IMPROVING THE PHYSICS LABORATORY EXPERIENCE THROUGH SENSORS ON A WIRELESS OPEN SOURCE HARDWARE AND SOFTWARE PLATFORM

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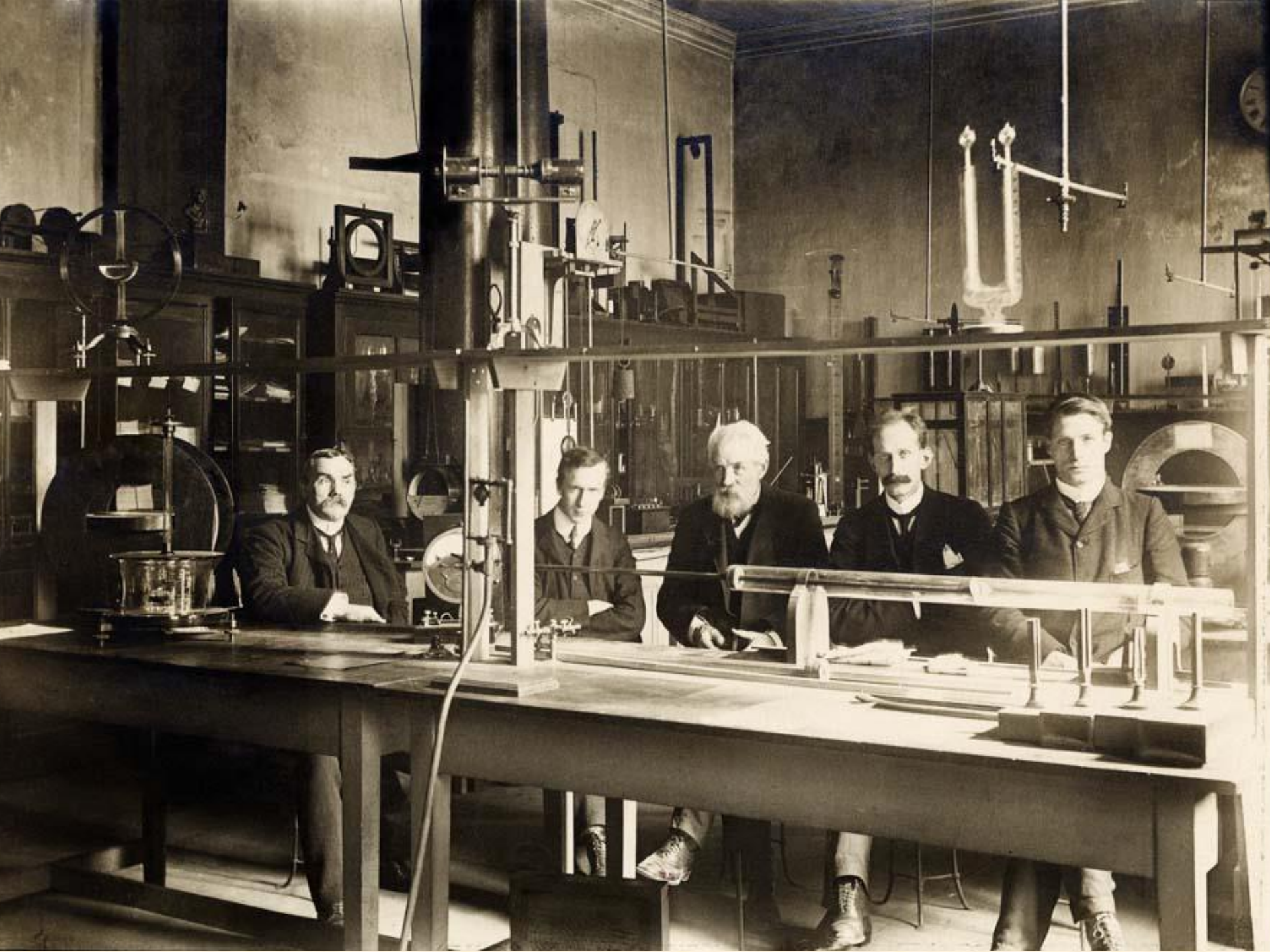
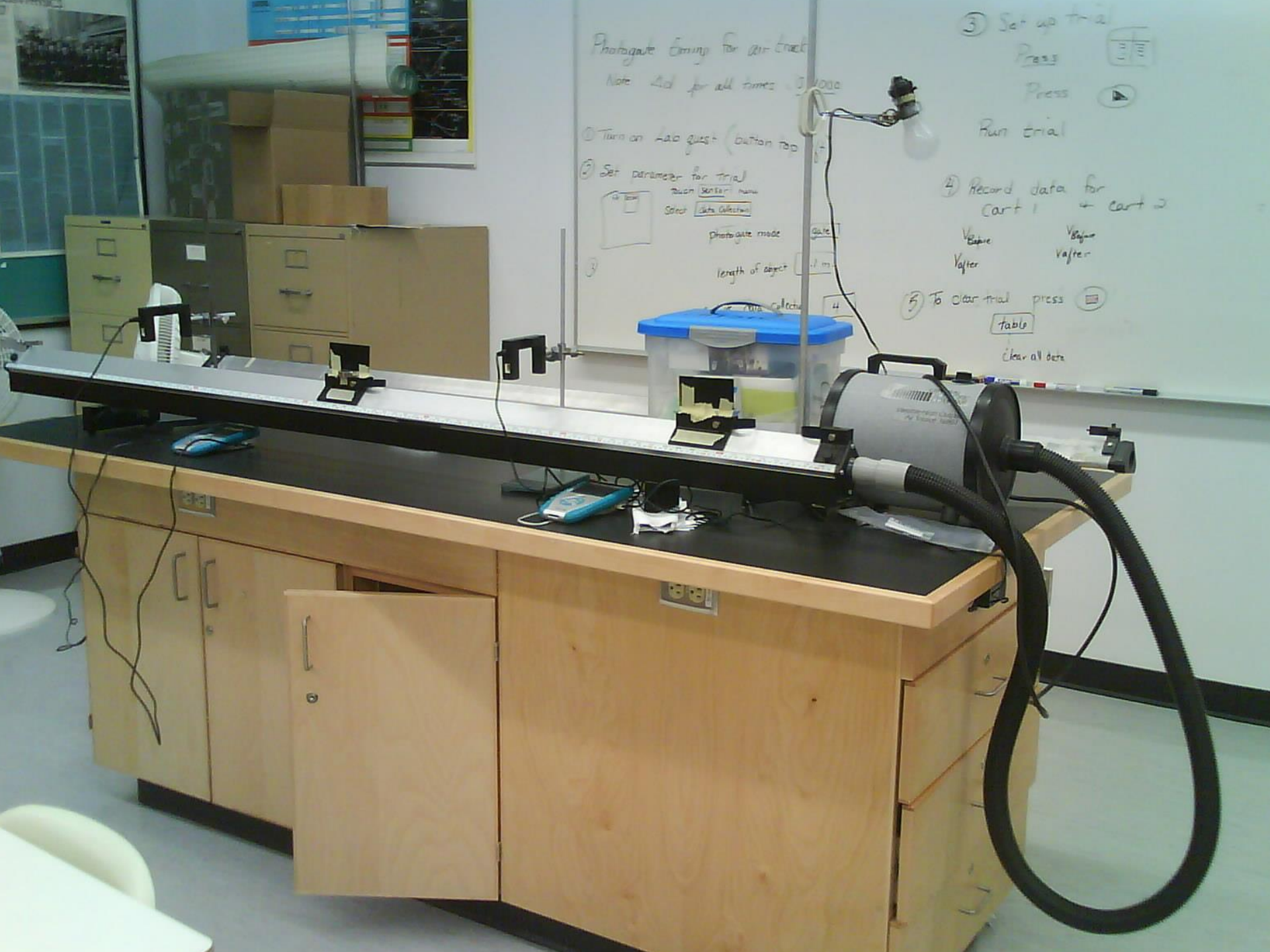
Tecnología, Innovación y Aprendizaje

1982




Photogate timing for air track
Run trial
Record data for
Cart 1
Cart 2
To clear trial press
table
Clear all data

Some facts about learning kinematics

- This resources are limited.
- Sometimes they are more than expensive.

  and

- There are many other possible settings in real world suitable to make demonstrations
  - A weel of a bicycle, a car, an elevator, the human body…

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Some good news from the community of Makers

- MEMS, optic sensors, and many other are now very cheap, and
- a grade diploma in electronics is not compulsory.

- Maker's community is a buoyant market and
- 3D Printing and
- Low cost printed circuits, are cheap too.

¿Could we take advantage of them?

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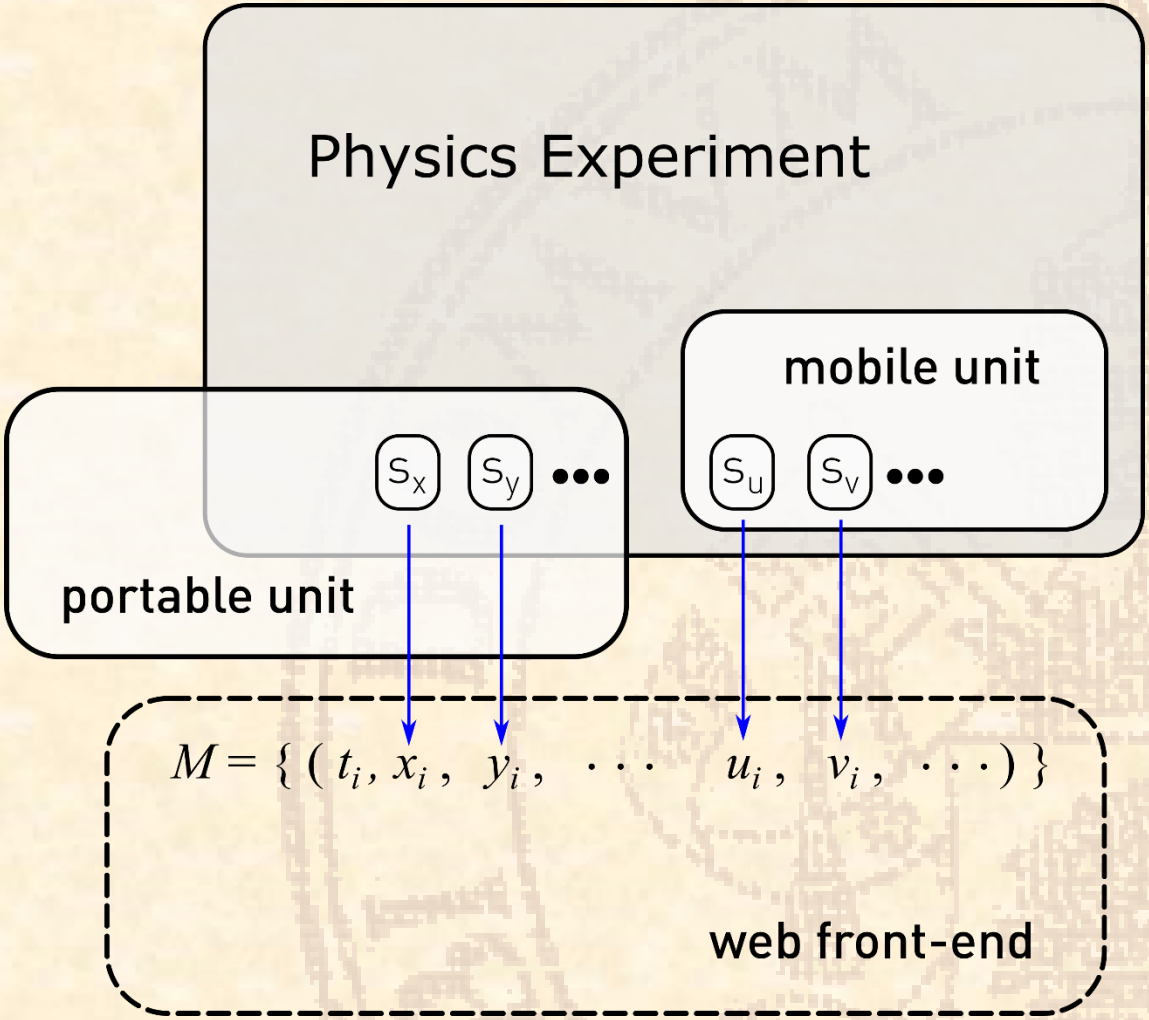
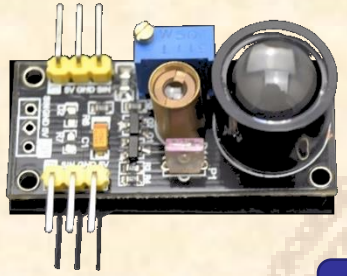
Our proposed model



Some Examples of Electronic Sensors

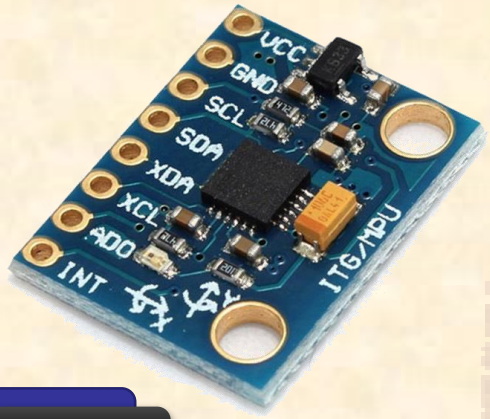
Laser emitter - receiver



30 €

Infrared telemeter

20 €



6 Axis IMU (Accelerometer + Gyroscope)

30 €

Infrared Line follower

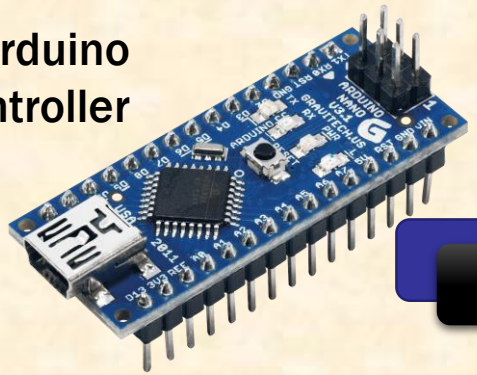
5 €

Ultrasound telemeter

12 €

Hardware Base

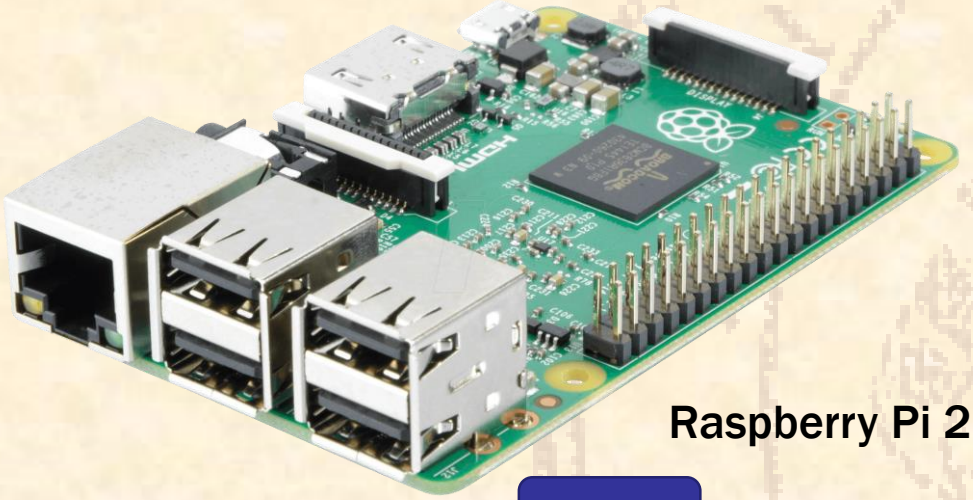
Arduino
µ-controller



12 €

Serial thru
Bluetooth

20 €

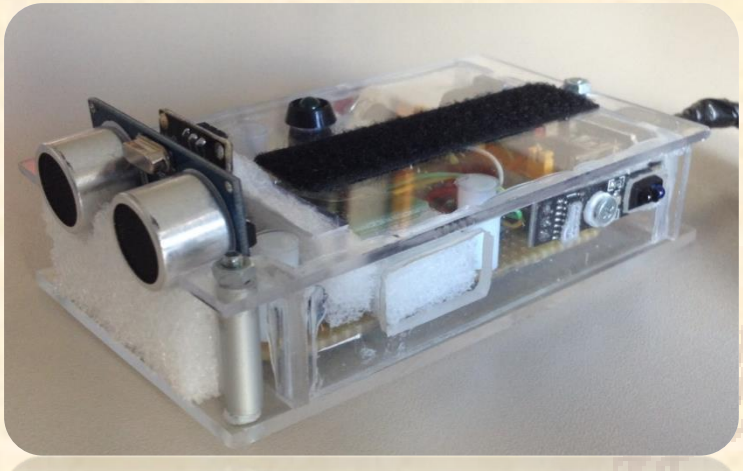


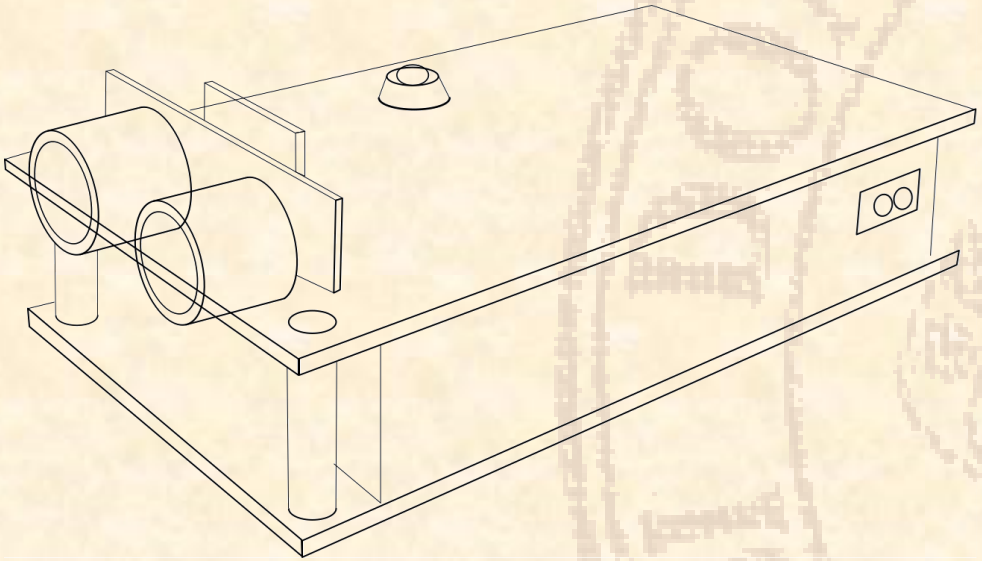
Raspberry Pi 2

45 €

+some other
modules
BT, Wifi,
Powerbank,
...

50 €





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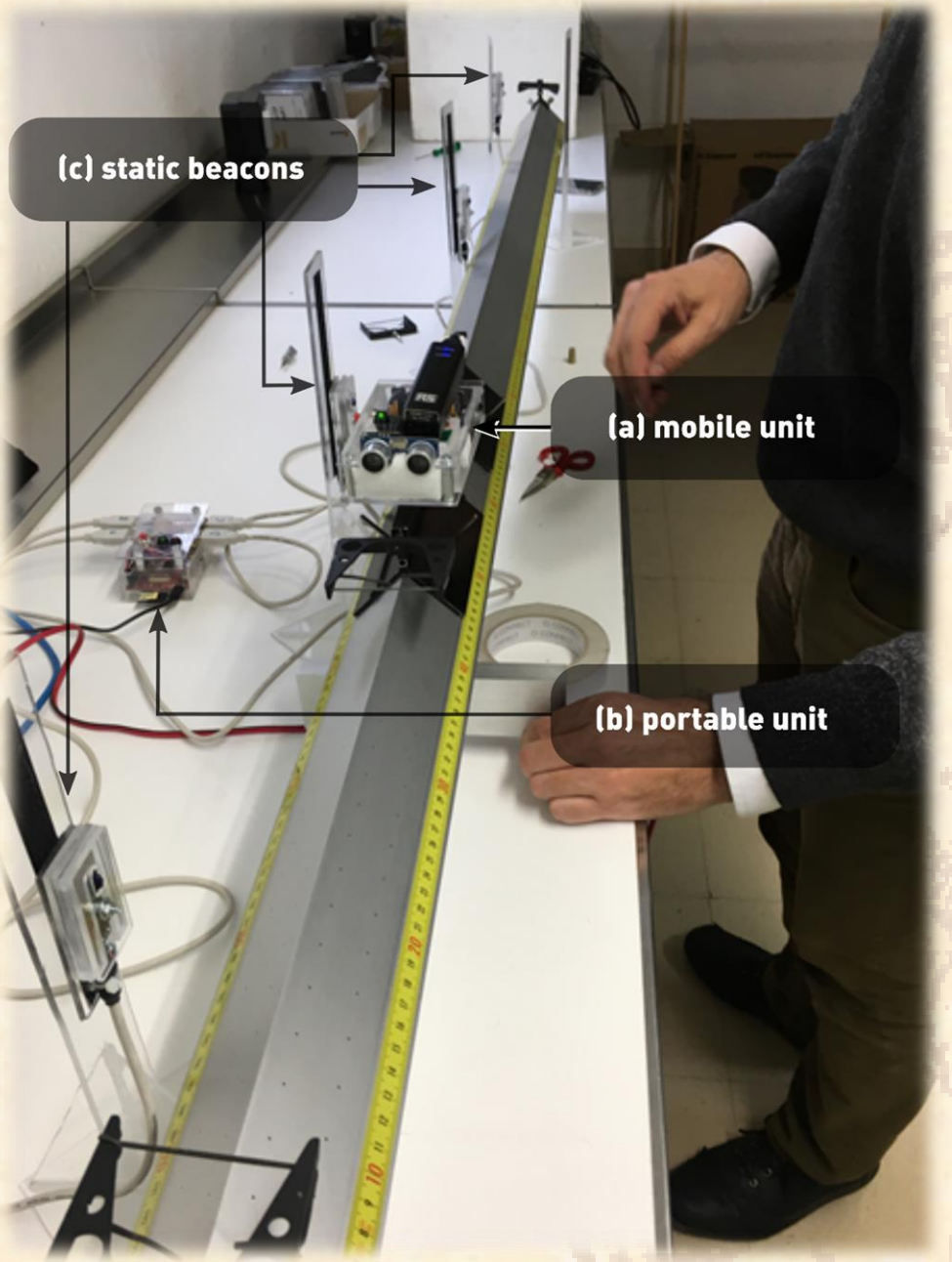
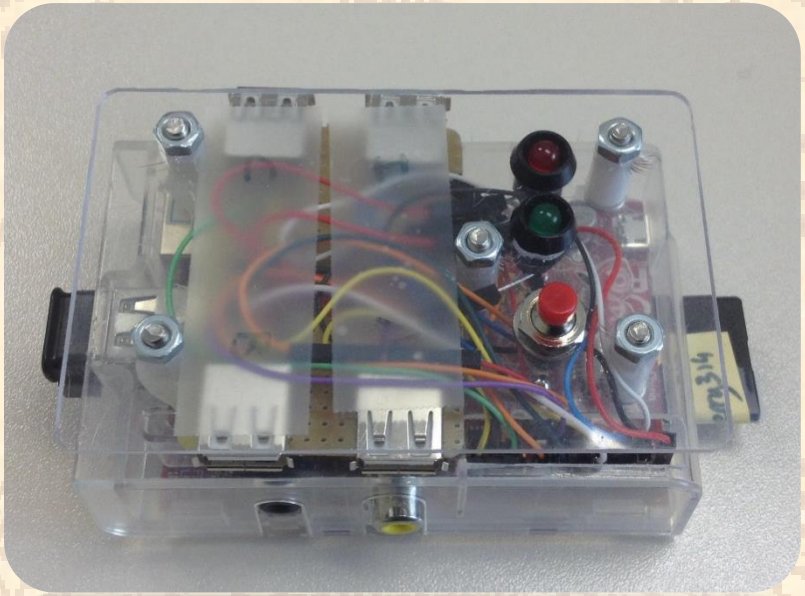
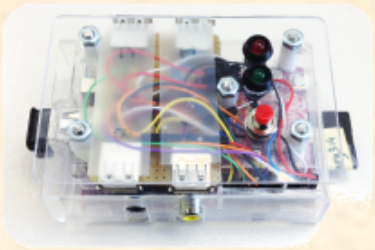

(c) static beacons
(a) mobile unit
(b) portable unit



Your device

Wi Fi

Portable subsystem
Raspberry Pi



Bluetooth

Mobile subsystem
Mobile

Battery or mains

Battery

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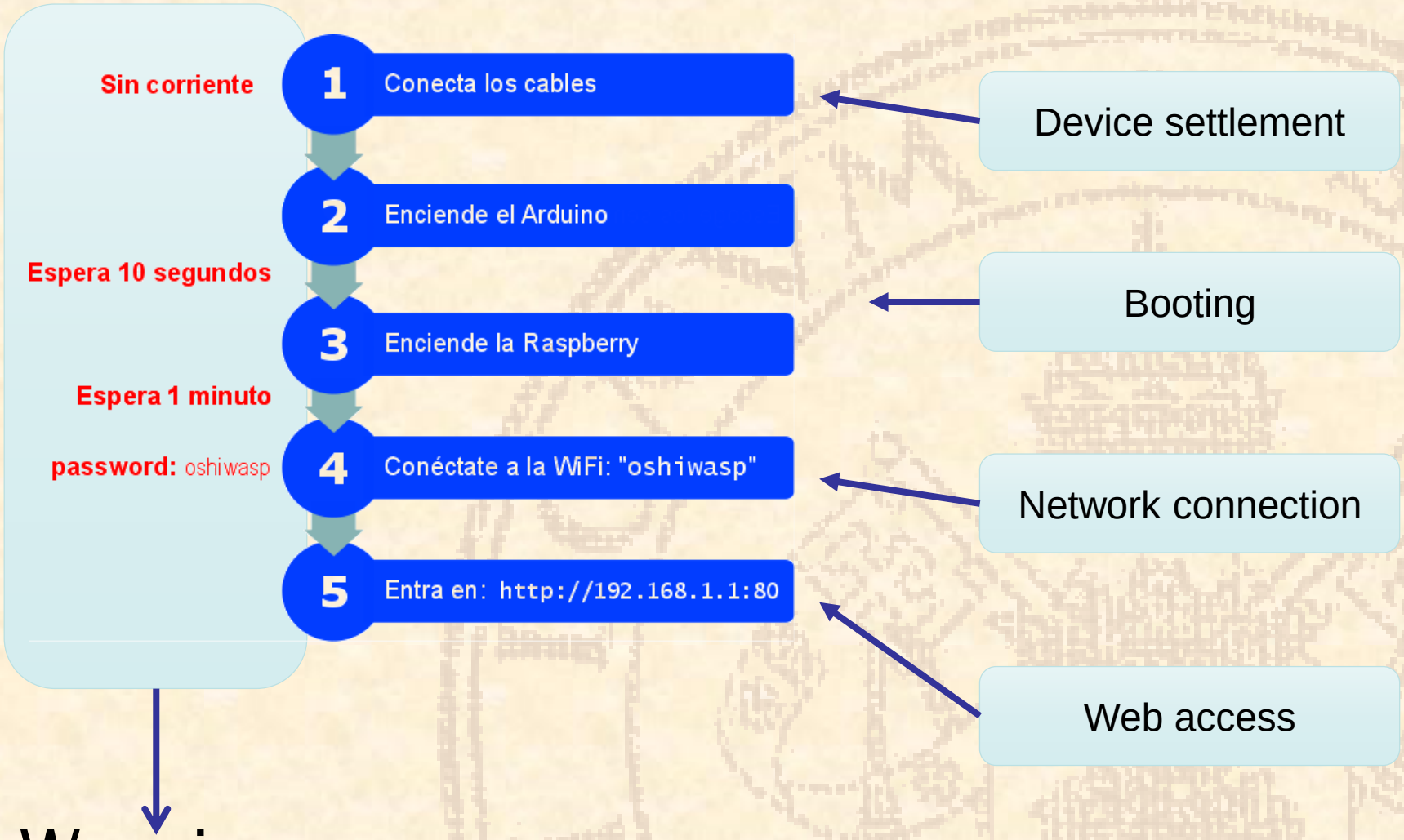
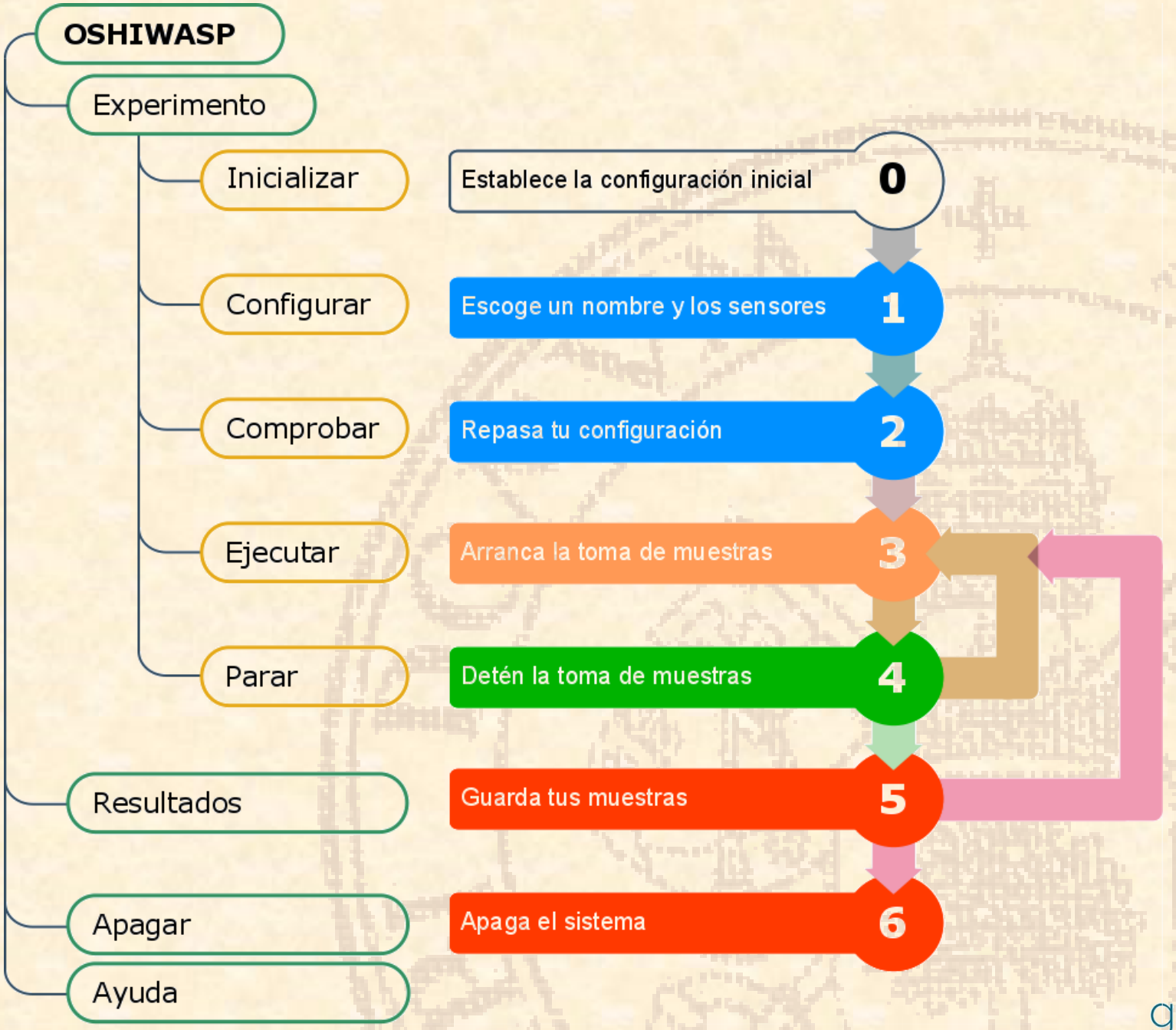
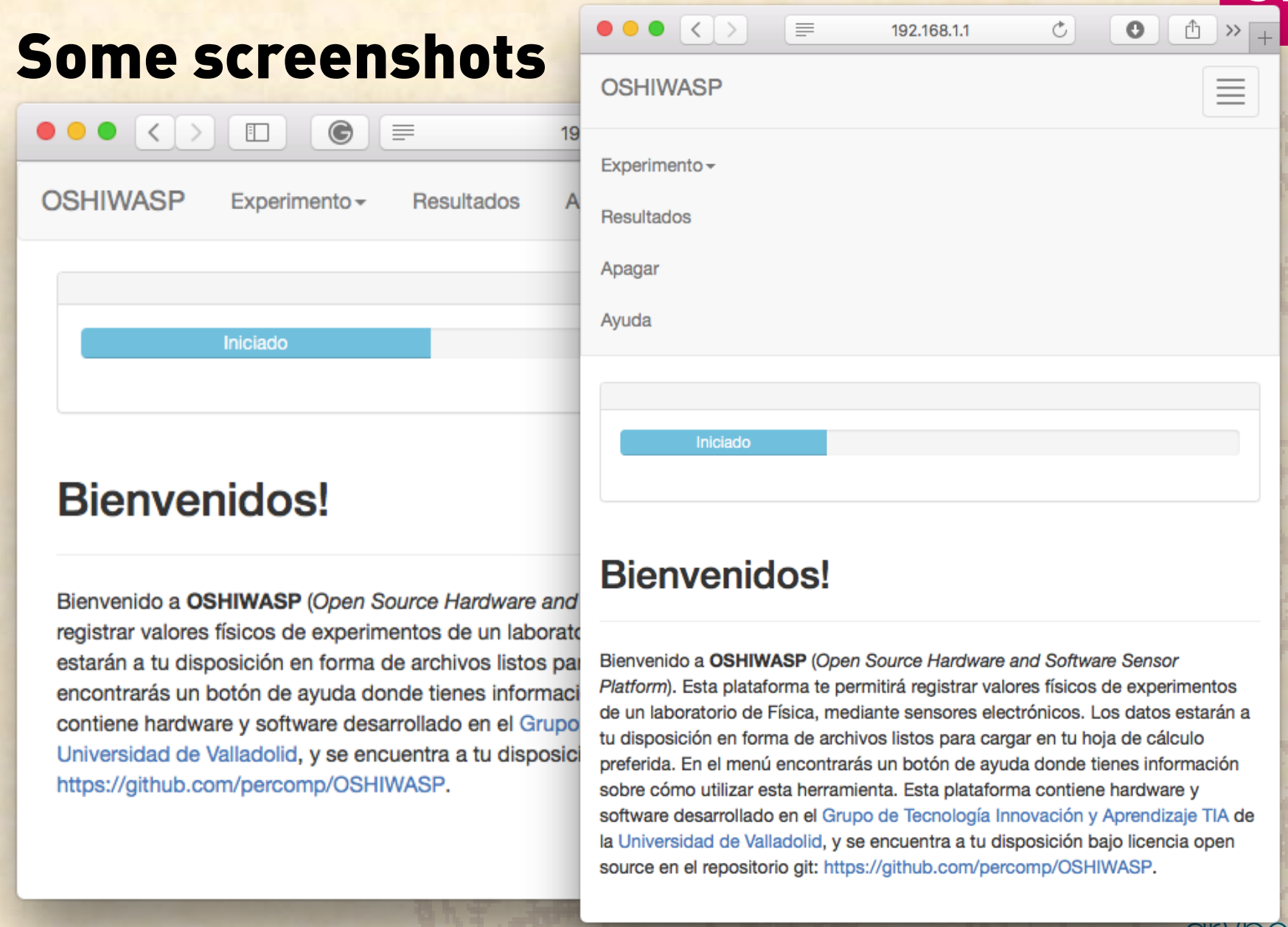
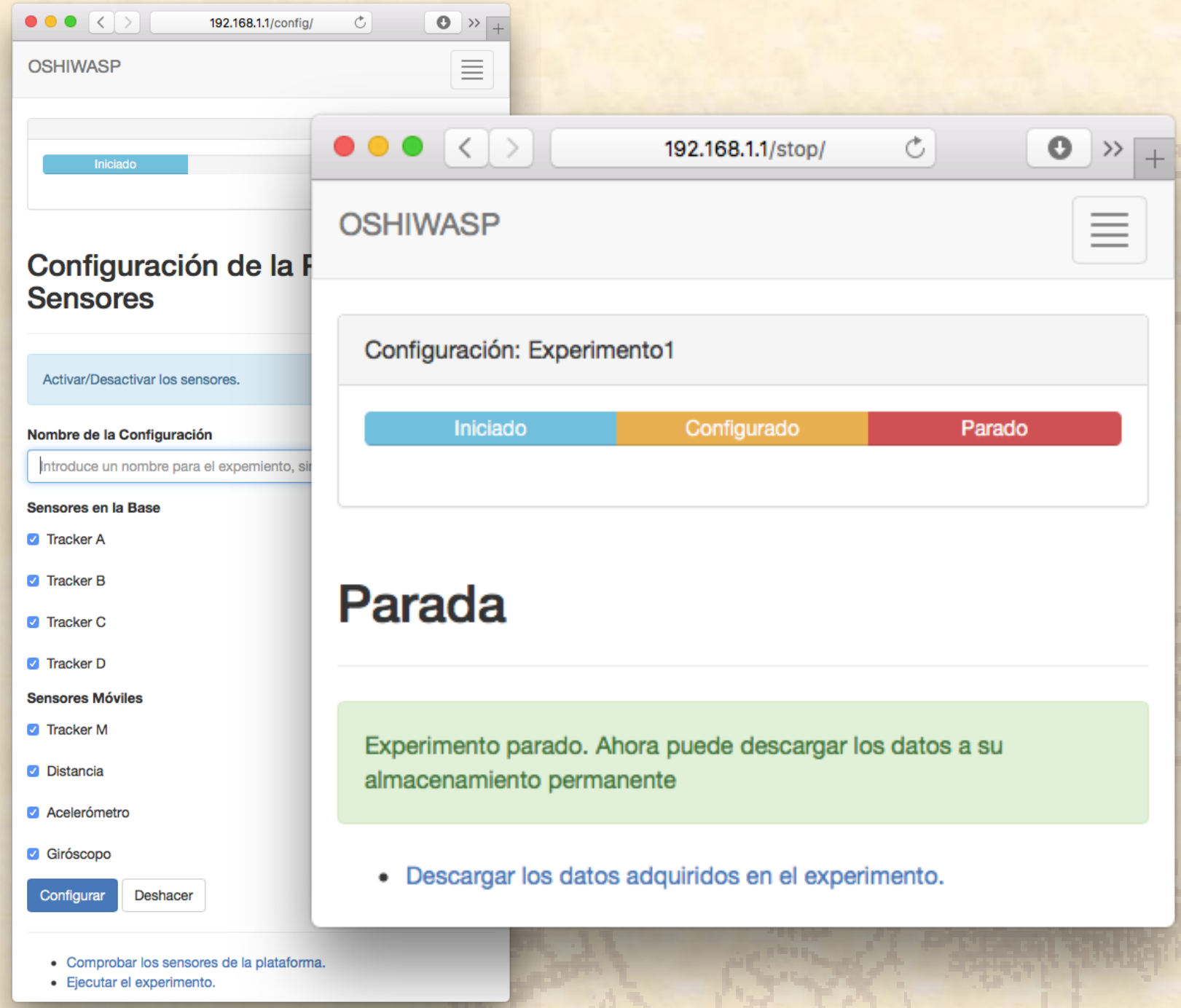

Sin corriente
1
Conecta los cables
2
Enciende el Arduino
Espera 10 segundos
3
Enciende la Raspberry
Espera 1 minuto
password: oshiwasp
4
Conéctate a la WiFi: "oshiwasp"
5
Entra en: http://192.168.1.1:80
Device settlement
Booting
Network connection
Web access
Warnings


OSHIWASP
Experimento
Inicializar
Configurar
Comprobar
Ejecutar
Parar
Resultados
Apagar
Ayuda
Establece la configuración inicial
0
Escoge un nombre y los sensores
1
Repasa tu configuración
2
Arranca la toma de muestras
3
Detén la toma de muestras
4
Guarda tus muestras
5
Apaga el sistema
6

Some screenshots




192.168.1.1/config/
OSHIWASP
Iniciado
Configuración de la P
Sensores
Activar/Desactivar los sensores.
Nombre de la Configuración
Introduce un nombre para el expemiento, si
Sensores en la Base
Tracker A
Tracker B
Tracker C
Tracker D
Sensores Móviles
Tracker M
Distancia
Acelerómetro
Giróscopo
Configurar
Deshacer
Comprobar los sensores de la plataforma.
Ejecutar el experimento.
192.168.1.1/stop/
OSHIWASP
Configuración: Experimento1
Iniciado
Configurado
Parado
Parada
Experimento parado. Ahora puede descargar los datos a su almacenamiento permanente
Descargar los datos adquiridos en el experimento.

Some types of posible experiments

- A completely assisted setting
  - The instructor
    - specifies the academic goals to achieve,
    - devises the experimental setting and
    - writes the student's guide.
  - The students follow the guide and answer the questions.
- A partially assisted experiment
- A supervised project (and beyond…)

Some types of posible experiments

- A completely assisted setting
- A partially assisted experiment
  - The instructor
    - specifies the academic goals to achieve,
    - proposes a physics model to demonstrate
    - writes a student's guide.
  - The students
    - Choose some sensors useful to measure the model.
    - Explain their decisions and answer some questions.
- A supervised project (and beyond…)

Some types of posible experiments

- A completely assisted setting
- A partially assisted experiment

- A supervised project (and beyond…)
  - The instructor decides the goals and supervises the work done by the students.
  - The students analyse the elements available and assume the laboratory as a project.

Encourage the student to choose a suite of sensors

- Time:
  - Raspberry timer (miliseconds)
  - Arduino timer (microseconds)
- Acceleration:
  - Accelerometers
- Angular velocity:
  - Gyroscopes
- Distance:
  - Ultrasound distance
  - IR telemetry
  - Laser reflection diffusion
  - Line follower based beacons
- Orientation:
  - Magnetometer
- …

Some conclusions

- We have got a system
  - publicly available under open source hardware and software license.
  - very afordable, granted that there is a hobbyst at hand.
- In the practical side

  More experimental settings,
- And can motivate much more

  The laboratory is interesting!

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Thank you for your attention!

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