



I N T E R N E T O F T H I N G S -  
A L E A R N I N G  
E X P E R I E N C E

S C H O O L   G A R D E N S  
F O R   F U T U R E  
C I T I Z E N S

2018-1-ES01-  
KA201-050599

#ESGARDEN



# R E A L G A R D E N S V S V I R T U A L G A R D E N S



Do you know what the Internet of Things (IoT) is? IoT connects things around the world. The “things” are smart devices such as phones, tablets or watches, or small sensors hidden in our cities, houses, green spaces, or... in your school garden.

To understand how to install IoT in our school garden, first we need to understand the advantages and disadvantages of our small sensors.

Sensor devices are lightweight and handy, so they can be easily embedded in our environment. Moreover, we can build low-cost devices, and by building these devices with our students we also promote many STEAM competences to work with.

On the other hand, as a disadvantage, sensor devices are “low intelligence”, meaning they are unable to store much data and can only carry out processes that are not very complex.

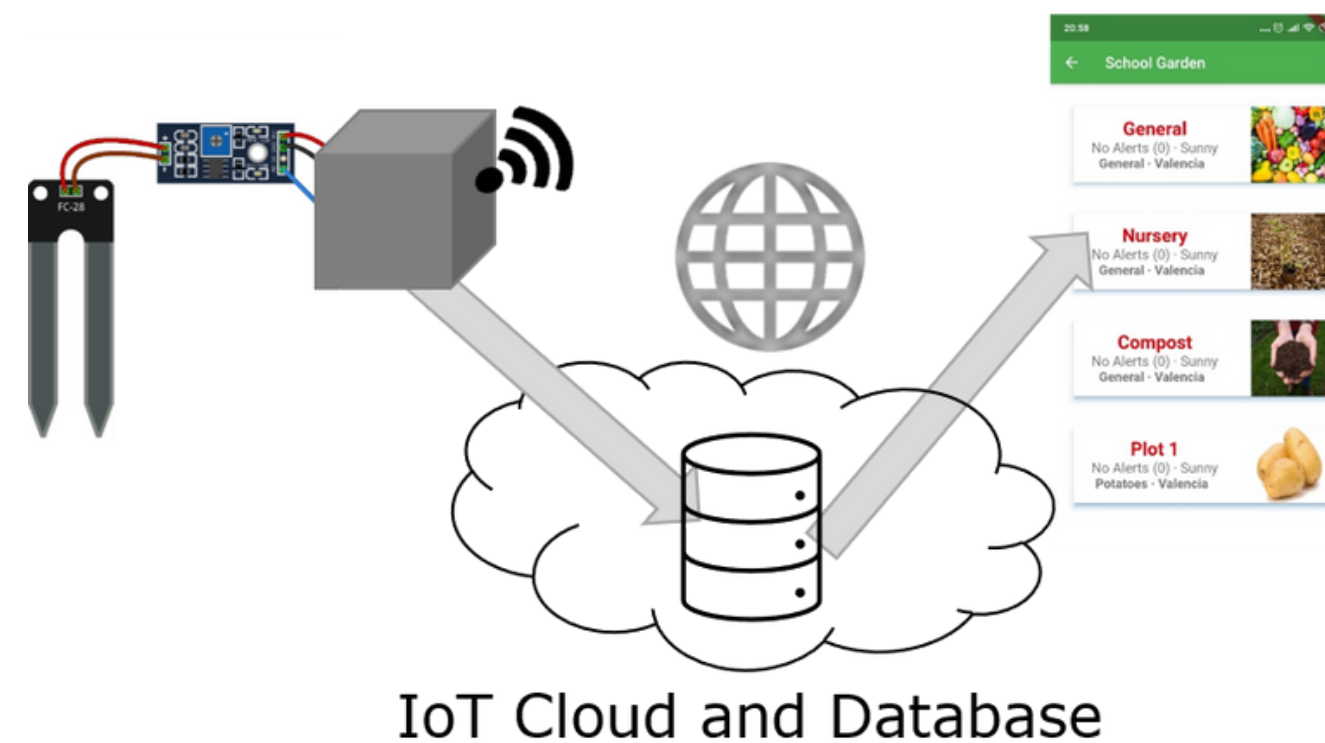
# THE IOT PARADIGM

The solution is to connect the “things” with the internet network. Data collected by the sensors is uploaded to the network and travels, either through cables, through the air, or with the support of satellites, to a bigger brain, the “cloud”, which connects all your things. The IoT cloud receives DATA. It is able to store thousands of pieces of DATA and send information to your smart device: phone, tablet, etc.



REAL GARDEN

VIRTUAL GARDEN





## SPACES

A garden is not a simple mesh of vegetables. A school garden has different spaces.



### GENERAL PARAMETERS

Physics and mathematics competencies can be practised and learned by gathering data from your garden. There are many ambient parameters that you can measure with a weather station. These parameters affect both the growth cycle of crops and human health. Consider building a weather station. Moreover, this activity can also relate to technology and informatics by introducing your students to a DIY project

### A NURSERY FOR SEEDS

You should consider preparing a suitable space for seeds and seedbeds. Look for a space in a classroom near a window, or in a greenhouse. Students can observe and monitor the process from seeds to plants in addition to maintaining adequate temperature, humidity and lighting conditions. Use recycled materials such as bricks, yoghurt pots, or paper cups.

### A COMPOST MACHINE

Another space you should take into account will house the compost, which has a twofold objective. First, it will provide the plants with nutrients through an organic process. And second, the composting process is related with physical and chemical principles that connect with curricular learning.



## THE CORE

Plan and organize your vegetables in plots.



## THE PLOTS

The most important part of your garden are the plots. You must divide your garden into plots depending on the area of land dedicated to each crop. Bear in mind that although some crops can share water requirements not all of them can, so divide the garden into plots. We assume that each plot has different water requirements.

# STEPS 1, 2, 3



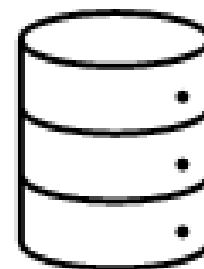
## SENSORS

Sensors are useful to observe our garden and make important decisions. Considering the school garden structures, we could add sensors such as temperature, moisture, radiation, etc.

<https://www.arduino.cc>

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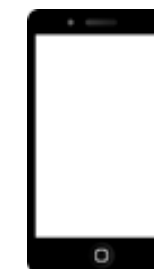
## DATABASE

You need a space in the cloud to store the data. Use a service-type cloud. We have used Google's Firebase.

<https://firebase.google.com>

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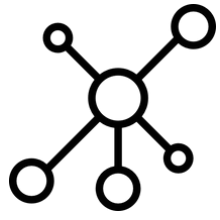
## APP

Develop a serious and educational APP for your technology project. Organize spaces, add sensors, and use graphs to visualize sensor data. We have used Android Studio and Flutter to connect the APP with Firebase.

<https://www.flutter.dev>

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# COMMUNICATION

## INDOOR

Use your WiFi school network for indoor communication between sensors - ARDUINOS - and the Cloud. Choose an ARDUINO board with a WIFI chip.



## OUTDOOR

Use LoRa shields to communicate outdoor sensors with an indoor gateway. The gateway must be able to receive by LoRa and forward by WiFi to the cloud.







# THE DATA



## A DATABASE IN THE CLOUD

ARDUINO boards with WiFi chip can send sensed data directly to a cloud database service. You should manage AUTHENTICATION, PRIVATE KEYS OR SECRETS, SECURITY RULES and APP SECURE CONNECTION.



## THE APP

Build an friendly APP to visualize sensed data in graphs. Use a plugging to connect the APP with your cloud database service. Define an AUTHENTICATION mechanism for teachers to modify data in the database directly from the APP. Students' role allow them a controlled the access to the graphs.

## KEEP MOVING FORWARD



### LEARN MORE ABOUT

Find useful material in our web page or immerse yourself with a Massive Open Online course in UPVx.

### RELATION WITH SOCIETY

Explore eTwining platform to find technologic projects or ask to our school partners:

- La Purísima Hna. Franciscanas, Valencia, Spain
- Osnovna sola Smartno pod Smarno goro, Ljubljana, Slovenia
- Agrupamento de Escolas de Paredes in Porto, Portugal
- The 4th in Preveza, Greece

# TITLE OF THE ACTIVITY



## MULTIMEDIA LINKS

**YouTube channel:**

[https://www.youtube.com/channel/UC\\_jVO7h-8Ymnua\\_AVFIDk8w](https://www.youtube.com/channel/UC_jVO7h-8Ymnua_AVFIDk8w)

**Webside:**

<http://esgarden.webs.upv.es/>

**Blog:**

<https://esgarden.blogs.upv.es/>

**Twitter:**

<https://twitter.com/eschoolgarden>



## DIGITAL RESOURCES

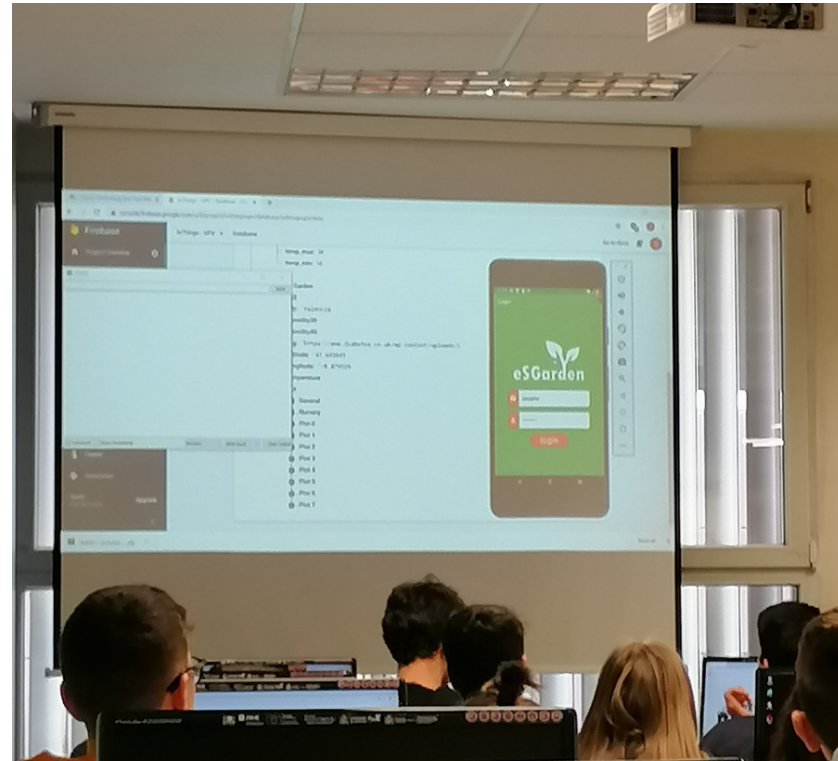
**APP code for Android Studio:**

<https://github.com/senenpalanca/esgarden>

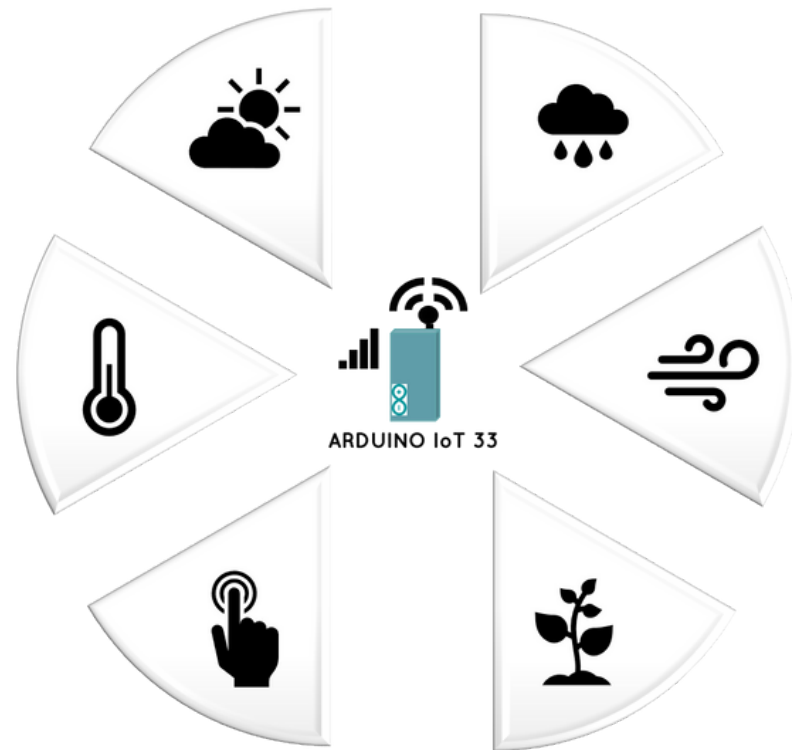
**ARDUINO projects:**

<https://github.com/esgardenArduino>

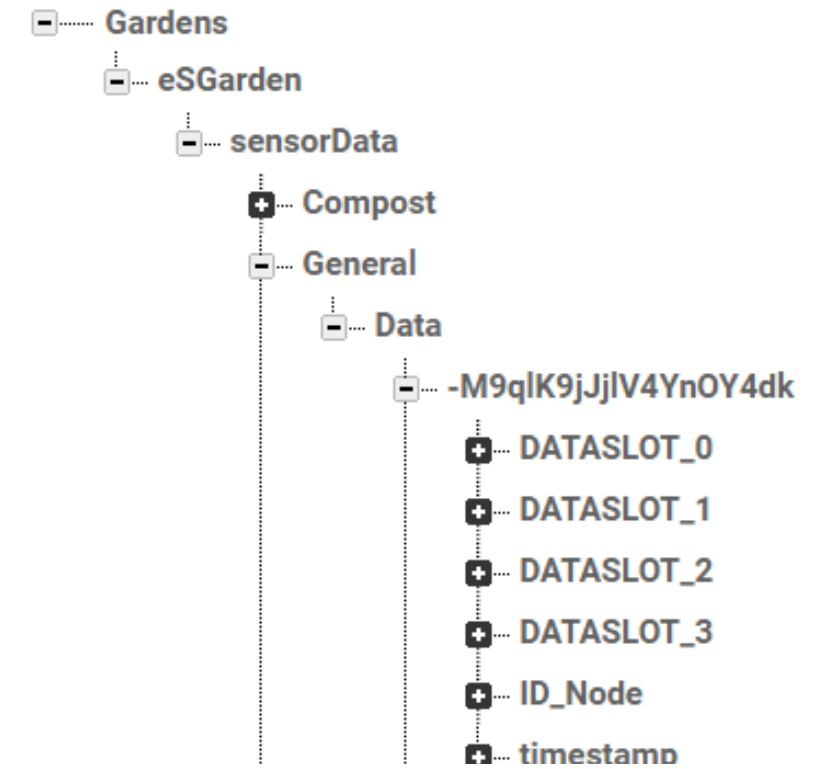
# PHASE 1 - LEARN AND DESIGN



Starting the project with a seminar about IoT with students and teachers.

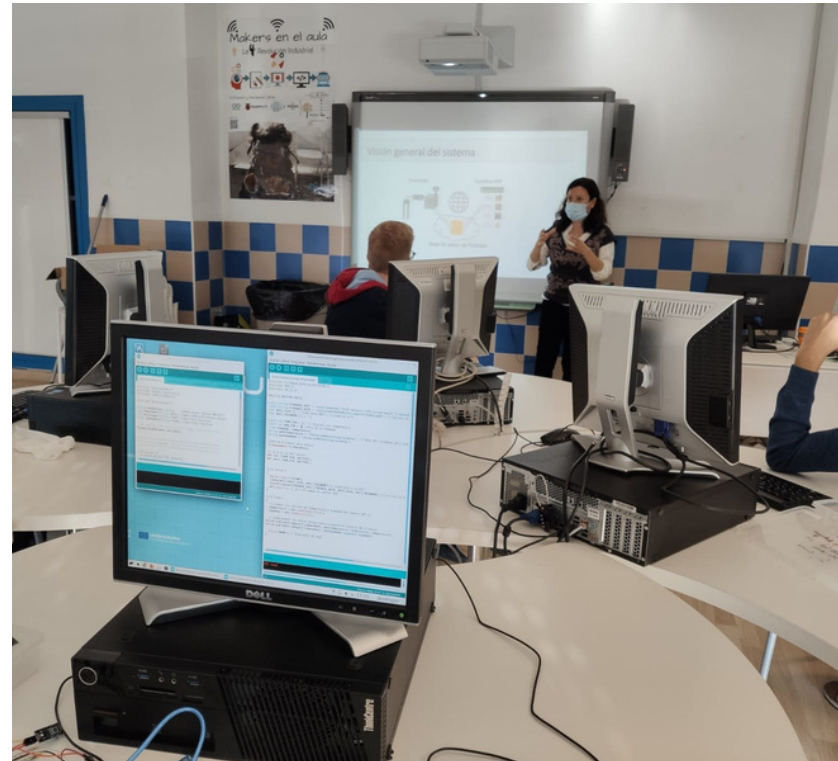


Designing the relation microcontroller-sensors.



Designing the cloud database.

## PHASE 2- PLAN AND DESIGN



Coding our kits of Arduino in class with our students.



Planning spaces ...



... to connect sensors and necessities.

# PHASE 3- BUILD AND SMILE



Building the "boxes" with Arduino's kits and sensors.



Enjoying the experience.



Disseminating the experience through our blog.



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