TEMPLATE for BEST PRACTICE EXAMPLES

1. **Name of the project:** A smart greenhouse

2. **Subjects covered from STEAM areas:** Technology, physics, biology, ecology, informatics, mathematics, business.

3. **Target group (age range and size of the group):** pupils in grades 5-12

4. **Duration of the activity:** 1-3 months (depending on age group)

5. **Key words:** smart green house; green house; smart greenhouse; smart agriculture; Arduino; sensor; data; plant; flower.

6. **Key sentence describing context of the activity, followed by short description (200 words):**

   The point of this project is to promote and develop practical prototyping and development skills in children by making a smart greenhouse from scratch. The smart greenhouse works automatically by lowering the temperatures, changing the levels of humidity, soil moisture, reading the levels of water capacity that it still has, watering the plants. By having a system that is mostly self-sufficient at growing the plants we can enable older people, or the disabled to have an easy-to-use garden in the reach of their hands.

7. **Description of the activity environment, including the list of materials and tools needed:**

   We are building a smart greenhouse at school. We have a FabLab workshop at the school so we can laser cut the necessary parts of the greenhouse frame. The greenhouse does not require a large room. The theme I chose with the kids is attention bringing, as it is not only interesting because of the innovations used, but also, because of its real application possibilities. An aesthetic version is currently being prototyped with the kids that we as a business would then provide to the public.
   The smart greenhouse is built with the following parts:
   1 - light system block;
   2 - water supply pump;
   3 - fan;

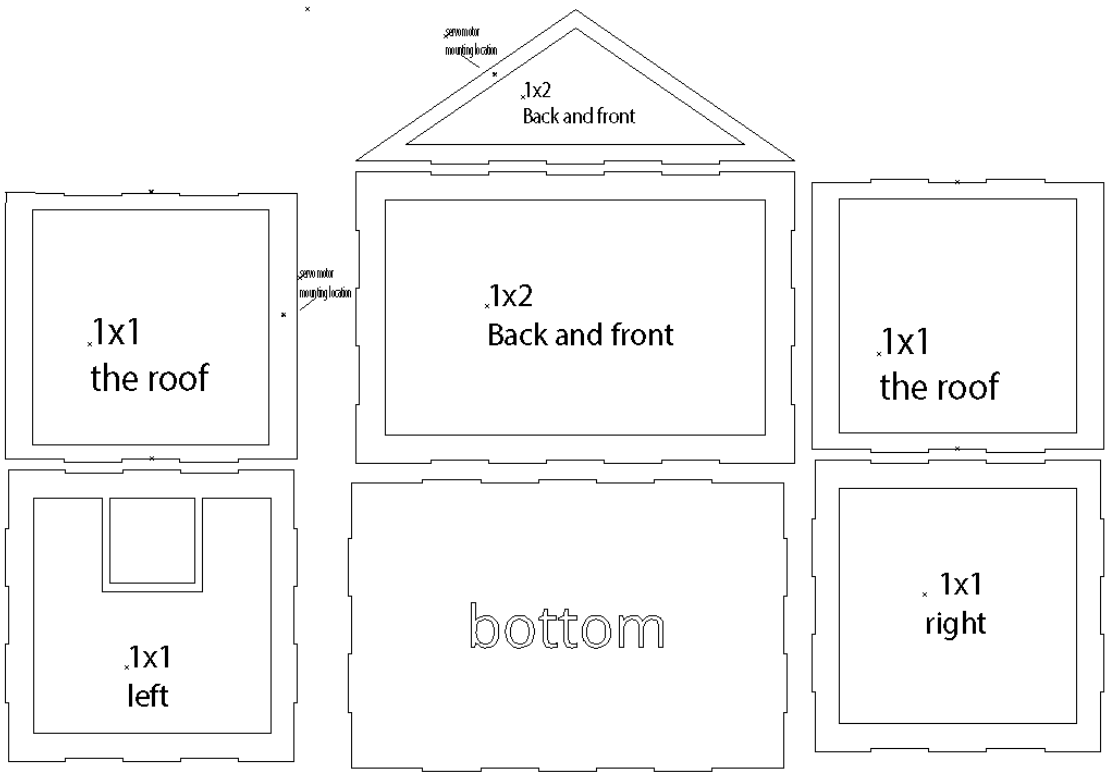
4 - DC engine;

5 - relay;

6 - power supply block;

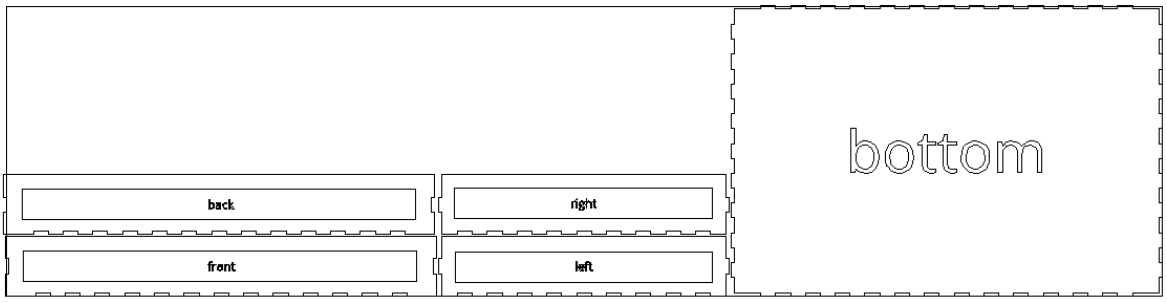
7 - voltage regulator;

8 - controller “Arduino UNO”.



Box of engineering devices

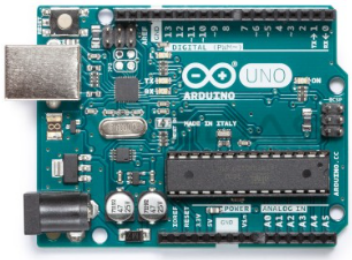
The box of engineering devices can be under the greenhouse



TEMPLATE for BEST PRACTICE EXAMPLES

Fan 120x120 12V

Servo TowerPro MG995 – Standard



Arduino Uno R3

Temperature sensor PT1000

TEMPLATE for BEST PRACTICE EXAMPLES

Soil Moisture Sensor with 1 channel relay 12 V - for automatic watering 1x4

12V R385 Water Pump

PVC pipe for water pumps

DHT22 temperature and humidity sensor with PCB

TEMPLATE for BEST PRACTICE EXAMPLES

CO2 meter AIRCO2NTROL COACH TFA with 24-hour data recording function

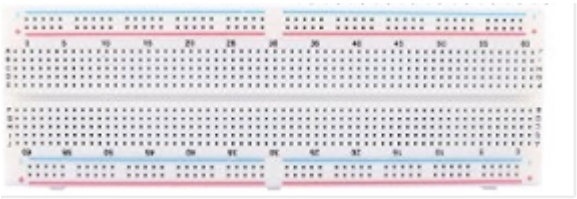
Grove RGB LED Strip WS2813 digital addressable IP65 30 LED/m 9W/m 5V 3m

RGB Strip Controller 12-24V 216W / 432W white

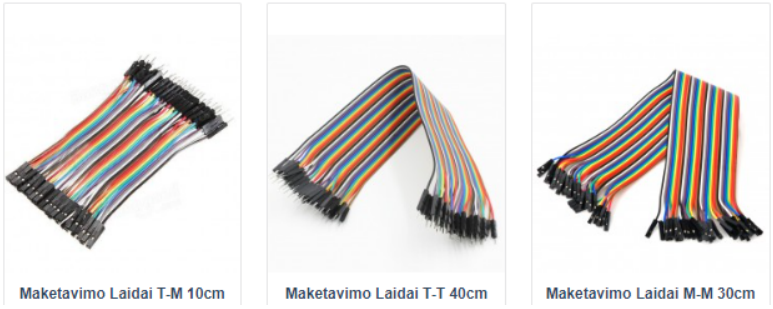
Rele 1x3

DC/DC Voltage Converter from 3V-32V to 5V-35V (STEP UP)

CP power cp12060E20



Mounting plate



Layout wires

8. Step by step, detailed description of the activity, including teaching and learning strategies:
   It starts with a goal, objectives and an algorithm for building a smart greenhouse.

   Gather information about the plants, decide what to grow in the greenhouse.

Drawings of the structure are made, cuts are made.

Electronics parts are selected. Programming.

The structure is assembled, the wiring is done, all the electronics are connected, everything is tested.

Data collected in the greenhouse during the study:

Weekly Study time	Room temperature °C	Greenhouse temperature °C	Greenhouse humidity %	Soil humidity %	CO2 in the greenhouse (% by volume)
10:00-13:00	20,3	24,65	43,00	38,91	0,06
11:00-14:00	21,5	24,89	32,00	38,91	0,05
9:00-12:00	19,8	23,10	25,00	39,00	0,05
12:00-15:00	22,6	25,90	48,00	42,25	0,06
13:00-16:00	23,2	25.40	44,00	38,91	0,05
14:00-17:00	21,9	24,86	43,00	34,00	0,06

Seeds are purchased. Planted in the greenhouse. We test again and do the tests as planned.

9. **Learning objectives/competencies:** The goal is to create a smart greenhouse for your school. Competences of initiative and creativity, communication competences, learning competences, cognitive competences, personal competences, subject competences, social competences, creativity competences.

10. **Evaluation/Assessment guidelines:**

Student evaluation:

- builds self-esteem, helps to understand how his/her abilities are changing over time (months, years);
- motivates the pupil to develop, encourages him/her to overcome obstacles, helps him/her to survive encourages a sense of success;
- increases the pupil's autonomy, helps him/her to reflect on his/her achievements to reflect on the next steps of the project;
- helps to reveal his/her understanding of the world, abilities and experiences;
- stimulates his/her thinking, develops problem-solving skills, encourages creativity;

- empowers the pupil to take some responsibility for his/her own learning.

Student assessments collect evidence of learning in planned and systematic ways, and in doing so, they establish levels of student learning.

11. **Lessons learned:** Programming, engineering, technology. The smart greenhouse project has been successful. Currently, our goals are set on making an aesthetically appealing variant that then could be launched onto the market.

12. **Additional information/Links:**

    https://www.facebook.com/photo/?fbid=2417987731671618&set=g.856170121499375
    https://youtu.be/3CPGfBIJ5M8

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