



# Hydrosens Manual

GROEN Joshua, MICHELENA  
Tristan, ROLLAND Melvyn,  
WATTENHOFFER Nicolas  
**EPF – 4Y Project semester**  
01/06/2023

## Table of content

Introduction .....	2
List of parts and how to make them: .....	3
Laser cuted: .....	3
3D printed: .....	4
Other parts .....	5
Box Assembly .....	6
How to setup the software .....	8
How to prepare the samples .....	9
How to use the software.....	10
Conclusion.....	11

## Introduction

Hydrosens is a project ordered by Julia Mouton and executed by Groen Joshua, Michelena Tristan, Rolland Melvyn and Wattenhoffen Nicolas. The objective of this project is to automate the procedure of capturing images of small paper fragments adorned with water droplets and subsequently analyzing them to ascertain whether water has been absorbed. The purpose is to enhance efficiency, accuracy, and consistency by enabling the experiment to be replicated, thereby saving time, and yielding more precise and reliable outcomes. In this manual you can find how to make, install and to use the photobox as well as the software that comes with it. Hydrosens is an opensource project feel free to share it.

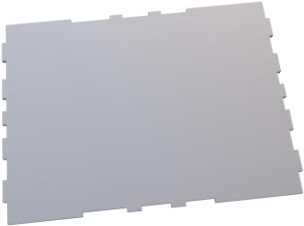
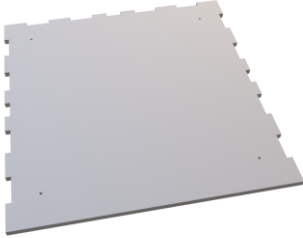
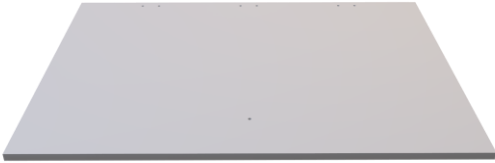

## List of parts and how to make them:

### Laser cut:

The biggest part that needs to be cut is 300mm X 420mm. Check if your laser cutter is big enough before cutting it.

There is two set of files one for 7mm wood thickness and the other for 6mm wood thickness.

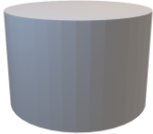

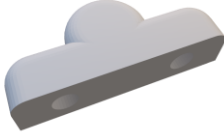

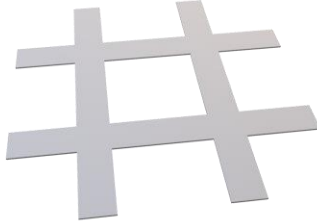
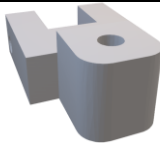

We advise to use MDF but plywood and other type of woods can work to.

Name	Quantity	Picture
Back	1	
Base	2	
Door	1	
Side	2	

### 3D printed:

The biggest part that needs to be printed is 220mm X 220mm. Check if your printer is big enough before printing it.

All parts are printed using PLA because it is an easy to print material and its ecological impact is better than other thermoplastics.

Name	Quantity	Picture
Foot	4	
L Joint	2	
Magnet holder1	1	
Magnet holder 2	1	
Grid	1	
Webcam_Connector	1	
Thrash_Bag_Holder	4	
Hinge_cale	3	

Recommended settings are a layer height of 0.2 mm and an infill of 15%.

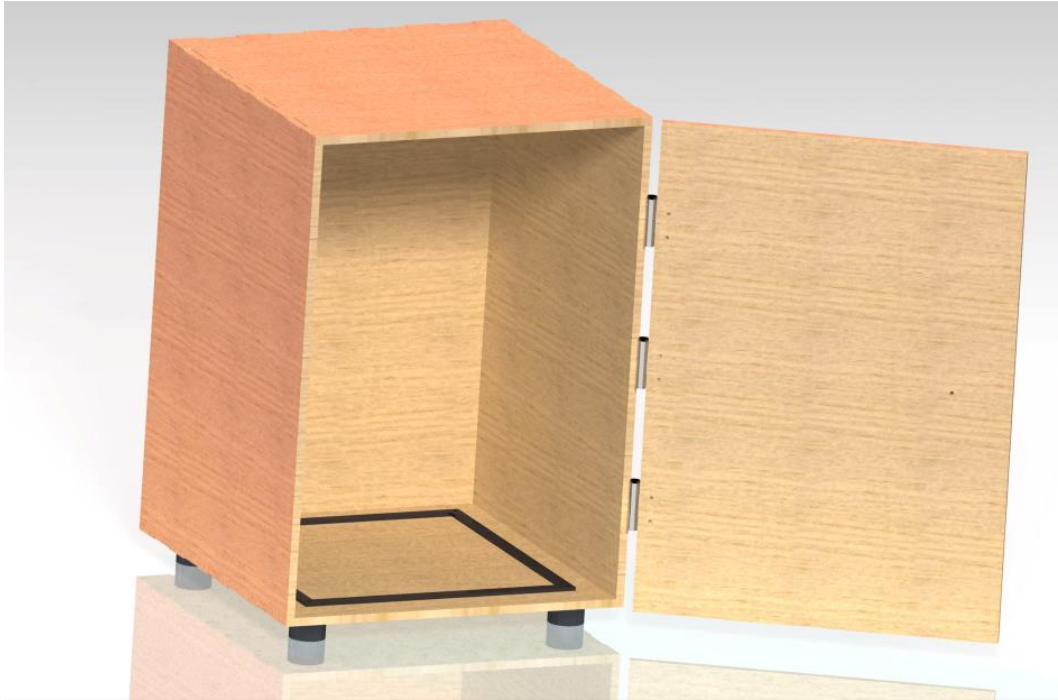
## Other parts

Name	Quantity	Picture
Webcam Logitech C270	1	
3mm*10mm Wood screw	16	
3mm*20mm Wood screw	4	
M2 bolt and nut 2mm	1	
Led Strip	1	
Trash bag	1	
Acrylic white paint	1	
Hinge	3	

Be careful to note that the remote of the led strip uses a cr2025 battery.

## Box Assembly

To assemble the box, it is necessary to have all the parts pre-cut and printed in advance.



Render of the assembled box: keep in mind that there may be variations or discrepancies between this representation and the actual physical model.

Here are the complete instructions for assembling the box:

First paint the interior of the box in white.

Gather the following items: base, 4 Feet, 4 screws, 4 Trash\_Bag\_Holders, 2 L-shaped brackets, wood glue, box back, 3 hinges, 3 hinge shims, 12 screws, door, magnet holder 1 and 2, magnet, webcam, new webcam support, LED strip.

- 1 - Place the Trash bag on the base.
- 2 - Insert a Trash bag holder into a 3mm screw.
- 3 - Insert the screw with the holder into one of the 4 pre-made holes in the corners, piercing the garbage bag.
- 4 - Once done, screw a Foot onto the end of the screw.
- 5 - Repeat steps 3 to 5 three more times, using the remaining 3 screws, Trash\_Bag\_Holders, and Foot.

6 - Take one side of the assembled box and attach it to the base by screwing the two L-shaped brackets in a way that they hold the base and sides together.

7 - Apply wood glue where the pieces meet.

8 - Assemble the box back while applying glue.

9 - On one side, screw the 3 hinges using the hinge shims. Use the provided 12 screws.

10 - Screw the door onto the hinges.

11 - Screw magnet holder 2 onto the door, placing a magnet inside.

12 - Screw magnet holder 1 onto the side, inserting a magnet inside.

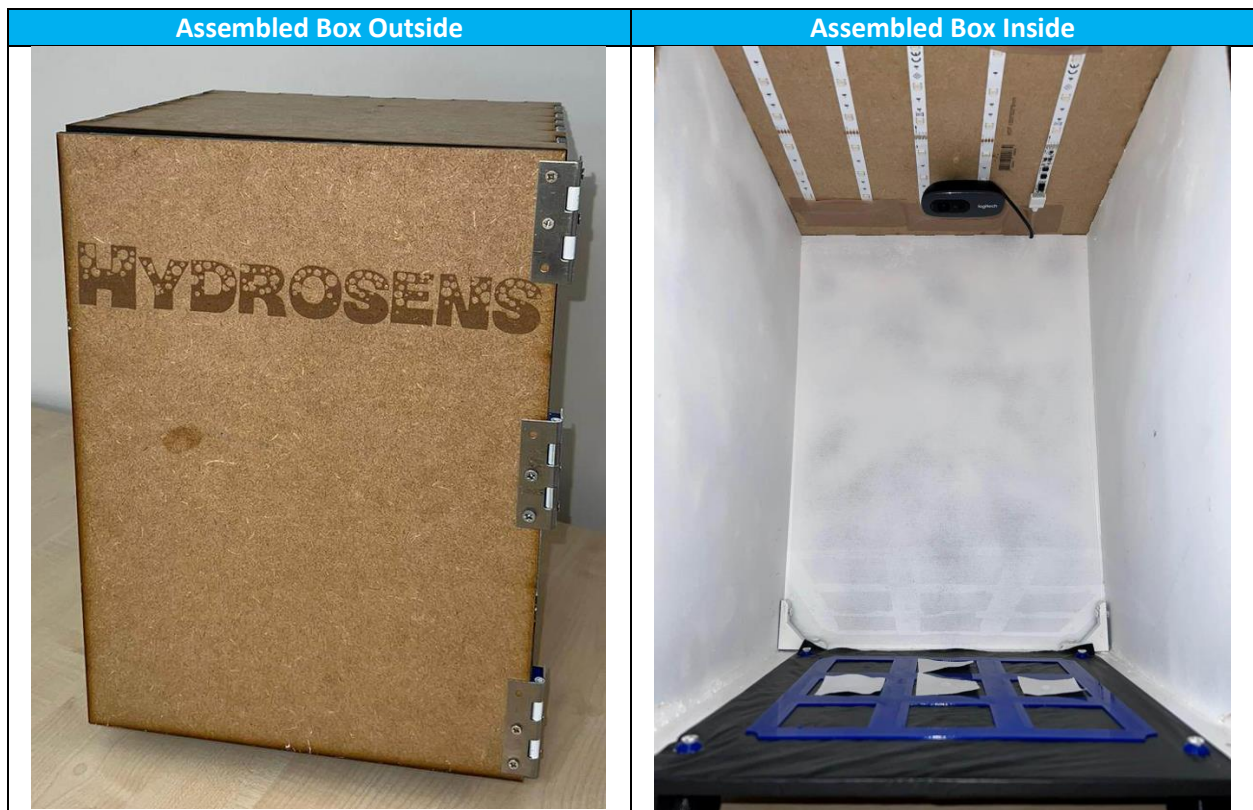
13 - Next, take the webcam, remove its support, and attach the new webcam support by screwing it onto the top of the box.

14 - Glue the LED strip onto the top of the box.

15 - Once the top of the box is assembled, position it onto the box.

These instructions will guide you through the complete assembly of the box, following the specific steps.

Here are the results of what you should have:





## How to setup the software

The software has been developed to run on a windows computer as easily as possible. To make it possible, an executable file has been created with the software and all the necessary packages. That means no installation is required for a simple user. You just need to trust the executable file when you are using it.

With a view to reusability and optimization, it is possible to create the executable file from the script following a few steps in the terminal:

1. Create the python environment. (if it's not already done)

```
> python -m venv venv
```

2. Enter into the python environment.

```
> .\venv\Scripts\activate
```

3. Install pyinstaller.

```
> pip install pyinstaller
```

4. Install all the necessary libraries.

```
> pip install -r requirements.txt
```

5. Get the path of the customtkinter library

```
> pip show customtkinter
```

6. Create the .exe file with option to add the assets folder and the necessary customtkinter theme

```
> pyinstaller --onefile --windowed --add-data "<Path of the customtkinter library>/customtkinter;customtkinter/" main.py
```

Then the main.exe is created in the dist folder.

## How to prepare the samples

To prepare the samples, follow these steps:

Place the samples on the grid. Note that there are only 8 samples, so the first position on the grid will not have space for a sample.

Once the samples are in place, position the droplet dispenser. To do this correctly, place the dispenser's legs on top of the screws protruding from the ground. Push the entire system against the wall.

Ensure that the tubes protruding from the tube splitter are not connected to any needles.

Attach the precision pipet to the 100ml setting by screwing the cap to either 099 or 100, as shown in the image. Place the plastic cover underneath the syringe's output.

Use the syringe to fill the needles with water. Do this by putting droplets of water into the tubes sticking out of the needles.

Next, connect the tubes sticking out of the tube splitter to the needles.

Once everything is properly attached, you can release the droplets by allowing air to flow through the long tube attached to the upper part of the droplet dispenser.



Once all the droplets are dropped on the paper, please remove the droplet dispenser, and start the image capture with the software.

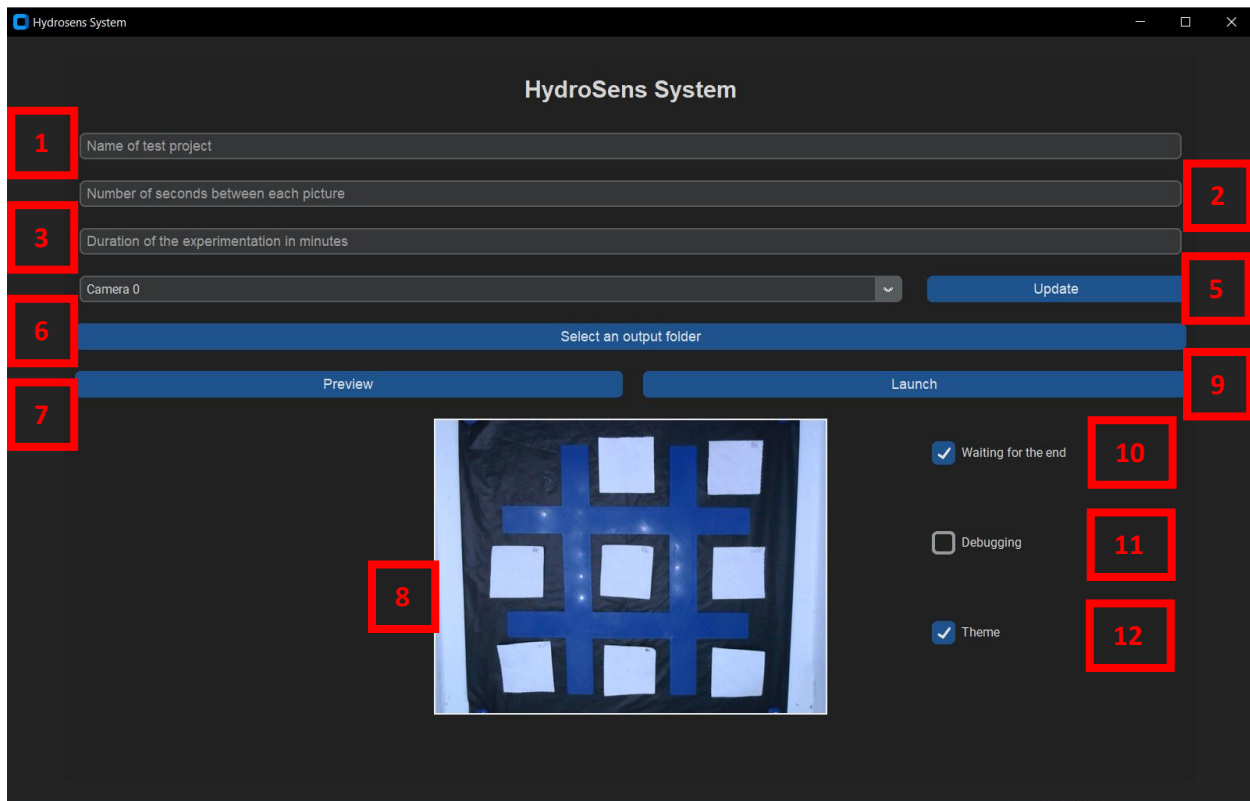
## How to use the software

The software release is in an .exe format it is compatible with windows 7, 8, 10 and 11. No prerequisite is needed. When you open the software, a temporary folder called HydroSens\_temp will be created, the folder can be deleted after the execution.

The software can run even without the photobox connected. However, to capture pictures using the photobox as intended, please follow these steps:

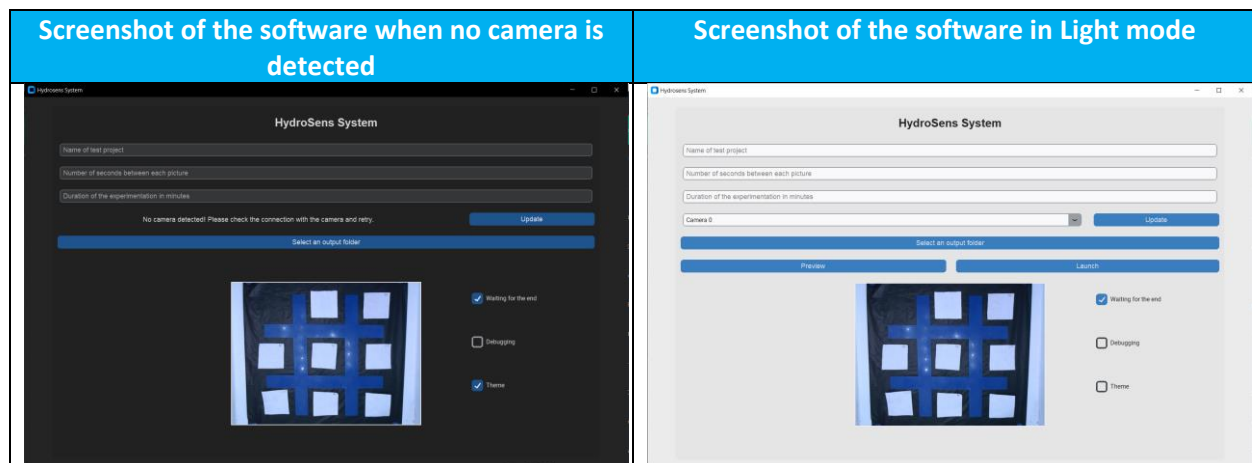
- 1 - Connect the photobox to your computer via USB.
- 2 - Plug in the power plug of the photobox to activate the LEDs.

After opening the software, make sure to select the photobox webcam to ensure the correct device is used for capturing pictures. Use the preview button to check if you have selected the right camera. If the computer does not detect the webcam, please click on the update button.



number	Name of the action	What does it do
1	Name of test project	Enter the name of the project
2	Number of seconds between each picture	Define the number of seconds between each picture
3	Duration of the experiment in minutes	Enter the number of minutes of the duration of the experiment.

4	Camera selection	Select the camera or webcam if you have multiple devices connected to your computer
5	Update	Click here to update the list of cameras, if your computer doesn't find the webcam please verify the webcam is plugged and click on the update button.
6	Select an output folder	Select a folder where the software will output the results (pictures + .txt file + csv file)
7	Preview	The preview button takes a picture with the selected webcam for you to check the pictures you will be taking during the experiment. They will be shown in the preview screen.
8	Preview screen	
9	Launch	Launch the image capture.
10	Waiting for the end	By default, the option is activated that means that the program will go to the end of the parameters given by the user. In the other case it stops the execution when each sample has absorbed water.
11	Debugging	Show all the pictures and the steps of the image analysis in order to check if something goes wrong or unintended results.
12	Theme	Change the Theme from Dark Mode (checked) To light mode (unchecked)



## Conclusion

I hope you find both this manual and the project itself useful. They were specifically designed with the intention of being helpful.