DRONES@STEAM

Fostering digital Transformation in VET schools
and creating new job prospects in the labour market

Project Result No: 2

Activity 3: EDUCATIONAL PACK: TEACHING MATERIAL AND ASSESSMENT

UNIT 2, Chapter 2.2, Worksheet 2.2.2

Lead partner(s): N.C.S.R. “Demokritos”, University of Crete

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CONTEXT

Grant agreement	2021-1-EL01-KA220-VET-000034686
Programme	Erasmus+
Key action	Cooperation for innovation and the exchange of good practices
Action	Strategic Partnerships
Project acronym	DRONES@STEAM
Project title	DRONES@STEAM: Fostering digital Transformation in VET schools and creating new job prospects in the labour market
Project starting date	28/02/2022
Project duration	28 months
Project end date	27/06/2024

WEBSITE:

https://dronesteam.eu/

CONSORTIUM: PARTNER LIST

- University of Crete (UoC) - Greece
- ECAM-EPMI (ECAM) - France
- Cyprus Computer Society (CCS) - Cyprus
- Politeknika Ikastegia Txorierri S. Coop (PIT) – Spain
- National Center for Scientific Research "Demokritos" (NCSRD) - Greece
- A & A Emphasys Interactive Solutions Ltd (EMP) – Cyprus
- Regional Directorate of Primary and Secondary Education of Attica (RDPSEA) – Greece

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Contents

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UNIT 2: Lesson Plan 2.2.2

UNIT 2	
Chapter 2.2	DIY drone kit assembly instructions and testing
Equipment, Software, Consumables	Equipment: Assembled air:bit and remote controller/Pen/Scale (optional) Software: MS MakeCode
Duration	1.5 Teaching hours
Short description	In this worksheet, there are activities on how to complete the initial testing of the mechanical parts of the air:bit drone.
Learning Outcomes	Ability to test the mechanical parts of a drone, including aerodynamics, weight distribution and rigidity of the frame
	Attention to detail, problem-solving, critical thinking, collaboration, communication of ideas, careful and methodical working
Activities	
Activity 1	**Exercise 2.2.2.1 | Micro:bit Out of Box Experience**
Aim of the activity	The aim of this activity is to familiarize students with how to run a special demonstration program that shows off some of micro:bit's features in a playful way, which is called the "out of box experience" program. Also, students should learn how to test the functionality of micro:bit's buttons, speaker, microphone, accelerometer and gyroscope.
Duration	20 min
Type of Activity	Exercise
Teaching Objectives	By the end of this exercise, students will understand how to complete the out of box experience program of micro:bit and test if its buttons, speaker, microphone, accelerometer and gyroscope are working properly.
Resources	Air:bit DIY drone kit
Activity 2	**Exercise 2.2.2.2 | How to Test the Motor Functionality of Air:bit**
Aim of the activity	This activity aims to familiarize students with how to test the motor functionality of air:bit.
Duration	30 min
Type of Activity	Exercise
Teaching Objectives	By the end of this exercise, students will understand how to test the motor functionality of air:bit.
Resources	Air:bit, Air:bit remote, PC, links
Activity 3	**Exercise 2.2.2.3 | How to Test the Propeller Rotation of Air:bit**
Aim of the activity	The aim of this activity is to familiarize students with how to test the propeller rotation of air:bit.
Duration	10 min
Type of Activity	Exercise
Teaching Objectives	By the end of this exercise, students will understand how to test the propeller rotation of air:bit.
Resources	Air:bit, Air:bit remote, PC, links
Activity 4	**Exercise 2.2.2.4 | How to Test the Operation of the Gyroscope of Air:bit**
Aim of the activity	The aim of this activity is to familiarize students with how to test the operation of the gyroscope of air:bit.

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Duration	10 min
Type of Activity	Exercise
Teaching Objectives	By the end of this exercise, students will understand how to test the operation of the gyroscope of air:bit.
Resources	Air:bit, Air:bit remote, PC, links
Activity 5	**Exercise 2.2.2.5 | How to Test the Weight Distribution & Frame Rigidity of Air:bit**
This activity aims	The aim of this activity is to familiarize students with how to test the weight distribution & frame rigidity of air:bit.
Duration	10 min
Type of Activity	Exercise
Teaching Objectives	By the end of this exercise, students will understand how to test the weight distribution & frame rigidity of air:bit.
Resources	Air:bit, Pen, scale (optional)

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Activity worksheet 2.2.2 (student version)

Chapter 2.2: DIY drone kit assembly instructions

Level: Intermediate

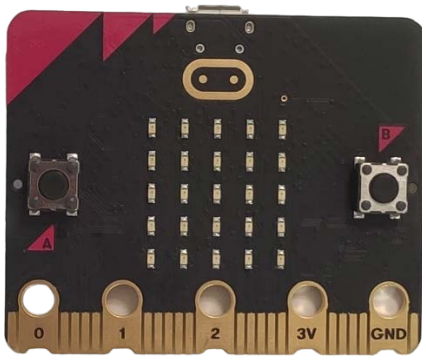
The purpose of this chapter is to teach students how to assemble a DIY drone kit and familiarize them with the different components involved in the process. The chapter will cover assembly instructions, initial testing, and prototyping using generic servos/motors with the micro:bit.

This activity worksheet will guide students through the initial testing of the mechanical parts of the drone, including aerodynamics, weight distribution, and rigidity of the air:bit frame.

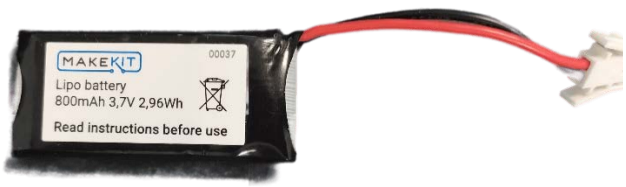
Students should have a basic understanding of electronics and have access to the air:bit drone and its remote for the hands-on activities. Also, they should have access to a PC with access to the internet in order to load the necessary code in the micro:bits.

Exercise 2.2.2.1 | Micro:bit out of box experience

Equipment



micro:bit



battery

Description

Micro:bit comes with an “out of box experience” program preloaded. When you power it up, it will automatically run it, taking you through its functionalities. Follow the instructions displayed on the LED matrix to go through the various functionalities which run in the following order:

- Press the buttons
- Shake

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- Tilt: chase the dot game
- Clap meter

What components of micro:bit are we testing through this program? Is everything working properly?

What steps do you need to follow

1. Connect the battery to the micro:bit.
2. After some audio and animation patterns followed by a “Hello” message, through which students can test if the speakers and the led screen are working properly, they should press button A to display sound and animation, when it prompts on the led screen.
3. Press button B to display sound and animation, when it prompts on the led screen.
4. Shake micro:bit to display sound and animation, when it prompts on the led screen. Through this process, students can test if the accelerometer of micro:bit is working properly.
5. Tilt micro:bit to the correct direction, in order to catch the flashing dot (target dot) with the chaser dot (in the middle of the screen). Through this process, students can test if the gyroscope of micro:bit is working properly.
6. Clap your hands and see if micro:bit counted the clap. Repeat 5 times. Through this process, students can test if the microphone and sound reaction of micro:bit are working properly.
7. **Bonus game**: If you press the A and B buttons together, it will unlock a secret snake game.

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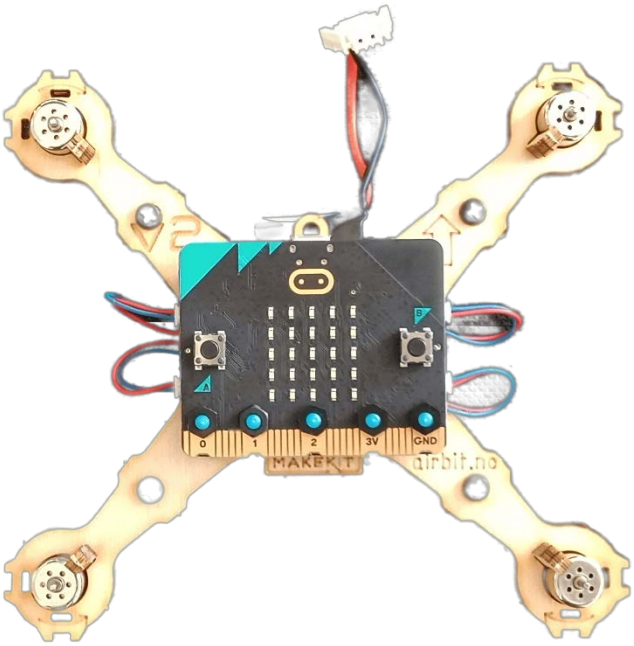
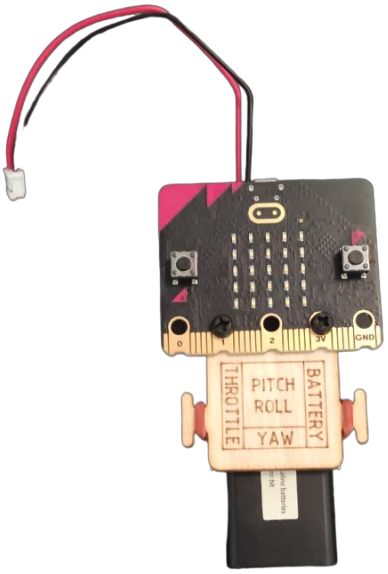
Exercise 2.2.2.2 | How to test the motor functionality of air:bit

Equipment



air:bit preferably without the propellers



air:bit remote

Software

- MS MakeCode
- Air:bit 2 code
- Remote controller code

Description

After mounting the motors, the control board with micro:bit and battery to air:bit, and after assembling the remote controller, install the ready-made codes to their micro:bits accordingly. Test if the motors of air:bit are working properly. Are they also able to accelerate?

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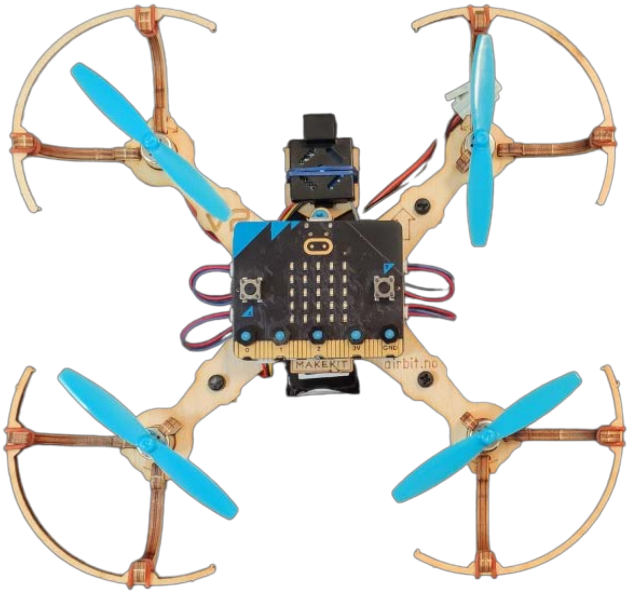
What steps do you need to follow

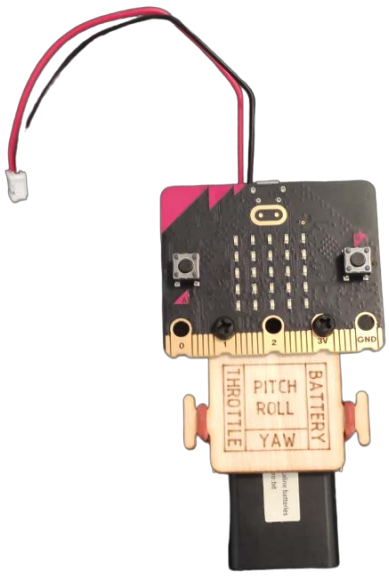
1. Download the code for air:bit 2 from https://www.makekit.no/en/docs/ and load it to the drone's micro:bit through MS MakeCode environment. Make sure the orange light of the micro:bit is blinking during the loading process.
2. Download the code for the air:bit remote from https://www.makekit.no/en/docs/ and load it to the remote's micro:bit. Make sure the orange light of the micro:bit is blinking during the loading process.
3. Press the buttons A + B on the remote and test if all four motors are working properly.
4. Press button B on the remote to test if throttle is working as well.
5. Decrease throttle by pressing the A button.
6. Press buttons A + B to turn off the motors.

Exercise 2.2.2.3 | How to test the propeller rotation of air:bit

Equipment



air:bit



air:bit remote

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Description

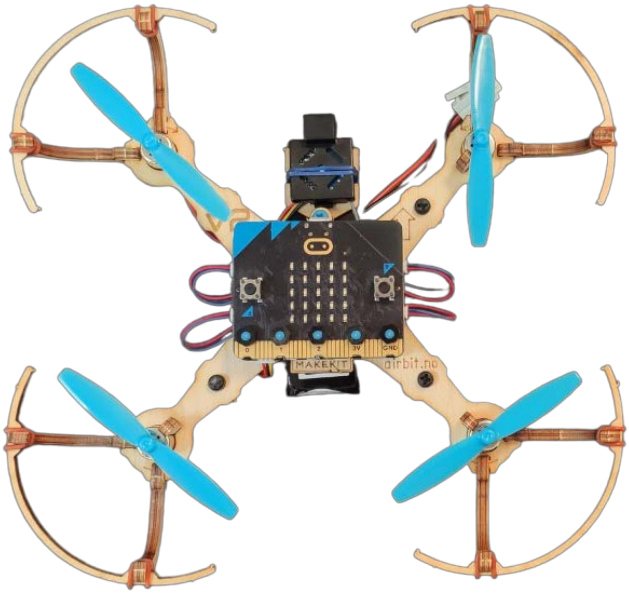
Verify that the propellers are securely attached to the correct motors and manually spin each propeller to observe if they rotate smoothly without obstructions and according to their direction (CW/CCW). Turn on the motors through the remote and test if all four propellers are working properly.

What steps do you need to follow

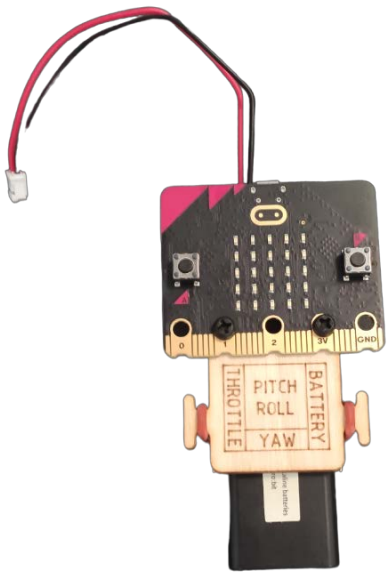
1. Verify that the propellers are securely attached to the correct motors, according to the arrow direction on the frame (↻ is clockwise-**CW** & ↺ is counterclockwise-**CCW**).
2. Manually spin each propeller to observe if they rotate smoothly without obstructions and according to their direction (CW/CCW).
3. Press buttons A + B on the remote and test if all four propellers are working properly.

Exercise 2.2.2.4 | How to test the operation of the gyroscope of air:bit

Equipment



air:bit



air:bit remote

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Description

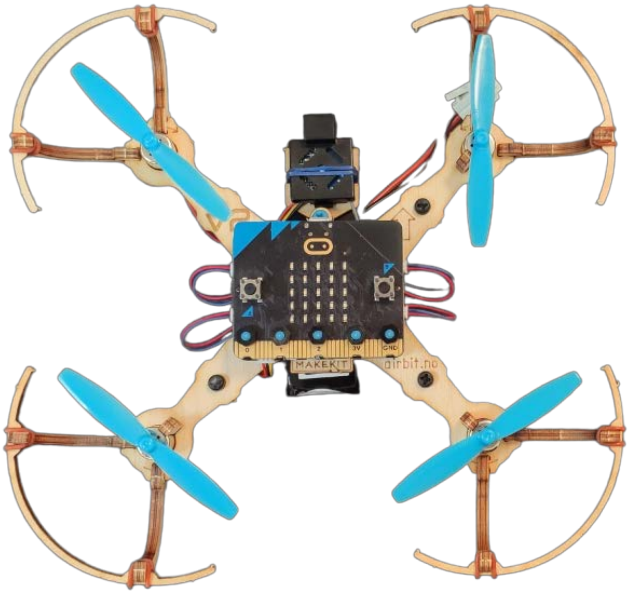
Verify that the gyroscope of air:bit is working properly.

What steps do you need to follow

Tilt the remote in various directions and watch if its center dot is moving the same way to the drone's led panel as well.
This way you can verify that the remote should be able to control the drone's roll and pitch movements successfully.

Exercise 2.2.2.5 | How to test the weight distribution & frame rigidity of air:bit

Equipment



air:bit

pen

Description

Verify that the weight of the drone is equally distributed and that its frame rigidity is satisfactory.

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What steps do you need to follow

1. Place the drone on a balance or pivot point (such as a pencil or dowel) and observe if it tilts to one side or remains balanced. If there is a significant imbalance, adjust the positioning of components that can be moved (battery, cables, etc.) to achieve better balance.
2. Inspect the frame for any signs of weakness, flexibility, or misalignment. Gently apply pressure to different parts of the frame to assess its rigidity. Look for any visible bending or flexing, as well as loose connections or weak spots.
3. Extra check: Measure the overall weight of the assembled drone using a scale. Compare it to the expected weight specified in the design or user manual (90g without the camera). Ensure that the weight falls within the desired range.

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