# HYDROPONICS

## COMMUNITY OF THE FUTURE INNOVATION CHALLENGE
## INSPIRATION KIT

Brilliant LABS

LABOS Créatifs

# What if...

## we could grow food in our class year round ?

Students will design and implement hydroponic systems to grow food indoors year-round. The final outcome will be a fully functional indoor garden where students can automate and monitor key conditions such as light exposure, water levels, and nutrient delivery. The project involves coding these hydroponic systems to ensure optimal plant growth and sustainability.

Ideation and problem-solving students experiment with different variables, such as light intensity and duration, to optimize plant growth. Their innovative approaches to system design and experimentation will directly impact the project's success and the effectiveness of their indoor gardens.

This knowledge can be applied to solve global challenges by promoting sustainable food practices and resource-efficient agriculture. Students will gain insights into indoor gardening techniques that can be used to address food security issues, especially in urban areas or regions with limited arable land. The skills acquired can help in developing solutions for more efficient and environmentally friendly food production.

# UN SDG


- Understand food growth and the impact of food shortages.
- How fresh food contributes to a healthy lifestyle.
- Sustainable farming for urban and non-traditional environments.
- Energy consumption and its relationship to farming.
- Reduce the negative impact that growing food has on the environment and ecosystems.
- How the environment affects growth.

# SKILLS

## Students will learn :

**Basic principles of hydroponics:**

Understanding how to grow plants in a soil-free environment.

**Programming skills:**

Coding hydroponic systems to automate and regulate environmental conditions.

**Experimental methods:**

Conducting experiments to observe how varying light conditions affect plant growth.

### FUN FACT:

**Hydroponics can use up to 90% less water than traditional soil farming! This is because water in hydroponic systems is recirculated, making it an incredibly efficient way to grow plants, especially in areas where water is scarce.**

## Topics/curriculum area

Science: Photosynthesis, Biodiversity and Conservation
Technology : Coding and Programming, Hydroponic System
Engineering: Design, Assembling
Arts: Photography, Written and Oral Communication
Mathematics: Data Management, Measurement

## Competencies

This project has been designed to support the Council of Ministers of Education, Canada global competencies.

- critical thinking and problem solving
- innovation, creativity, and entrepreneurship
- learning to learn/self-awareness and self-direction
- collaboration
- communication
- global citizenship and sustainability

## BADGES

- UN SDGs
- b.Board
- Design Thinking
- Engineering
- Problem Solving

# Levels of activity

## Hello World

- Students grow different vegetables in their hydroponic garden without automating any components.

## Intermediate

- Students code different parts of the growing process in order to automate some tasks (water level alarm, lights on and off).

## Advanced

- Students explore a variety of different plants and their needs.

## Brilliant

- Students operate a fresh food bank.

## Prerequisite skills

- b.Board cards link to be added here
- Water detect
- Motor control

## Timeframe

1-2 hours to set up, and up to two months growing period.

## Suggested grade level

**K - 12**

# Materials & resources

## In the Kit:

- growing trays and covers
- growing sponges
- growing baskets
- tweezers (for seed placement)
- growing tray water height gauges
- air pumps
- seeds
- USB Full spectrum LED strips
- USB to bare wire adapters
- USB to bare wire adapters
- micro:bits
- b.Boards
- Batteries and chargers
- Brilliant Labs Screwdrivers
- nutrients
- Alligator Clips

## Not in the Kit:

- personal protection equipment
- buckets and measuring cups
- building materials for LED support structure

## Useful resources

**Idea Cards** **b.Board Cards** **b.Board Ideation Cards**

# Possible development

## Introduction

Discuss the differences between traditional and non-traditional farming methods. What do we know about how food has been grown in the past vs the ways we are innovating today?

## Group brainstroming ideas

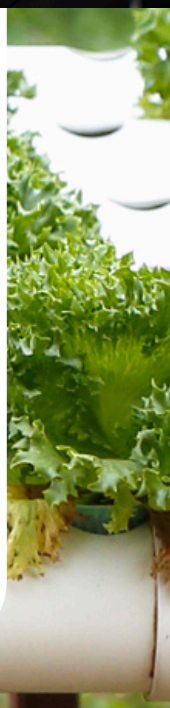
Look at traditional farming methods and hydroponics and how they differ

## Understanding plant growth

Explore the basics of nutritional value, growth time, and the specific needs of different plants.

## Group discussion

- Exploring the different food and their sources and the effect that has on our lives,
- identify different challenges and potential solutions.



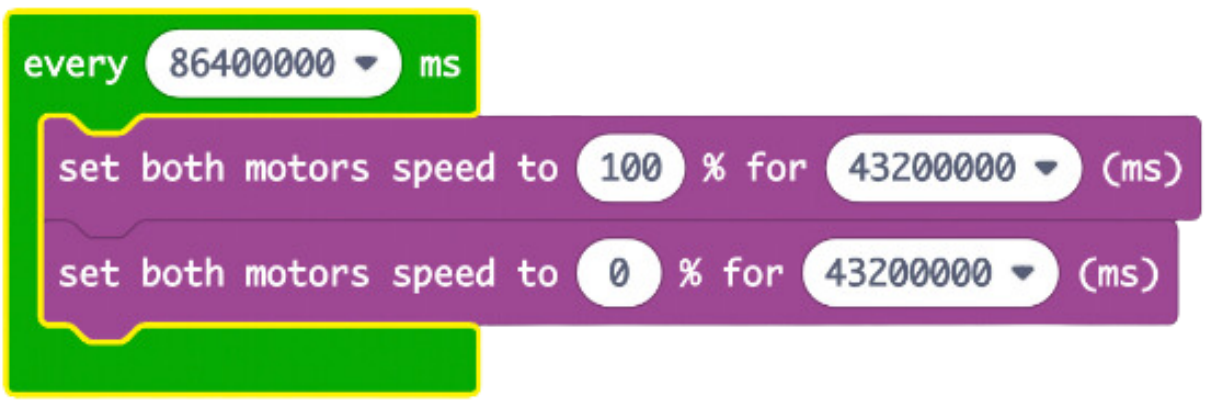
## Reflection

Reflect on the importance of hydroponic farming and how technology can be used to address global food security challenges. How could their future projects contribute to sustainable farming practices?

# Creating the PROJECT

## Assembling the system

1. Design and create a stand to support the LED light strip (and the USB pump if using)
2. Connect LED light strip to USB-wire adapter.
3. Connect USB-wire adapter to motor drivers on the b.Board
4. Add power to the b.Board (battery plugged to outlet if possible?).
5. Program the b.Board to control the motor driver so the light stays on for part of the day.
6. If using the programmable USB pump, connect to the other motor driver with a USB-wire adapter and program accordingly.
7. If desired, design a method to use the alligator clips to indicate water level



# Creating the PROJECT

## Setting up the hydroponic system

1. Place the air pump outside the tank.
2. Disconnect the air stone from the tube. Put the long side of the tube through the small hole in the top cover. Reconnect the air stone.
3. Place the air stone on the bottom of the tank. Mix 4 L of water with the nutrients according to the instructions and pour it in the empty grow tank.
4. Place the white flange in the cover.
5. If using the water level tube, place it through the flange, with the red end visible.
6. Using the tweezers add 2-3 seeds to the sponge, at about 0.5cm (¼") from the top of the sponge.
7. Place the sponge in the basket and place the basket in the top cover.
8. Make sure that the sponge gets wet with the splashing of the bubbles.
9. Measure the progress daily.(Water level should be high enough so that about half of the roots are in the water. Having some roots exposed to air is important for the growth of the plant.)

# Possible Problems:

## Lights or pump not working

- LED lights are polarity sensitive; try switching the USB-wire adapter wires over on the motor driver
- make sure the wires are not loose or touching
- double check your code
- ensure b.Board is turned on

## Plants are not thriving

- roots should not be submerged
- prevent temperature fluctuation
- avoid cold drafts from open windows
- nutrients may need be replenished

## Seeds do not sprout

- Make sure the moss is always wet.
- Try fresh seeds

## DID YOU KNOW ?

Plants in hydroponics can grow up to 50% faster than in soil!


# Facilitator tips

## Provide Demonstration:

The motor driver is used as it provides power when only two wires are available.

Encourage students to consider manipulating variables (e.g.,light time, light height, pump time, spring water vs. tap, etc.)

# Safety tips

Consider what may be required for the project (e.g. gloves, lab coat, safety glasses) and ensure students have access to anything they may need or want to protect themselves.


## Clean Up:

When finished working on the project for the day, clean up the working area and place materials where they belong.

# Ongoing efforts - what is needed to keep this up ?

Students will need to check on water levels to ensure there is enough to keep the plants alive. Some of the plant's roots must be in the water while other parts of the roots should be exposed to air to help encourage the plants to grow. The nutrient solution level of the plants should be checked every few days to ensure the plants grow as best as they can. Students will need to ensure that the plant remains in the same light source throughout the time of the experiment.

**purchasing of seeds and nutrient solution

## Did you know?

**Hydroponic plants can grow anywhere—even in space! Without the need for soil, hydroponics allows astronauts to grow fresh vegetables using water and nutrient solutions, providing food and oxygen during long missions in space.**

# Glossary

## Stem

The main body or stalk of a plant, typically rising above ground.

## Hydroponics

the technique of growing plants using a water-based nutrient solution rather than soil.

## Root

absorb water and minerals and transport them to stems. They also anchor and support a plant, and store food.

## Nutrient

any substance that plants or animals need in order to live and grow.

**Innovation Challenges Possible:**

**Community of The Future**

**Innovation Challenge**

**Date created:** September 2024 **Created by:** BL Team

Brilliant LABS LABOS Créatifs