

## We are the makers – Web-based weather station

Activity elaborated by WeMakers Romania team

*Monitoring environmental parameters in a particular place or room is a very important topic. A project in this sense can be approached as a children's hobby or can be developed from a professional perspective.*

### Scenario

Dan's parents have a country house where they also have a greenhouse where many plants grow. Given that a WiFi Internet connection is available, Dan thought he could create a simple device to monitor the environmental parameters in the greenhouse.

He conducted a study on the Internet and concluded that in order to create this device as easily as possible, he needs a programming platform to which sensors can be easily connected to monitor environmental parameters. That platform should also have a built-in WiFi interface and an operating system on which a web server can be installed and configured. Also, an accessible programming language.

After the study, Dan chose Raspberry PI as his development platform because it allows the installation of a web server and allows programming in the Python language. Another reason is that on the Raspberry PI it can connect an electronic board that includes all the sensors needed for his project (Sense HAT).

<b>1. Title of the Scenario</b>	<b>Web-based weather station</b>
<b>2. Target group</b>	Depending on the students' experience: 14 - 18 years
<b>3. Duration</b>	About 8-9 lessons (of 50 min each)
<b>4. Learning needs which are covered through the exercise</b>	<ul style="list-style-type: none"> <li>- Understanding how environmental parameters influence plants.</li> <li>- Understanding microcomputer architecture and Linux OS basics.</li> <li>- Understanding WiFi Internet connectivity.</li> <li>- Understanding how sensors works.</li> <li>- Understanding Python programming basics.</li> <li>- Understanding Web programming basics.</li> <li>- Understanding how to build an IoT device (weather station).</li> <li>- Understanding basic aspects of 3D printing (for beginners).</li> </ul>
<b>5. Expected learning outcomes</b>	<ul style="list-style-type: none"> <li>- Building a system of interconnected devices</li> <li>- Printing 3D objects</li> <li>- Combine programable devices with 3D printed objects in order to create a useful interactive object</li> </ul>
<b>6. Methodologies</b>	<ul style="list-style-type: none"> <li>- Project based learning</li> <li>- Inquiry based learning</li> <li>- Cooperative learning</li> <li>- Heuristic conversation</li> </ul>
<b>7. Place / Environment</b>	Room with computers and 3D printers
<b>8. Tools / Materials / Resources</b>	<ul style="list-style-type: none"> <li>- Raspberry PI board with Sense HAT and accessories.</li> <li>- computers with 3D modelling software (variant - online version – <a href="https://www.tinkercad.com/">https://www.tinkercad.com/</a>).</li> <li>- tutorial 2 from O3 (<a href="#">here</a>).</li> <li>- other materials presented in tutorial.</li> </ul>

<p><b>9. Step by step description of the activity / content</b></p>	<p><b>Lesson 1</b> In this lesson, students will learn about the influence of environmental parameters on plants and other living organisms. The teacher will present studies on the influence of temperature, humidity and atmospheric pressure on plants. Their values that produce visible positive or negative effects on plant growth will be highlighted.</p> <p><b>Lesson 2</b> In the second lesson, students will learn about the general architecture of a microcomputer. A comparison with a desktop computer will be made. The students will learn about Raspberry Pi board and the basics of the Raspbian operating system.</p> <p><b>Lesson 3</b> A device can be connected to the Internet using various transmission media. In this lesson, students will learn the basics of WiFi technology. Also, they will learn how is implemented the Internet addressing mechanism and what are the main protocols used.</p> <p><b>Lesson 4</b> The sensors are included in most of the devices we use. In this lesson, students will learn what sensors are, what their role is and what types of sensors there are. Extensions that include multiple sensors (e.g. Sense Hat) will be presented.</p> <p><b>Lesson 5</b> Basics of Python programming will be introduced in this lesson. Students will learn to create simple programs in Python.</p> <p><b>Lesson 6</b> Students will learn about the client-server model and how to implement client / server programming. The main web technologies will be presented.</p> <p><b>Lesson 7</b> In this lesson the students will build the web weather station using the indications from the tutorial 2 from O3.</p> <p><b>Lesson 8</b> Students will learn to search the Internet for various STL models, possibly to modify and print them in 3D. The teacher will introduce them to the basics needed for 3D printing.</p>
<p><b>10. Feedback</b></p>	<p>At the end of the activity the teacher will collect students' feedback and discuss about students work and results.</p>
<p><b>11. Assessment &amp; Evaluation</b></p>	<p>The teacher will observe the students work during the whole activity. For the final evaluation, the students will demonstrate the system functionality collecting data for several days and creating charts with these values.</p>