Title: Smart Educational Bee Park – Technology for Nature

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Description of the challenge

Bees are one of the most important pollinators on Earth, yet their populations are declining due to habitat loss, pesticides, climate change, and food scarcity**.**

The '**Smart Educational Bee Park**' project connects students, teachers, and the community to explore how technology can protect biodiversity. Using bees as a central theme, students explore environmental challenges and apply coding, IoT, and AI concepts to design a Smart Educational Bee Park. The project integrates STEM, sustainability, creativity, and civic responsibility.

Purpose of the challenge

To understand the ecological importance of bees and biodiversity

· To develop computational thinking and basic coding skills

· To apply technology to solve real-world environmental problems

· Foster teamwork, creativity, and critical thinking

· To raise environmental awareness and civic engagement

Target Audience

Students aged 12–18 (lower and upper secondary education)

Time Required

10–12 hours (can be extended as a long-term project)

Recommend tools: Learners design a digital and real-life Bee Park**,** integrating: Materials & tech requirements

- AI-based fire detection**,**
- Microcontrollers: Arduino Uno, ESP8266, Micro:bit
- Design Software: Tinkercad, Canva, Scratch
- Spirulina microalgae bioreactors as sustainable bee nutrition,
- IoT Tools: Temperature, humidity, flame, and pH sensors
- Apps and Platforms: ThingSpeak (data visualization), Google Earth (park mapping), Spotify (podcast creation)
- NBS Resources: NBS EduWORLD, Scientix repository, NetworkNature, Oppla
- and AR/QR-based learning trails for public education.

Build an automatic watering system using:

- Arduino Nano / Uno
- Soil moisture sensors

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- Mini servo motors
- Water pump

Instructions

Steps 1- 2 : Problem Identification and Research
During this phase students understand the ecological role of bees, identify global and local problems faced by beekeepers, and explore how digital technologies can help mitigate them.
The first phase begins with the awareness campaign: "Put the Bees Back to Work! Plant a SUNFLOWER" which summarizes a series of commitments for a healthy, good, economic, and environmentally friendly future.

'If bees disappeared, humanity would survive for 4 years'
- ALBERT EINSTEIN -

Bees have the ability to be attracted to certain colors, mainly purple, yellow, etc. Sunflowers are one of their favorite flowers.



The students have conducted a study on the types and favorite flowers of bees, as well as ways to help bees and eliminate their disappearance. This will be part of a collaborative effort with local farmers and beekeepers in the Patos municipality and beyond. This message should also apply to the employees of the Green Cleaning Enterprise of our city, to be careful when choosing decorative flowers in the city's flower gardens for decoration, as not every flower that looks beautiful contains pollen and serves as food for bees.
Also, farmers or people who plant their vegetable gardens should plant the favorite flowers of bees around the garden and according to the respective seasons. This ensures the attraction of bees to their garden, which will then pollinate the garden's vegetables, making the planting more productive.
Students conduct field observations and interviews with local beekeepers to identify problems:

🌍 **Problems Faced by Beekeepers**

- *Habitat Loss:*

Urbanization, deforestation, and agricultural monocultures reduce wildflower fields and nesting spaces for bees.

- *Pesticide Impact*:

Synthetic pesticides cause colony collapse disorder and damage pollination chains.

- *Diseases and Parasites*:

Varroa mites and bacterial infections severely threaten bee health.

- *Climate Change*:

Unpredictable temperatures and droughts disrupt flowering seasons and weaken bee colonies.

- *Lack of Food Sources*:

With reduced biodiversity, bees face seasonal shortages of pollen and nectar.

They summarize findings in collaborative Google Docs and visualize them using Canva infographics.

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·Students use Google Earth to map bee habitats and areas at risk deforestation.
·Data on temperature and pollution levels is retrieved via open-access IoT databases (e.g., ThingSpeak).
·They present their findings through a digital presentation in Genially or Canva.

Steps3 - 4: Design of the Bee Park.

Students co-create a virtual and physical layout for the educational bee park.
Activities: Digital Design:
·Using Tinkercad and SketchUp, students design the park with separate zones:
·Flower gardens (bee-friendly plants)
·Bamboo beehive zone
·Using Canva for poster, demo + infographic creation, Spirulina cultivation lab
·IoT control center (technology hub)
·They simulate sensor placement, irrigation routes, and bee movement paths.

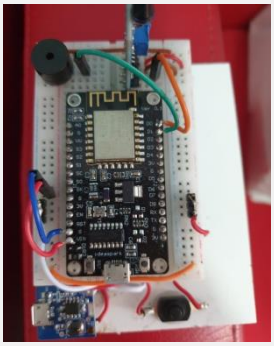
Step 5: Coding for nature

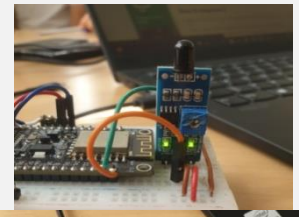
Students use CoSpaces Edu or BlippAR to create Augmented Reality visualizations of bees and flowers. Visitors can scan QR codes in the real park to see 3D models of bee anatomy, hive structures, and pollination cycles.
Use of Technology:
·3D modeling software (Tinkercad / SketchUp)
·Using Scratch to create games 'How to make a bee move' or 'How the bee collect pollen'
·Augmented reality tools (CoSpaces Edu, Canva QR integration)
·Microcontroller planning for sensor installation (Arduino schematic design); IoT or AI tools
The students created a website for beekeepers to share their problems and concerns and address their solutions through the creation of a chatbot, to advertise the sale of their products, and to serve as an educational teaching tool for school students with periodic information about the life and organization of bees in the hive, as well as various curiosities. Websites and tools to carry out a project with coding and online 3D design, e.g.:
Outcome: A hybrid blueprint — digital and physical — for the park's creation, connecting design thinking with environmental sustainability.

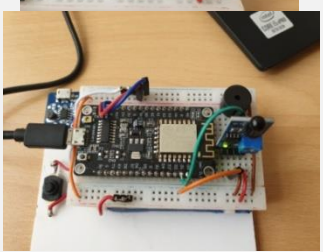
Step 6. Smart irrigation system

A. Smart Irrigation and Plant Care System
Problem Addressed: Drought and lack of bee-friendly plants due to irregular watering.
Technological Solution: Build an automatic watering system
Students write a C++ code to activate watering when soil humidity drops below a certain threshold.
Impact: Ensures continuous flower blooming — guaranteeing food sources for bees year-round.

Step 7. Fire & climate alerts







B. IoT Fire Detection and Alert System
Problem Addressed: Summer forest fires destroying hives.
Technological Solution: IoT system using: ESP8266 NodeMCU; Infrared flame sensor, Buzzer, SMTP or GSM module
The system sends an automatic email or SMS alert when flames or high temperatures are detected near hives.
Programming Platforms: Arduino IDE + Wi-Fi connection setup
Data Visualization: ThingSpeak platform for real-time updates.

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Impact: Prevents hive destruction, saving colonies and honey production.

C. Smart Hive Monitoring: Problem Addressed: Disease and hive stress due to temperature/humidity fluctuations.
Technological Solution: Installation of DHT11 sensors (humidity & temperature) inside hives.
Connection to Micro:bit or Arduino Uno for live data collection.
Development of a mobile dashboard (via MIT App Inventor) where students can view hive data.
Data displayed: Hive temperature(°C) Humidity (%) Activity patterns (vibration sensor)
Impact: Beekeepers can act early against disease or environmental stress,

Step 8: Spirulina Integration
With the aim of employing young people and reducing internal migration of young people or emigration of the rich and absorbing the workforce abroad, we suggest opening a business for the cultivation of microalgae which are fed as "bee vaccines", but not only honey for them, but also vitamins and proteins.
Create a **Spirulina cultivation lab** using transparent aquariums, air pumps, and pH sensors.
Students program **Arduino / Micro:bit systems** to control temperature, CO_2, and nutrient levels.
The produced Spirulina powder is tested as **bee feed supplement** during flower scarcity periods.
Discuss bioethics and sustainability implications of using algae-based supplements.

Step 9-10: Educational Activities
Open the park to students of all ages.
Install **QR codes** near each station (flowers, hives, Spirulina tanks) linking to explanatory videos and infographics.
Organize **coding workshops** for building small bee-inspired robots or AR apps showing hive anatomy.
Host **"Bee and Tech" Day** during Codeweek where visitors interact with projects, posters, and prototypes. https://youtu.be/H6XLZDeJOsU?si=uElFi178OxPrY6Md

Creating bee game in scratch :
https://youtu.be/10Wgz_s9US8?si=AQZRLkgo37szgLNW

Product Creation.
With honey and wax, the students created a variety of cosmetic products, such as hand cream, hair balm, lip balm, etc., in addition to health products, which are combined with royal jelly, propolis, etc.
In collaboration with the chemistry teacher, we created soaps with extracts of honey, wax, and pollen collected from bees.

Without Propolis in Bees, conditions would flourish that would normally cause disease and death among so many other species.
Propolis is collected by bees from a variety of tree sap sources, mixed with honey, pollen and only nature knows what else, but it contains a variety of beneficial nutrients and is antifungal, antibacterial and antiviral in nature.
Fun fact: Bees coat all surfaces of the hive with propolis and use it as a glue to hold everything together. But it could happen that if a rodent tries to invade the beehive, they will sting it to death, but it is too big for the cleaner bees to remove. In this way, by

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coating the rodent with propolis, mummification is done, so that it does not undergo the typical process of decay, which would endanger the hive. Propolis has been shown to be extremely useful as a natural immune system booster and an excellent source of macronutrients that are often deficient in our diets.

Step 11: Evaluation and Reflection
Students present results in panels, digital journals, and Canva posters.
Assessment through:
Peer collaboration rubrics
Project documentation and innovation reports
Self-reflection on sustainability goals (GreenComp alignment)

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