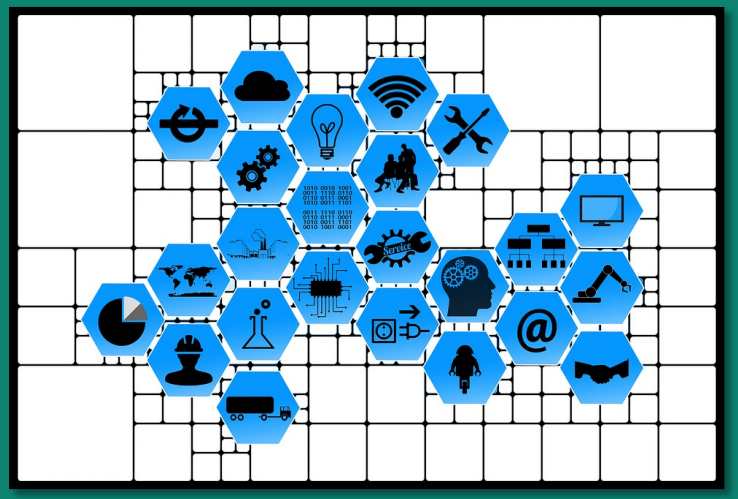

SIT123
Data Capture Technologies

Dr Imali Dias
imali.dias@deakin.edu.au

Lecture –Week 1
Trimester 2, 2022

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Introduction to SIT123 Data Capture Technologies

- Unit Teaching Team
- Unit Guide
- Lectures
- Practicals
- Assessments
- Introducing Sense-Think-Act

Unit Teaching Team

Unit Chair

Dr Imali Dias

Unit Teaching Team

Lecturer

Ben Philip

Unit Teaching Team

Tutor
Shafiuddin Mohammed

Cloud:
Tuesday 6 – 8 pm
Wednesday 6 – 8 pm

Unit Teaching Team

Tutor
Jason Pham

Monday 2 – 5 pm
Tuesday 2 – 5 pm

Unit Teaching Team

Tutor
Ashish Manchanda

Tuesday 2 – 5 pm

Unit Teaching Team

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Tutor
Mohamed Darweish

Monday 2 – 5 pm

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Unit Guide SIT123

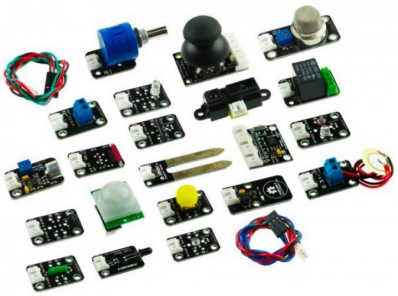
Lectures
Workshops
Assessment

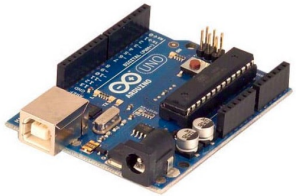
Unit Guide

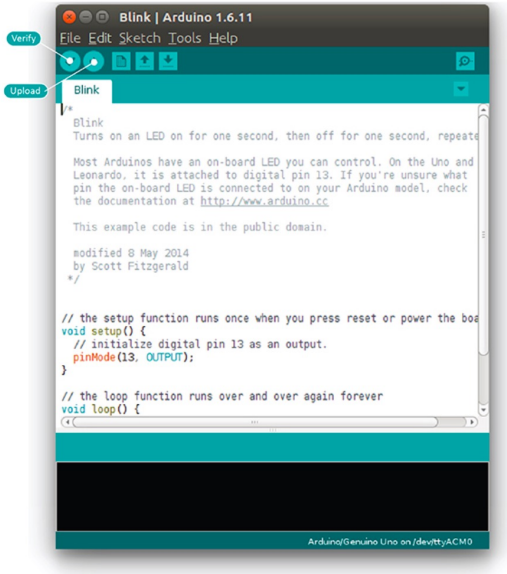
The unit guide will help you in understanding

1. Learning outcomes of SIT123
2. Unit structure (Lectures, Practicals)
3. Assessments and deadlines

Learning Objective







In this unit, you will learn about using sensor-enabled devices to capture and analyze data as well as visualization methods

SENSE – THINK – ACT

Key Dates

Trimester begins (classes begin)	Monday 11 July 2022
Intra-trimester break (a short break during the trimester)	Monday 15 August – Sunday 21 August 2022
Trimester ends (classes cease)	Friday 30 September 2022
Study period (examination preparation period)	Monday 3 October – Friday 7 October 2022
Examinations begin	Monday 10 October 2022
Examinations end	Friday 21 October 2022
Inter-trimester break (the period between trimesters)	Monday 24 October – Friday 4 November 2022
Unit results released	Friday 4 November 2022 (10:30 am)

Lectures

Week	Commencing	Topic	Assessment Activity
1	11 July 2022	Introduction	
2	18 July	Sensors	
3	25 July	Analyzing sensor data	Lab reports due this week
4	1 August	Ethics	
5*	8 August	Sensor output	Lab reports due this week
6	22 August	Data visualization	
7	29 August	Real world applications	Lab reports due this week
8	5 September	Mobile sensor data	Lab reports due this week
9	12 September	Sampling error	
10**	19 September	Presentation guidelines	Project code and report – online submission due this week
11	26 September	Q & A	Project poster and video presentation online submission

*Intra-trimester break: **Monday 15 August – Sunday 21 August 2022** (between weeks 5 and 6)

AFL Grand Final Eve (University closed) – **Friday 23 September 2022

Assessments

This unit has following two key forms of assessments:

1. Lab Reports - 50% [Due in Week 3, 5, 7 and 8]
2. Project [50%]
    - Code and Report [40%]
    - Project Poster [5%]
    - Video Presentation [5%]

NOTE: There will be no final exam in SIT123 in T2, 2022.

Lab Reports are to be done weekly, and have to be submitted via Cloud Deakin in weeks 3, 5, 7, and 8.

You will have a project involving the capturing and processing of sensor data. You will be submitting the project in week 10, and presenting the project poster and video presentation in week 11.

Lab Work/Practicals

	Practical/laboratory tasks
Brief description of assessment task	Students will demonstrate individual stages of acquisition, processing, visualisation and interpretation as well as the design of data capture protocols and methodologies to meet user and functional requirements through experiments, research, practical development and scientific enquiry.
Detail of student output	Students will produce four lab report forms evidencing their findings from practical investigations.
Grading and weighting (% total mark for unit)	50% Marked (15%, 15%, 10%, 10%)
This task assesses your achievement of these Unit Learning Outcome(s)	ULO1: Acquire, process, visualise and interpret data using existing devices and technologies ULO3: Design data capture protocols and methodologies to meet user and functional requirements
This task assesses your achievement of these Graduate Learning Outcome(s)	GLO1: assessed via student ability to demonstrate application of data capture techniques and concepts GLO4: assessed through student ability to analyse a given lab task and identify the sensing and analysing methods to be used GLO5: assessed through student ability to design a solution to a specific problem
How and when you will receive feedback on your work	Students are encouraged to interact with the teaching staff during practical sessions The students will be provided feedback on their assessment after it has been marked. Tutors will mark the assessment during the practical sessions in weeks 3,5,7 and 8.
When and how to submit your work	Lab report forms to be submitted via the unit site (accessed in DeakinSync) by Friday 8:00 pm (AEST) in weeks 3, 5, 7 and 8.

Lab Work/Practicals

Lab Work	Week Due	Due Date	Marks
Week 1 + 2	3	29th July 2022	15%
Week 3 + 4	5	12th August 2022	15%
Week 5	7	2nd September 2022	10%
Week 6 + 7	8	9th September 2022	10%

Weekly Lab Work details:

1.Lab work week 1: Arduino Blink
2.Lab work week 2: 2.1 Getting started with sensor, 2.2 preparing data
3.Lab work week 3: 3.1 Using the data shield, 3.2 Analyse motion sensor
4.Lab work week 4: Collect GPS data using mobile apps
5.Lab work week 5: 5.1 Ethical issues, 5.2 data capture scenarios
6.Lab work week 6: Test motion sensor for range and fov
7.Lab work week 7: Data Visualisation

Practical Sessions

On-campus Workshops:

- Every Monday: 2:00 pm – 5:00 pm (B1.28) – Jason, Mohamed
- Every Tuesday: 2:00 pm – 5:00 pm (LC4.107) – Ashish, Jason

Cloud Workshops:

- Every Tuesday: 6:00 pm – 8:00 pm (MS Teams) - Shafiuddin
- Every Wednesday: 6:00 pm – 8:00 pm (MS Teams) - Shafiuddin

Communication

Unit Chair, Lecturer

- Queries related to unit administration
  - Enrolment
  - Assessment extensions
  - Special consideration
- Last 5-10 minutes of the lectures
- Emails, MS Teams messages (Monday – Friday working hours AEST)
- Discussion Board (responses in 2-3 business days)
- Personal meetings (by appointment)

Lab Tutors

- Queries around
  - Lab work
  - Technical issues
  - Marking feedback (reports and final project)
- In-person meetings during Workshops
- Discussion board

Welcome to SIT123
Data Capture Technologies

School of Information Technology

Class
Week 1

DATA CAPTURE TECHNOLOGIES:

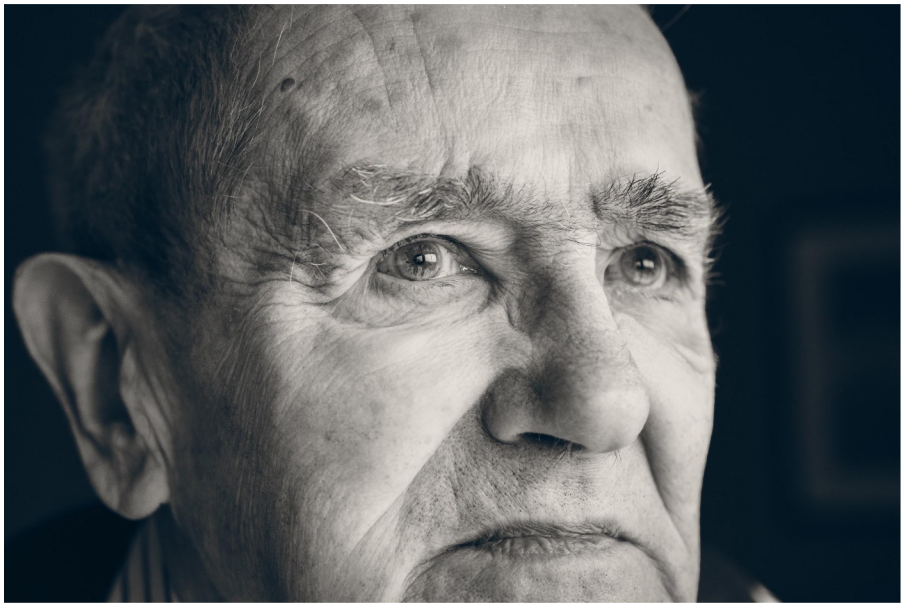
1. Use sensors to record data from the environment (**SENSE**)
2. Analyse the collected data (**THINK**)
3. Draw conclusions from the data (and) perform actions (**ACT**) such as automating functions, visualizing and taking informed decisions.

DATA CAPTURE TECHNOLOGIES:

Sense-Think-Act: Overview

DATA CAPTURE TECHNOLOGIES:

Example: Smart Homes for Aged Care

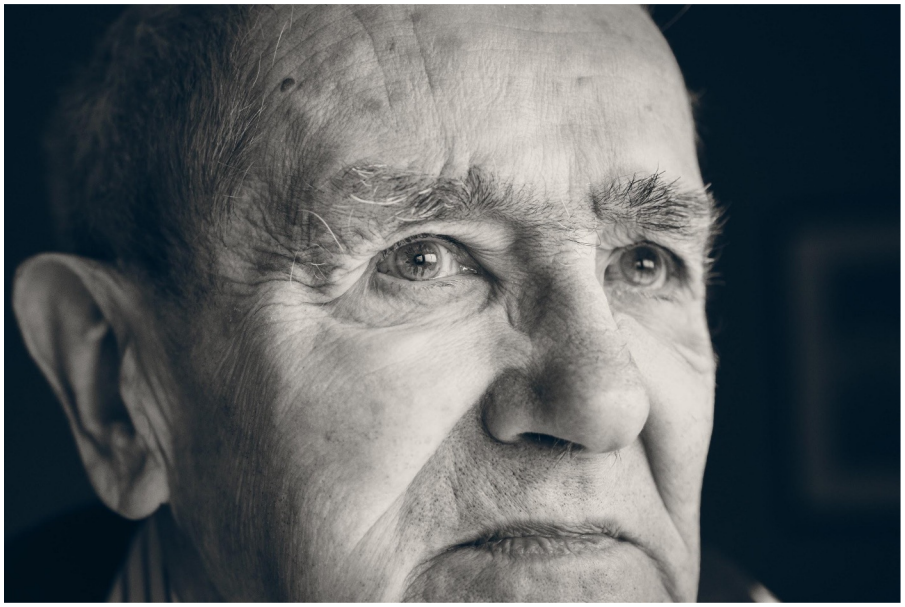


Imagine having a home that detects when its occupant is not well.

Using the occupant's usual activity patterns (morning routine, sleep patterns, time spent outdoors etc) , and inputs from the occupants mobile phone, the home is able to identify falls/sickness etc and notify care providers and issue warnings to the occupants.

DATA CAPTURE TECHNOLOGIES:

Example: Smart Homes for Aged Care



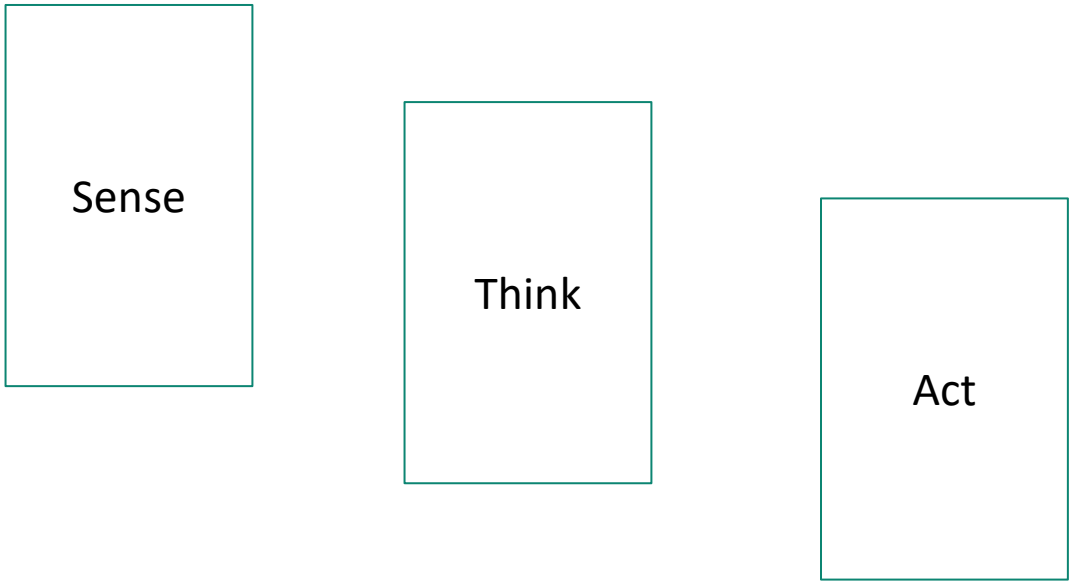
How does the smart home system capture data?

How does the smart home system process the captured data?

How does the smart home system use the information?

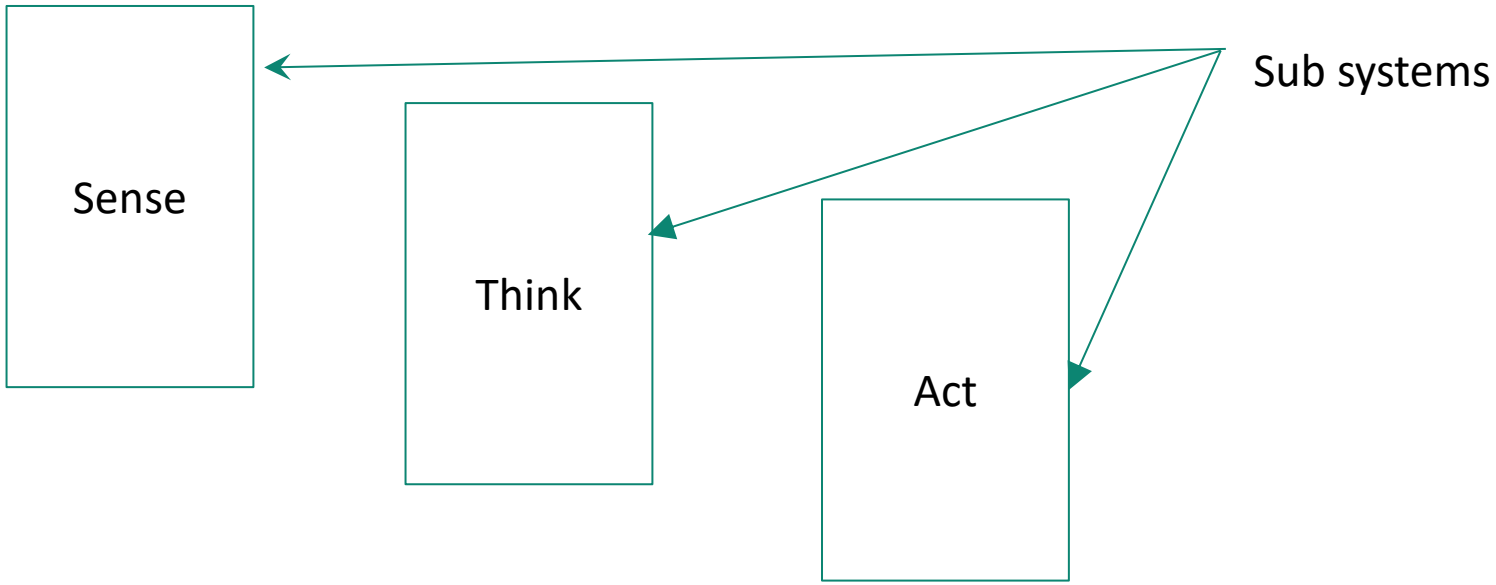
DATA CAPTURE TECHNOLOGIES:

Sense-Think-Act



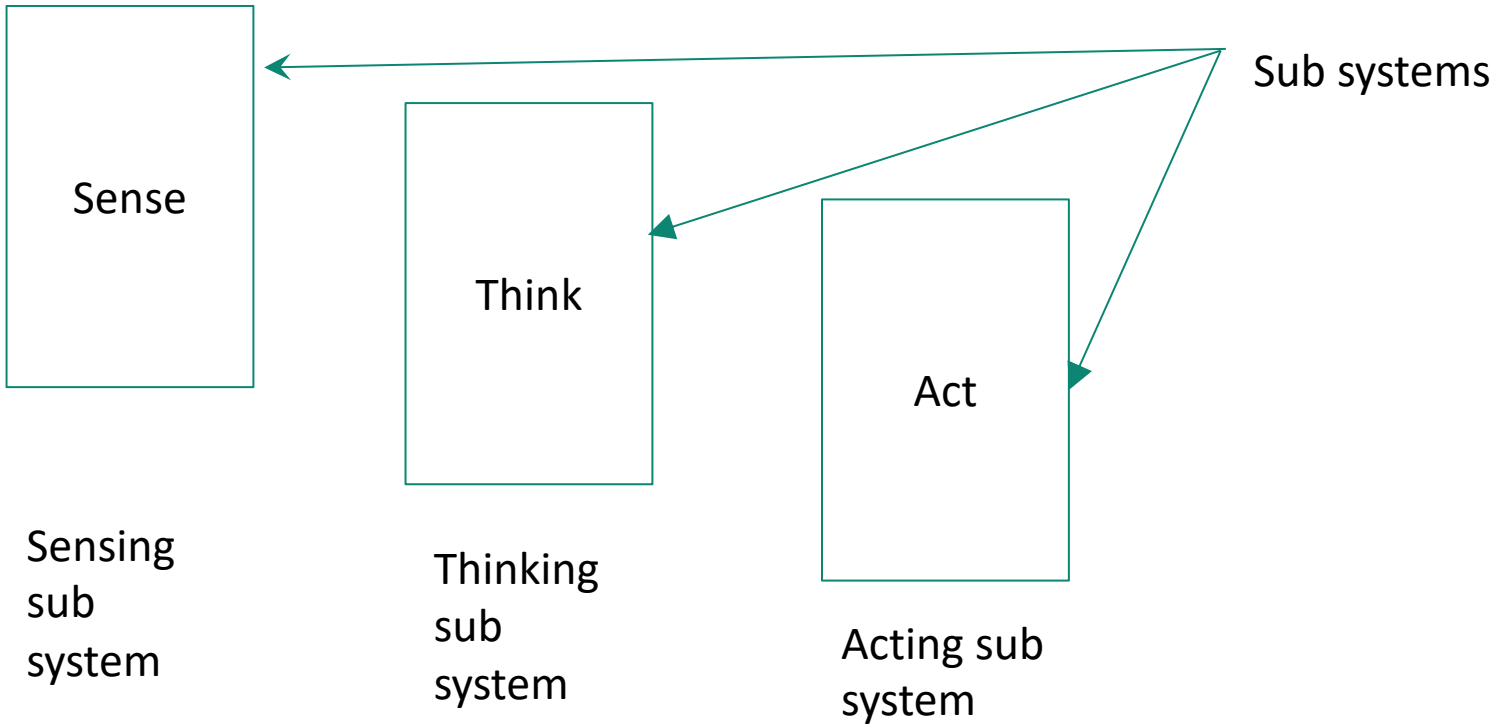
DATA CAPTURE TECHNOLOGIES:

Sense-Think-Act Subsystems



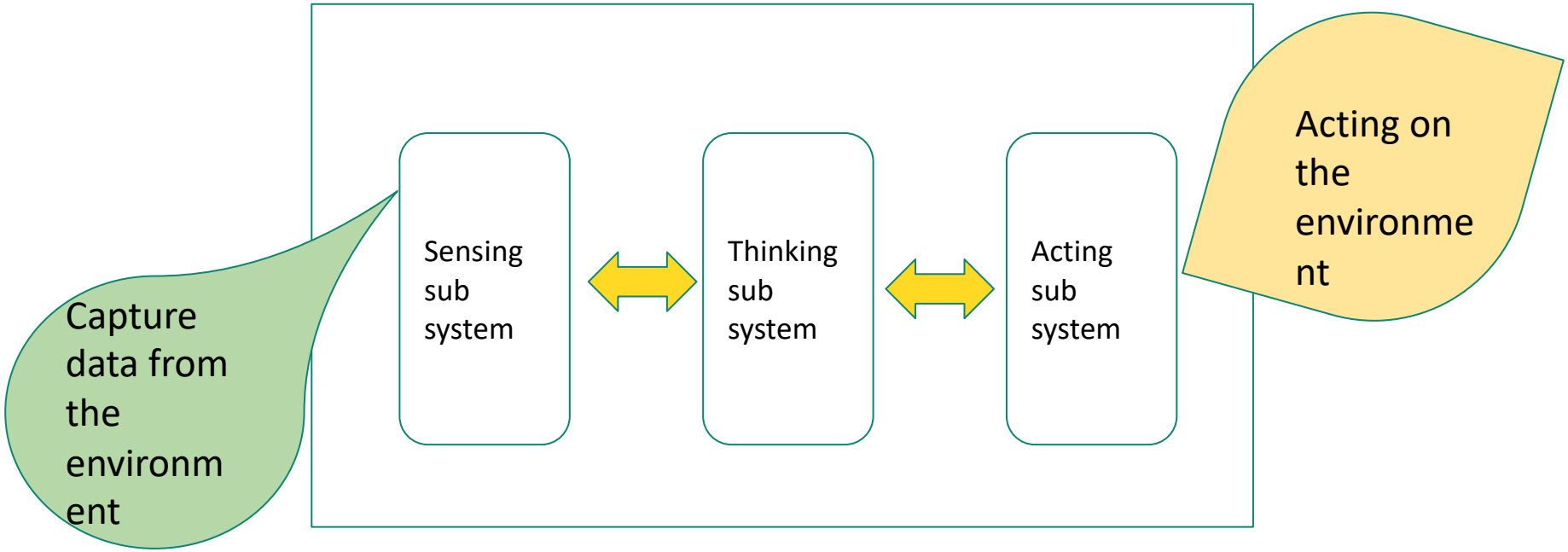
DATA CAPTURE TECHNOLOGIES:

Sense-Think-Act Subsystems



DATA CAPTURE TECHNOLOGIES:

Complex systems are made of subsystems...



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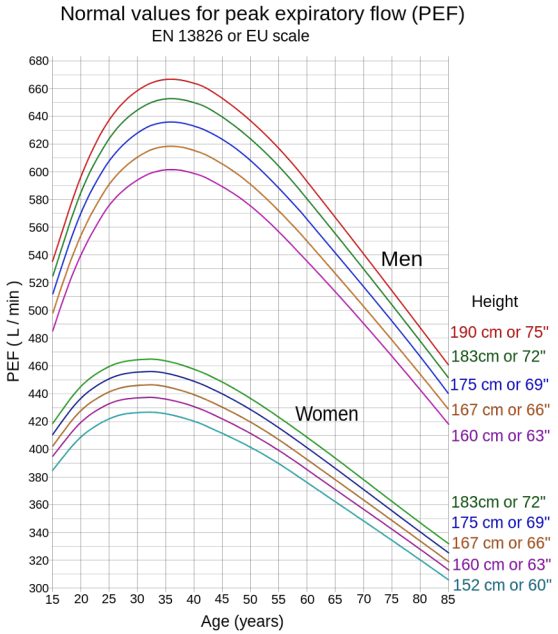
Sensing

DATA CAPTURE TECHNOLOGIES:

Why Sense?



https://commons.wikimedia.org/wiki/File:Lung_Volumes_Measurement_by_Body_Plethysmography.jpg

By Mikael Häggström - Nunn, A. J., and I. Gregg. 1989. New regression equations for predicting peak expiratory flow in adults. Br. Med. J. 298: 1068-1070 .Adapted by Clement Clarke for use in EU scale - see Peakflow.com > Predictive Normal Values (Nomogram, EU scale), Public Domain, https://commons.wikimedia.org/w/index.php?curid=8959642

DATA CAPTURE TECHNOLOGIES:

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Sensing/Sensors

Collect information about the world

Motion

Velocity and acceleration

Force

Pressure

Flow

Sound

Moisture

Light

Radiation

Temperature

Position

Chemical presence

…. Many more

DATA CAPTURE TECHNOLOGIES:

Sensing/Sensors in the Human Body

Hear
See
Taste
Smell
Touch

DATA CAPTURE TECHNOLOGIES:

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Sensing/Sensors

Sensor - an electrical/mechanical/chemical device that maps an environmental attribute to a quantitative measurement

Eg: motion controlled lights. **A motion sensor** listens for movement and when movement is detected, sends a signal to electronically turns on the lights.

DATA CAPTURE TECHNOLOGIES:

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Sensing/Sensors Applications

Examples:

Sensors in cars that aid in lane changing, reversing, parking

Lights that come on when there is movement

Gaming controls such as the Wii sensor

Automatic Air Con & Heating that regulates the air temperature

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Thinking/Processing

DATA CAPTURE TECHNOLOGIES:

Let's do an Experiment

What does this say?

DATA CAPTURE TECHNOLOGIES:

How about this…?

What does this say?

DATA CAPTURE TECHNOLOGIES:

Thinking/Processing

This sub-system interfaces with the environment and gets raw data, which then gets processed by various components into useful information/decisions.

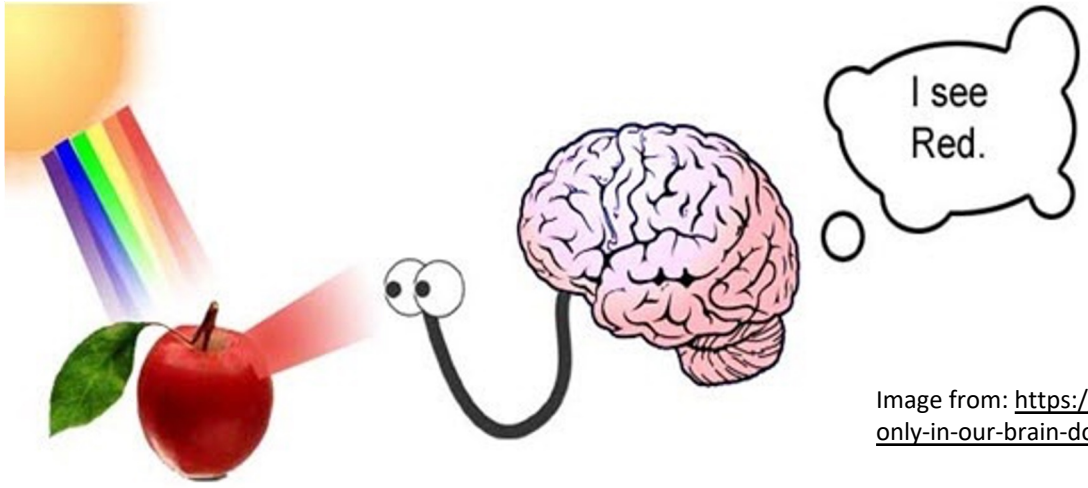
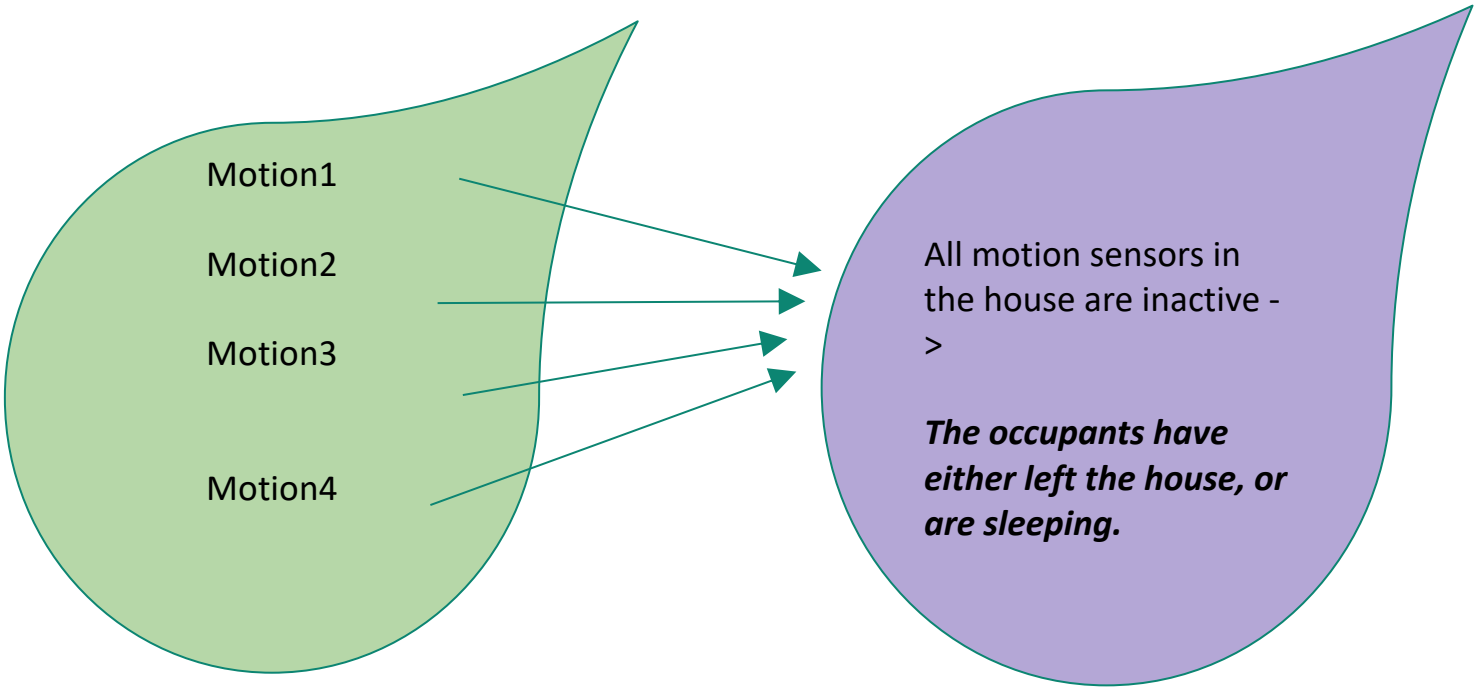


Image from: https://www.quora.com/Does-light-and-colour-exist-only-in-our-brain-do-blind-people-see-the-world-as-it-really-is

DATA CAPTURE TECHNOLOGIES:

Thinking/Processing in a Smart Home



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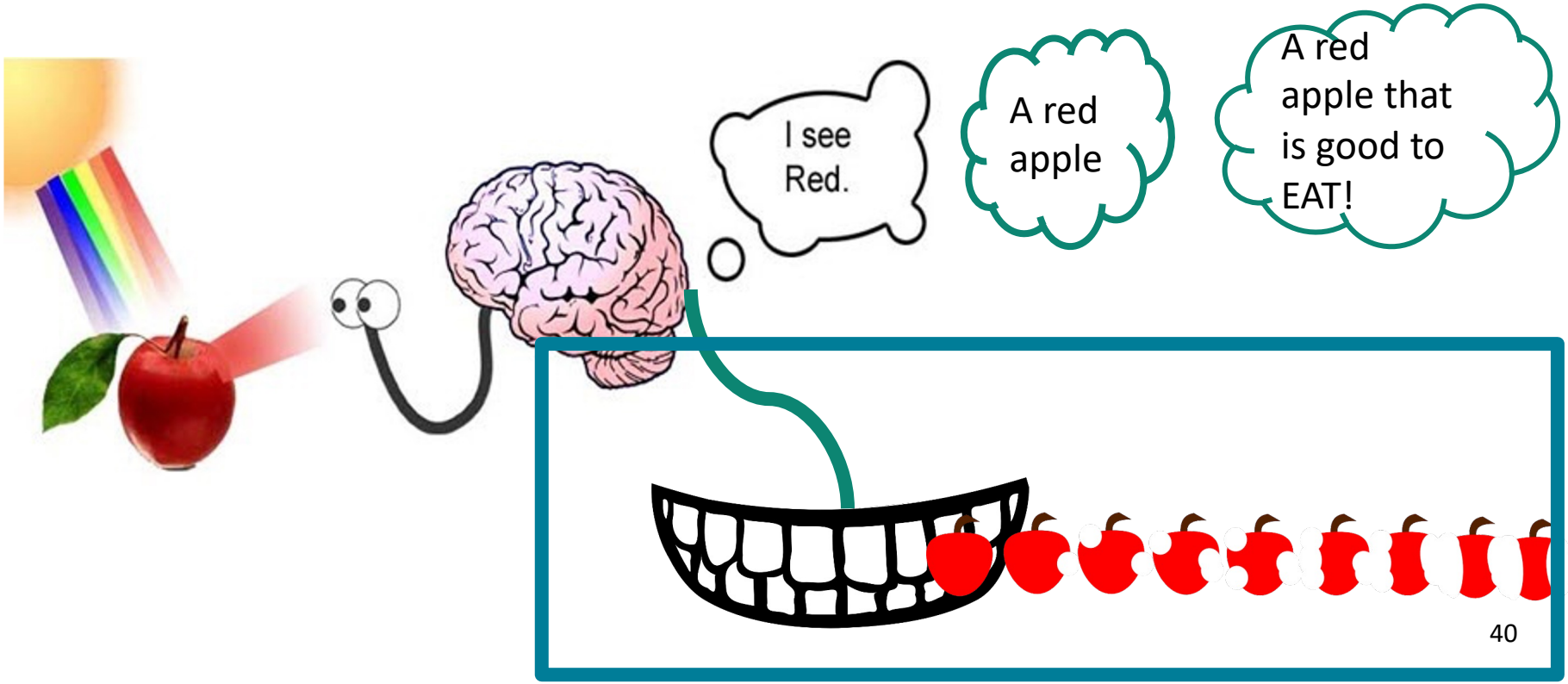
Acting

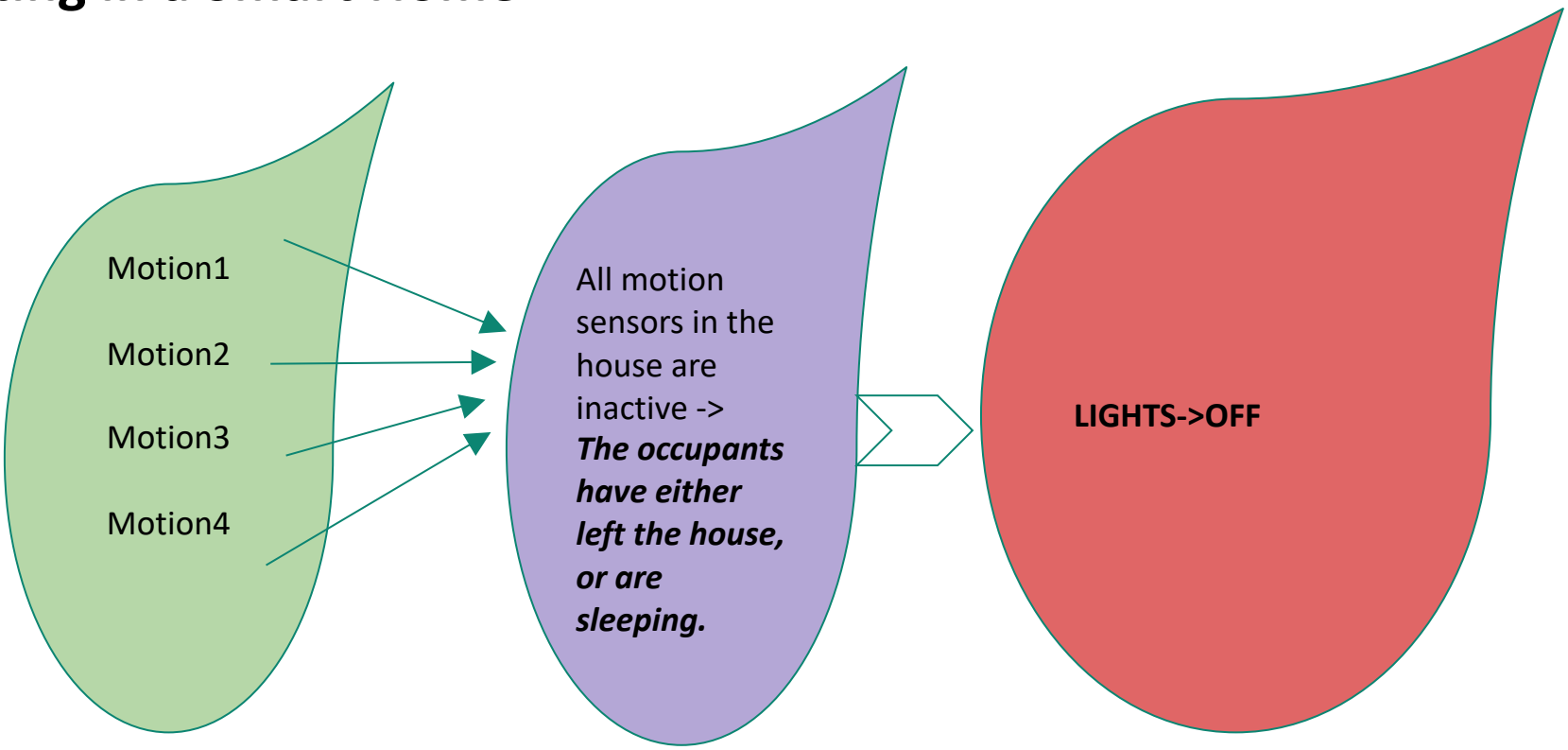
DATA CAPTURE TECHNOLOGIES:

Acting



DATA CAPTURE TECHNOLOGIES:

Acting in a Smart Home



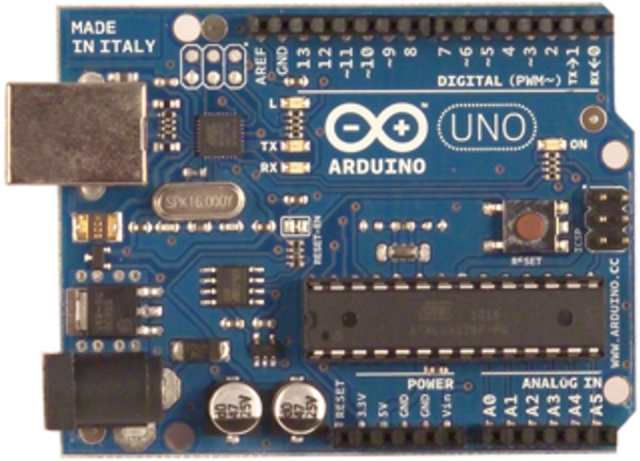
DATA CAPTURE TECHNOLOGIES:

We will be using Arduino to capture data...

Arduino is an electronic prototyping platform.

IDE software that runs on your computer (Integrated Development Environment)

Microcontroller (physical circuit board)



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Starting programming Arduino: Bare minimum code

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


DATA CAPTURE TECHNOLOGIES:

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setup() & loop()

setup : called only when the Arduino is powered on or reset. It is used to initialize values.

loop : runs continuously till the device is powered off. The main logic of the code goes here.

Dont worry too much if these don't make much sense yet. You will understand the concept of a loop as you learn more about programming

DATA CAPTURE TECHNOLOGIES:

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What's a 'loop' in programming?

Example:

You want to sense the air temperature every minute.

Sequence of instructions:

START-> sense air temperature (TIME = 10:00:00)

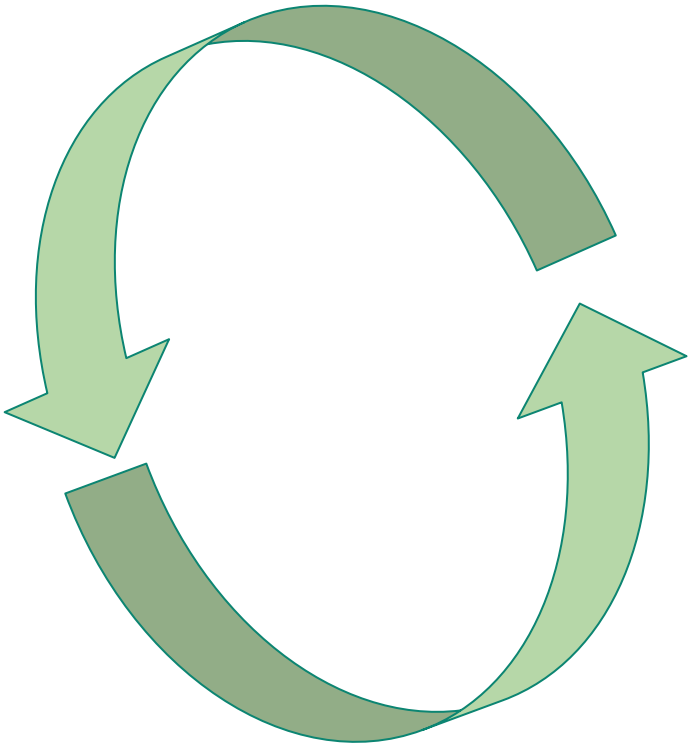
Wait one minute
sense air temperature (TIME = 10:01:00)
Wait one minute
sense air temperature (TIME = 10:02:00)
Wait one minute
sense air temperature (TIME = 10:03:00)
Wait one minute
sense air temperature (TIME = 10:04:00)
Wait one minute
.....

DATA CAPTURE TECHNOLOGIES:

That's a lot of repetition….

Repeating two steps over and over again…

sense air temperature
wait one minute



Loops repeat steps

DATA CAPTURE TECHNOLOGIES:

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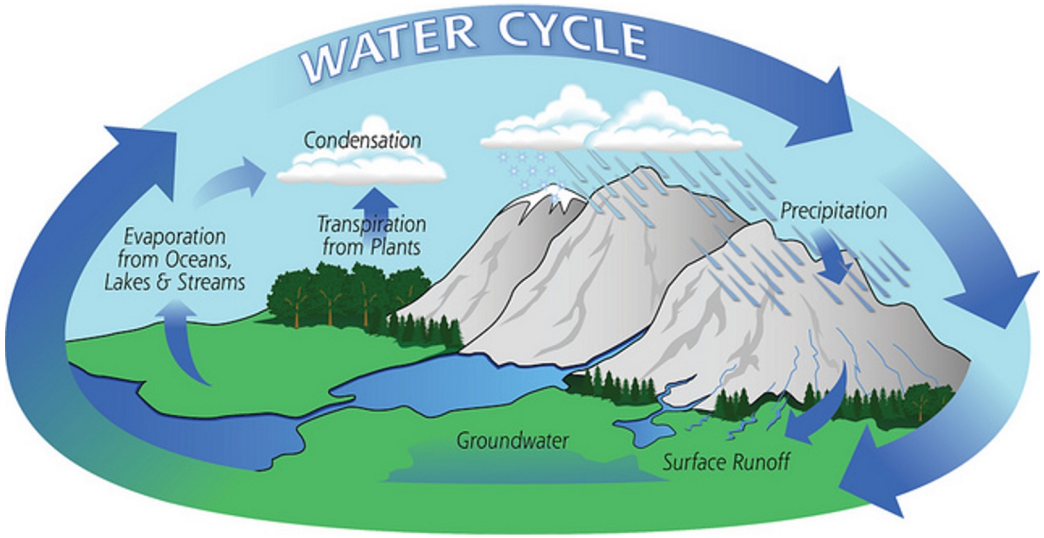
Loops in real-life




```
loop() {
    evaporate();
    condense();
    precipitate();
}
```


https://www.flickr.com/photos/atmospheric-infrared-sounder/8265046380

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Starting programming Arduino: Bare minimum code

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


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Arduino Pin Mode

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

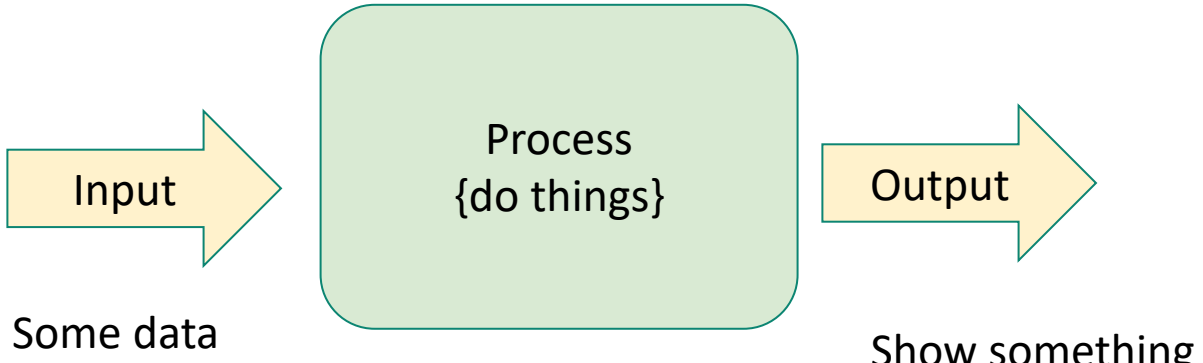
pinMode(13, OUTPUT); // sets pin 13 as output pin

pinMode(13, INPUT); // sets pin 13 as input pin

DATA CAPTURE TECHNOLOGIES:

Input/Output??

Also called I/O

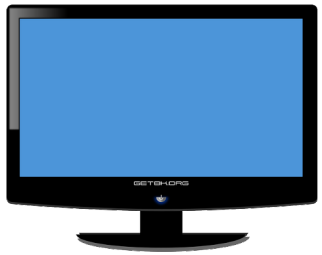


DATA CAPTURE TECHNOLOGIES:

I/O in a typical computer...

Input devices	Output devices
Mouse, keyboard, scanner, joystick, ...	Display, speakers, printer,...






Images: https://commons.wikimedia.org/wiki/File%3ABijoy_Keyboard_image.jpg , https://commons.wikimedia.org/wiki/File:Logitech-usb-speakers.jpg

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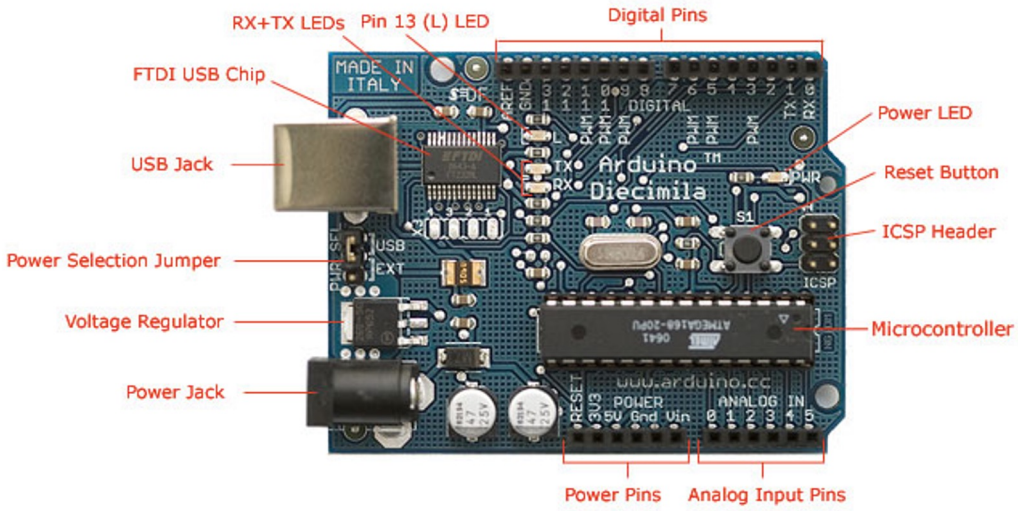
I/O on Arduino

A typical Arduino board can have 14 digital input/output pins & 6 analog inputs.

We use the input pins to give input data to the Arduino board. Example: attach sensors.

We use the output pins to give instructions to actuators. Example: light an LED, turn on a motor, make a sound etc.



Photograph by SparkFun Electronics. Used under the Creative Commons Attribution Share-Alike 3.0 license.

Image: http://mediatechnology.leiden.edu/openaccess/arduino

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Arduino Pin Mode

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

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

Pass instructions to an actuator connected to pin 13

pinMode(13, INPUT); // sets pin 13 as input pin

Take data from a sensor connected to pin 13

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Arduino Constants

Arduino constants are pre-defined values that never change.

Pin modes: INPUT, OUTPUT

Changing a pin with `pinMode()` changes the electrical behavior of the pin.

Pin levels: HIGH & LOW

built-ins: LED_BUILTIN

Most Arduino boards have a pin connected to an on-board LED in series with a resistor. The constant `LED_BUILTIN` is the number of the pin to which the on-board LED is connected. Most boards have this LED connected to digital pin 13.

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Writing digital values

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

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

NOTE: Reading values (inputs) to be discussed next week

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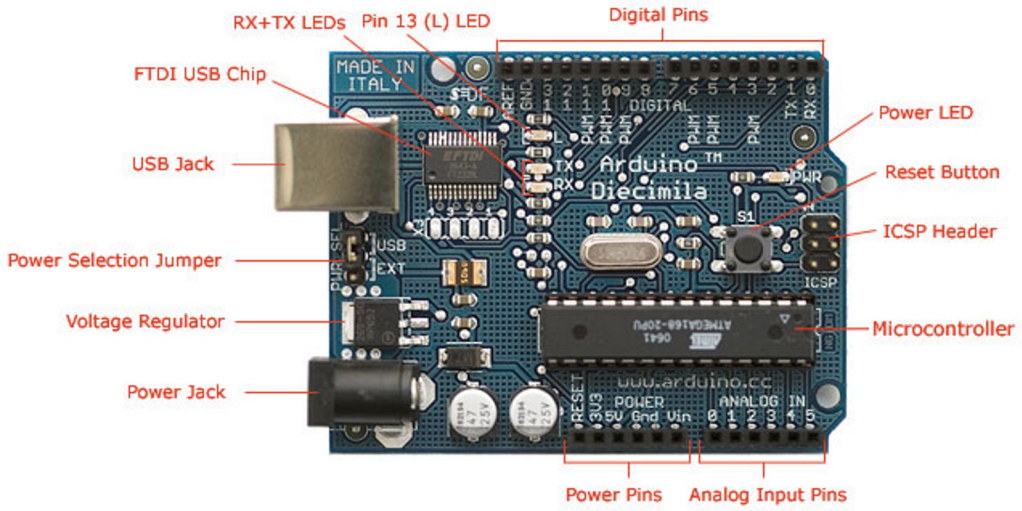
Arduino built-in LED

The Arduino has an on-board surface mount LED that's hard wired to digital pin 13. It's the one with an "L" next to it:



Photograph by SparkFun Electronics. Used under the Creative Commons Attribution Share-Alike 3.0 license.

Image:
http://mediatechnology.leiden.edu/openaccess/arduino

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Arduino built-in LED

```
// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  pinMode(LED_BUILTIN, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(LED_BUILTIN, HIGH);    // turn the LED on (HIGH is the voltage level)
  delay(1000);                        // wait for a second
  digitalWrite(LED_BUILTIN, LOW);     // turn the LED off by making the voltage LOW
  delay(1000);                        // wait for a second
}
```


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Etiquette & General Guidelines...

DATA CAPTURE TECHNOLOGIES:

Some things to remember...

We are learning about an emerging paradigm.

The technology will change and continue to evolve!

We teach you the underlying ideas and how things are done today. So you will know how to learn the future technologies!

Any Questions!