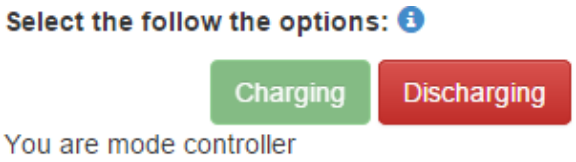
Solar Lab description

The Solar Lab has been designed in order to allow users to study:

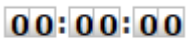
- from one side the difference between the amount of energy that the battery will store depending on the luminosity of the bulb and the position of the solar panel regarding the bulb;
- and from the other side the amount of energy used from the battery in order to move a weight of 90 g.

The user will be able to select either a charging or discharging mode:



and he is also informed of his role (controller or observer). The observers will not be able to change modes, just the controller.

In its charging mode, the Solar Lab is composed of:

	A led bulb, whose luminosity range is between 0 lumens (switch off) and 700 lumens (maximum luminosity).
	A solar panel, which can be rotated in its horizontal axis from -150º to 150º degrees and in its vertical axis up to 90º degrees (perpendicular to the led bulb).
	A battery. A minimum amount of energy needs to be stored in order to be able to move the weight.
	A clock. It can be used to select for how long you want the battery to be charging.

Whenever you connect to the lab to start an experiment you will find:

- The led bulb switched off (0 lumens).
- The solar panel in its resting position.
- The battery will show its present charge. If the charge is below the minimum it will be shown in red and you will be asked to load it.
- The clock showing 00:00:00.

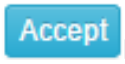
Two user roles have been defined:

- Controller. He will be able to interact with the elements described above.
- Observer. He will be able to notice the values given by the controller to the different elements and the results of the experiment.

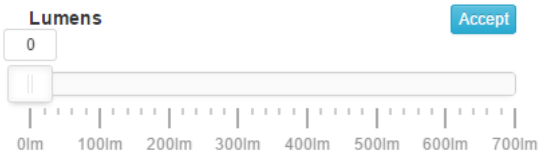
The controller will be able to:

- Select the luminosity of the led bulb between 0 and 700 lumens. The bigger this number is, the faster the battery charges. In order to start charging the battery, the light must be switched on.
- Select the horizontal and vertical position for the solar panel. Depending on this position in relation to the led bulb, the light will have a higher impact on the solar panel.

  For both, for the luminosity and solar panel position, the user could:

  - Either select a value in each slider and then click on the corresponding 

button.



  - Or to select the desired values for all parameters and then click on the 

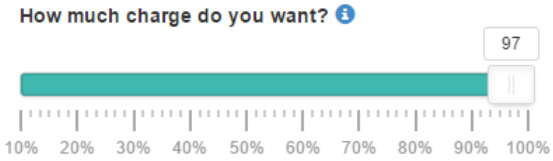
button.

  It is recommended to make use of the Accept button in order to be sure that the parameters are the desired ones before starting the experiment.

- Decide between:

  - How much does he want to charge the battery and click on the 

button.

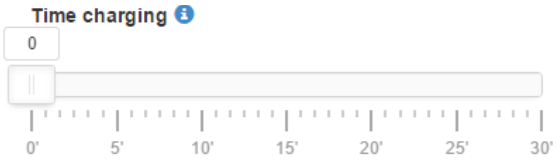


    The battery will charge till it reaches the selected value or the user clicks on the 

button.

  - For how long does he want to charge the battery and click on the 

button.

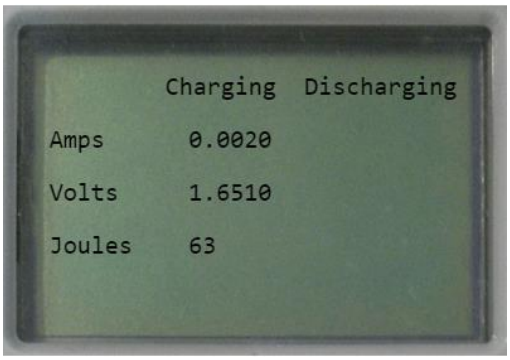


The battery will charge for the selected lapse of time or till the user clicks on the Stop button.

- Give values to both: to the amount of energy desired and the maximum time the battery will be charging and click on the Start button.
  In this case the battery will charge till the first variable fits the selected value or till the user clicks on the Stop button.
- If you do not give values to any of the variables and click on the Start button, then the battery will charge till it reaches its maximum or till the session time expires or till you click on the Stop button.

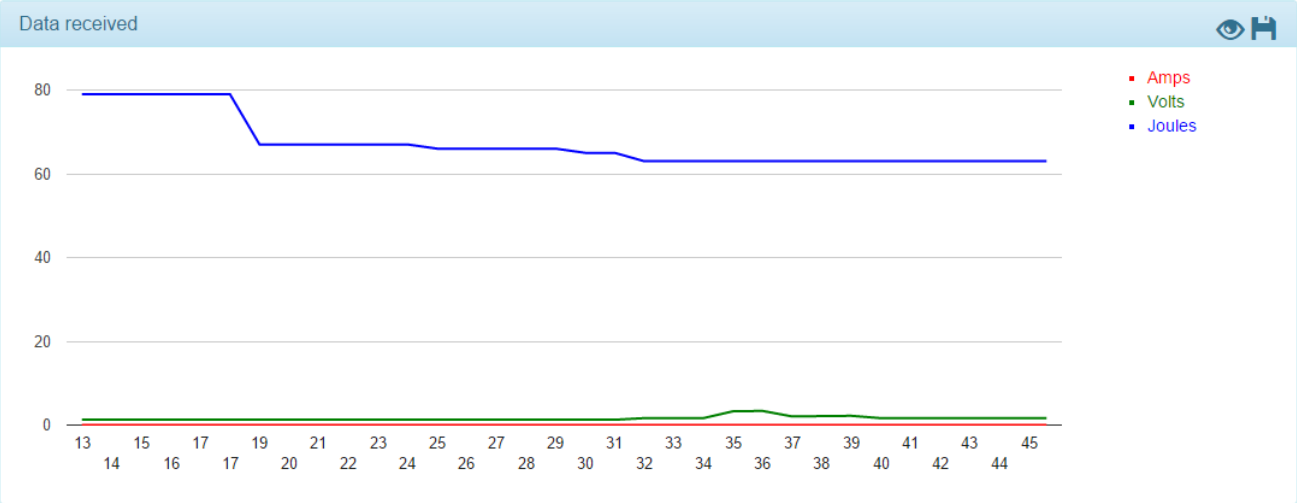
The observers will be able see in its navigator the modifications done by the controller and the data produced by the laboratory.

The data produced by the laboratory will be shown as follow:



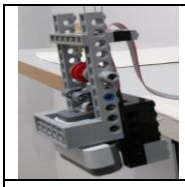
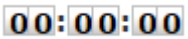
The amps and volts entering the panel, and the joules stored in the battery will be updated for the observers.

These data are also represented in a graph and can be downloaded.



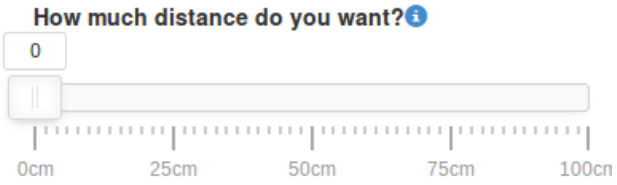
At any time, the controller will be able to change from the charging mode to the discharging mode. In this case, the charging mode will be stopped.

<u>In its discharging mode, the Solar Lab is composed of:</u>

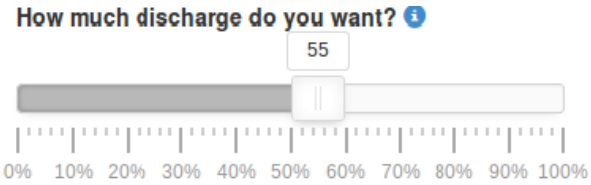
	A weight of 90 g.
	A battery. A minimum amount of energy needs to be stored in order to be able to move the weight.
	A clock. It can be used to select for how long you want the battery to be charging.

The controller will be able to:

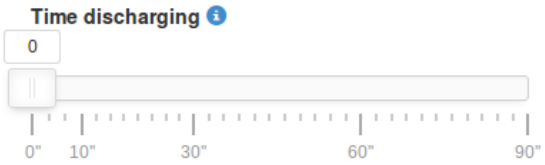
- Decide to move the weight a specific distance. The weight will move, from its current position, up and down till it goes all the way long.
  The weight does not have an initial position; it will remain where the latest user has decided.



- Decide the final battery charge value.



- Decide for how long you want the weight to be moving up and down.



For these three variables you could:

  - Select just the distance and click on the Start button.

    The weight will move till it reaches the selected value or the user clicks on the Stop button.

  - Select just the final joules stored in the battery and click on the Start button.

    The weight will move till it reaches the selected value or the controller clicks on the Stop button.

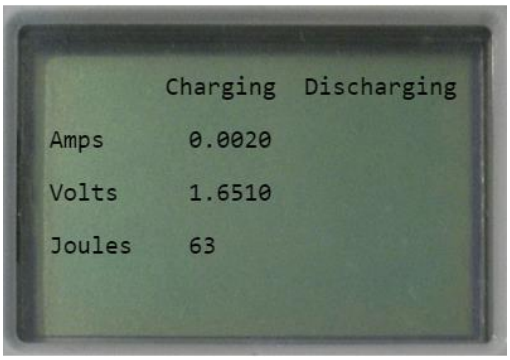
  - Select for how many seconds you want the weight to be moving up and down and click on the Start button.

    The weight will move till it reaches the selected value or the controller clicks on the Stop button.

  - Select any combination for the three variables above: (distance, joules), (distance, seconds), (joules, seconds), (distance, joules, seconds) and click on the Start button.
    The weight will move till the first of the variables reaches the selected value or the controller clicks on the Stop button.

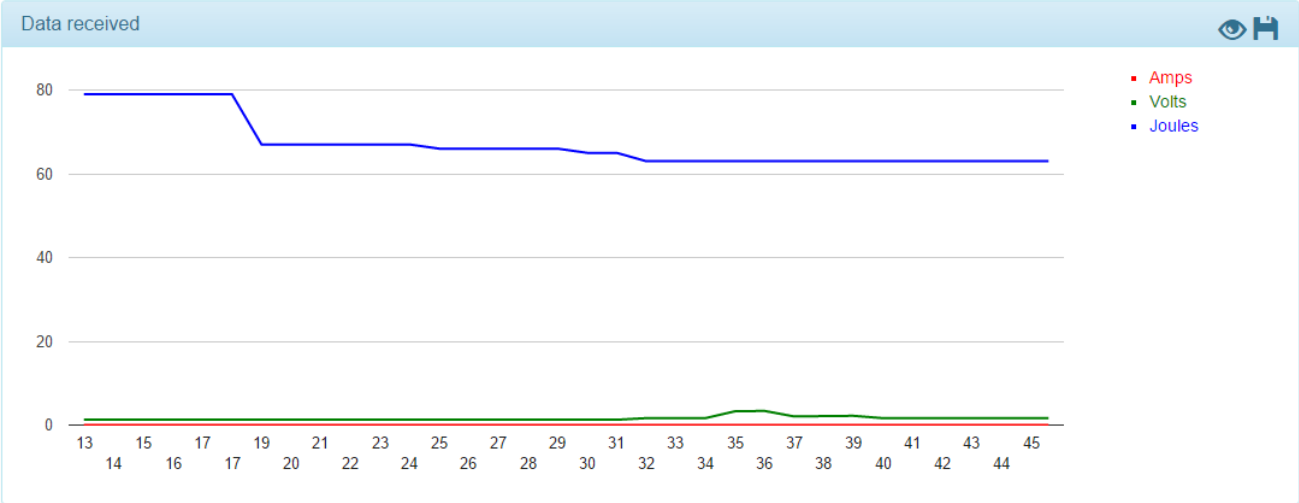
The observers will be able see in its navigator the modifications done by the controller and the data produced by the laboratory.

The data produced by the laboratory will be shown as follow:



The amps and volts exiting the panel, and the joules stored in the battery will be updated for the observers.

These data are also represented in a graph and can be downloaded.



It is not allowed to change from discharging mode to charging mode.