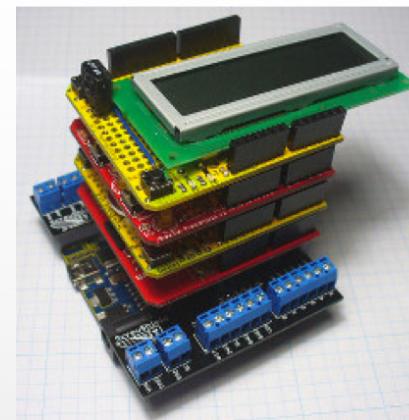
Pins that can attach “Shields”

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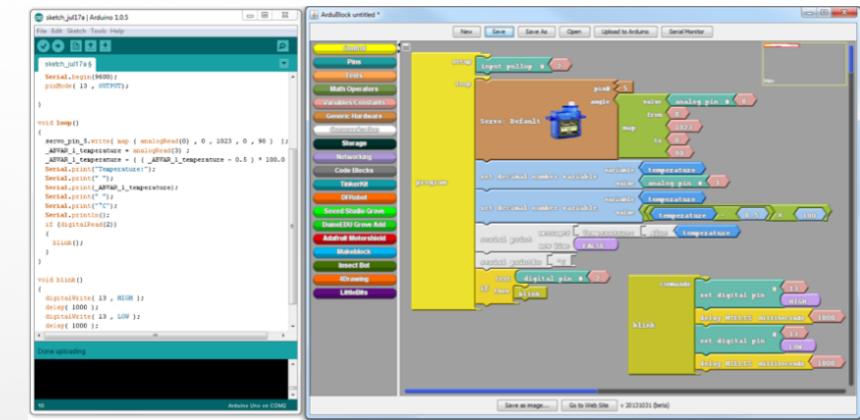
Solderless



Solderless circuit



Shields for Arduino



Block programming



# Open Source electronic prototyping platform

Arduino Uno - \$25, \$7



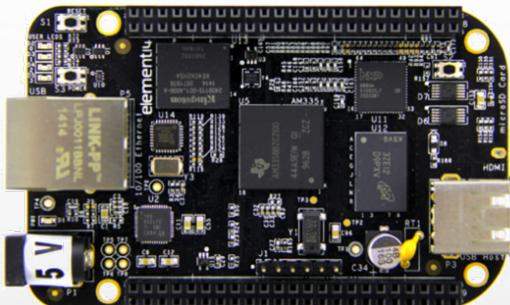
400 mhz  
256 KB

Raspberry Pi - \$35



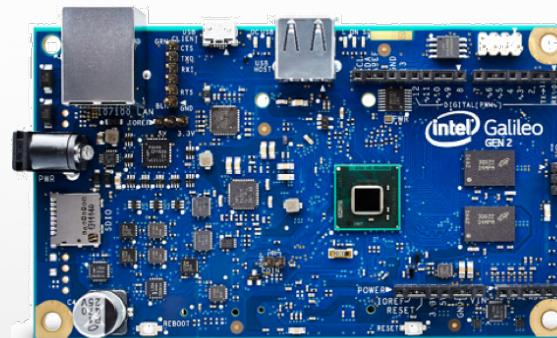
1.2 Ghz \*4  
1GB  
Wifi  
HDMI

Beaglebone Black - \$45



1Ghz  
512MB  
HDMI

Intel Galileo - \$70



400 mhz 32 bit  
256MB  
Flash storage

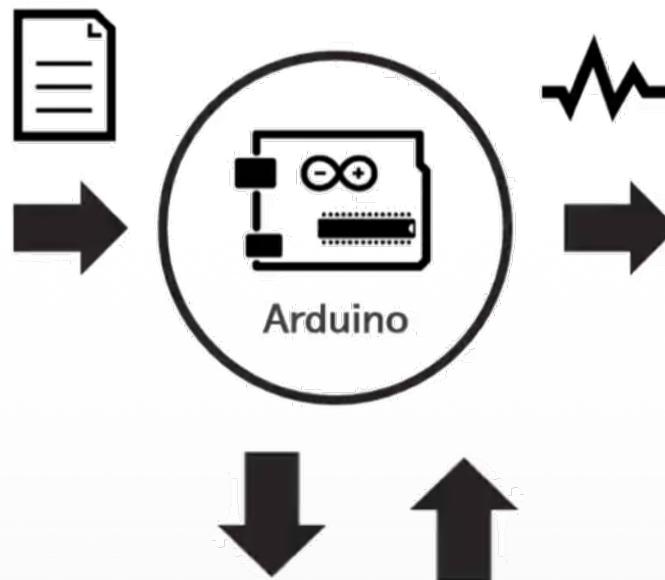


# Make your IoT application

Sensing like humans



Thinking like humans



Acting like humans



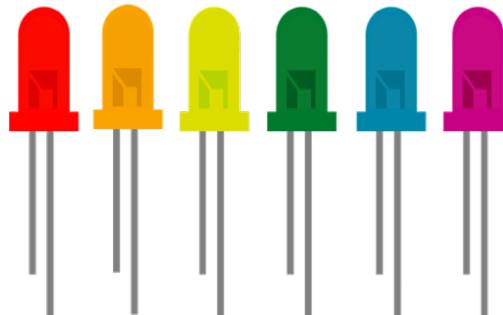
Remote monitoring and control



# What we can use



LED / Button / Speaker



Ultrasonic Sensor

Temperature / Humidity

Water-level Sensor

Air quality Sensor



GPS Module

Moisture Sensor

Wifi Module

Relays



Servo motor



# Make your IoT application

Part 1

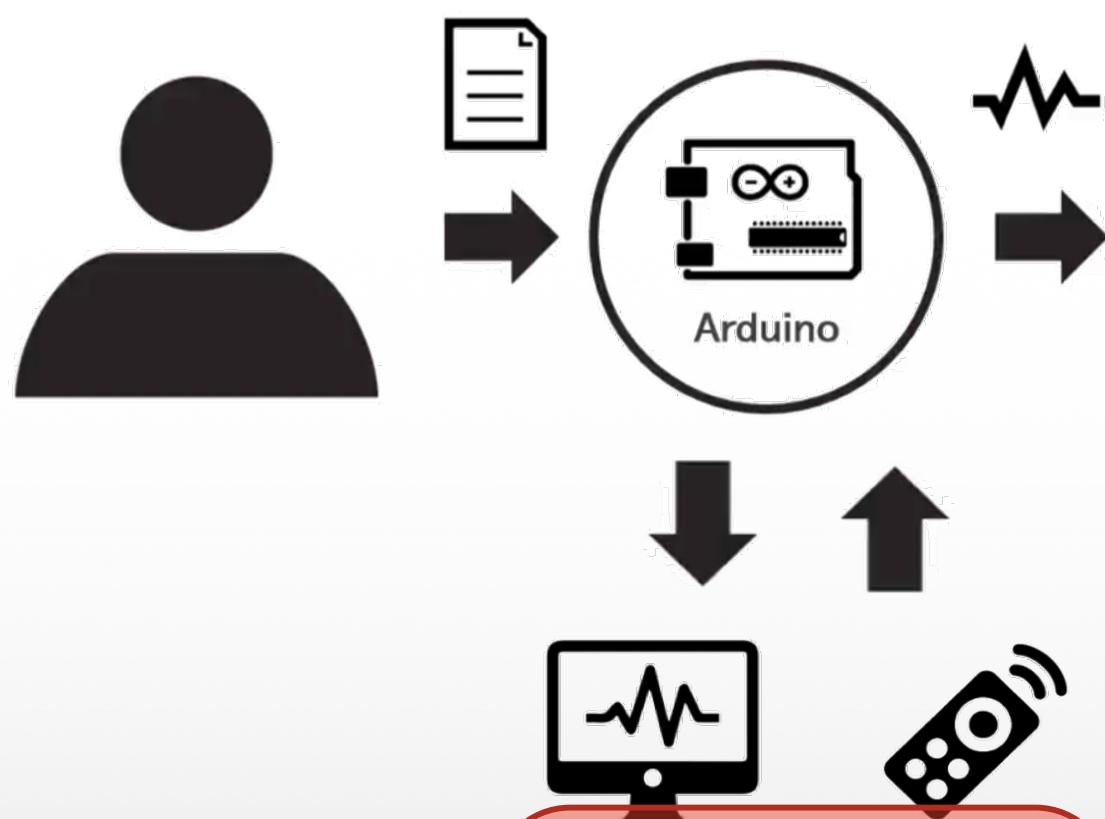
Sensing like humans

Not this class

Thinking like humans

Part 2

Acting like humans

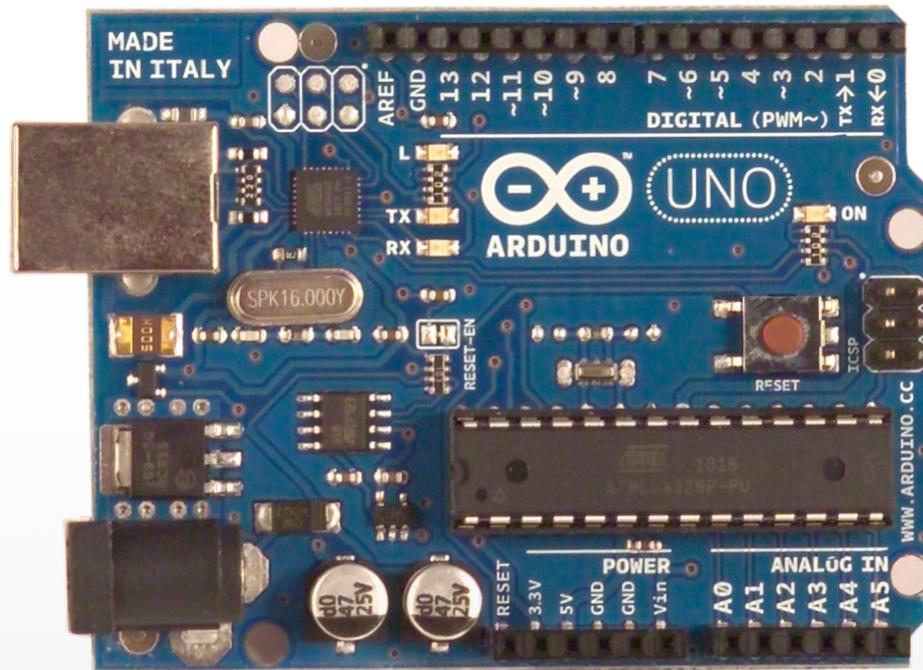


Part 3  
Remote monitoring and control



# Arduino

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

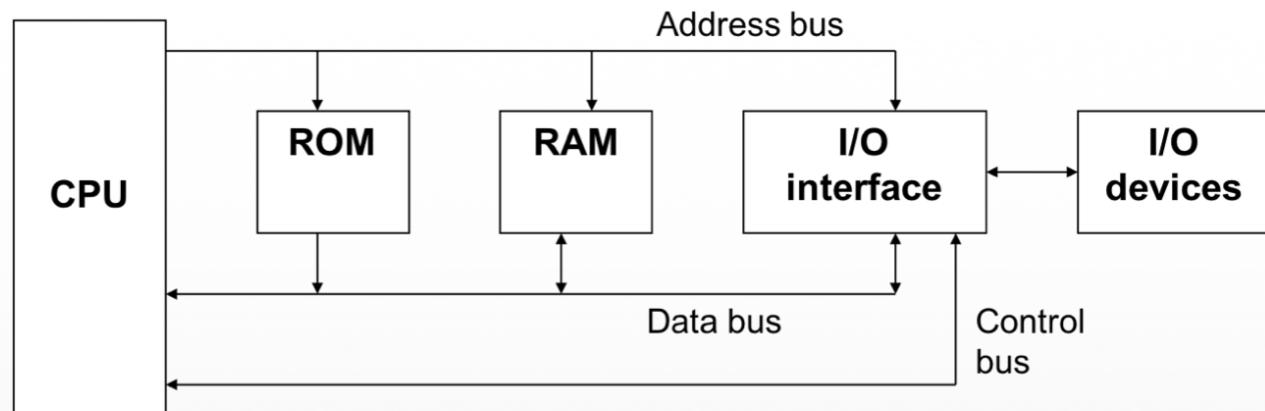




# Arduino / Microcontrollers

## a.k.a. Physical Computing

- “Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer.”



Block diagram of a basic computer system



# Comparison of MCU

	Arduino Mega 2560	8Bit Computer	Desktop
CPU	ATmega2560	Intel 8080	Intel Core i7
Bit	8	8	64
Memory	256 KByte	70 KByte	16 Gbyte
Clock	16 MHz (Single Core)	3 MHz (Single Core)	2.7 GHz (Hexa Core)
Price	약 25,000원 (ATmega2560)	450,000 (1984년)	약 1,600,000원



# Arduino Project

