60-minute Pixel Art

Astro Pi Mission Zero Project

The Mission Zero Project

The International Space Station (ISS), located 400 km above us —roughly the distance between Paris and Lyon—is the largest satellite ever sent into space. Construction began in 1998, and today the ISS measures 110 meters in length and 74 meters in width. The result of an international collaboration involving the European, Japanese, Canadian, Russian, and American space agencies, the station has continuously hosted astronauts of various nationalities since 2000. Functioning as a true space laboratory, its primary role is to study the effects of microgravity on humans and matter.
Since 2015, the ISS is home to Raspberry Pi computers, initially installed by British astronaut Tim Peake. As part of the Astro Pi project, these devices allow students to design short computer programs to be run in orbit, giving them the opportunity to conduct scientific experiments in space.
This is particularly true for the Mission Zero project, which invites students to code a simple program that reads a measurement from an Astro Pi sensor aboard the International Space Station and displays a personalized image that astronauts can see while performing their daily tasks.

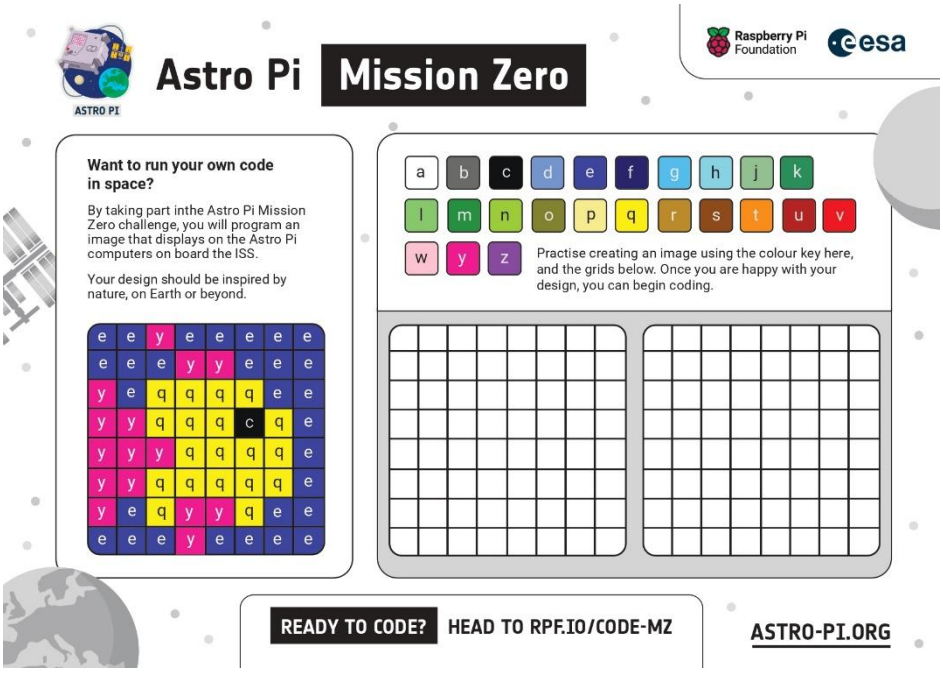
aboard the ISS ©NASA/ESA

Activity 1: Create Your Own Drawing

The goal of the “Mission Zero” challenge is to write a simple program to display a pixel-art image on an Astro Pi computer aboard the International Space Station and to take a measurement using its color and brightness sensor.

Your first mission will therefore be to create a drawing inspired by nature -whether on Earth or beyond. However, since this is a computer programming task, you’ll need to draw this image using pixel art. Once aboard the ISS, your drawing will appear on the LED screen of one of the Astro Pi computers located in the European Columbus module. This screen can only display a grid of 64 different colored squares. You’ll therefore need to come up with a design that fits on an 8x8-pixel screen.

Moreover, your code must use the Astro Pi's light sensor. You'll therefore need to imagine two versions of your drawing: a “day” version and a “night” version. **To do this, color in the squares on the document below using different colors to create two drawings.** You can use the attached sheet to create your drawings.



Activity 2: Programming the Astro Pi

Once you have your drawing, **you will need to program the Astro Pi computer to display it on its LED screen**. To do this, you need to use a programming language. Just as we use languages to communicate with people, there are languages used to instruct computers to perform specific tasks. Just as there are languages like French, English, Spanish, and German, there are also various computer languages for communicating with a computer. For the Astro Pi, you need to use Python, a language widely used by scientists.
However, writing computer code can be challenging when you're just starting out. To make programming the Astro Pi kit easier, you can use the Spaceblock tool developed by CNES through its ESERO France office. This tool allows you to code by assembling blocks, which are then converted to Python.

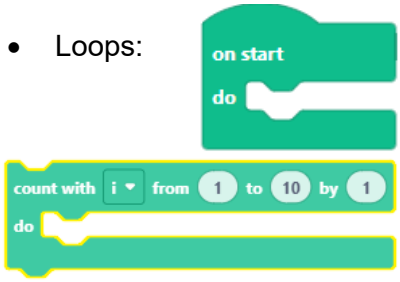
Your second mission will therefore be to create a program that will run for 30 seconds on the Space station. This program should display an image on the LED screen if it is dark. If it is light out, a different image should be displayed. The program will therefore look like this:

If *It's bright out*
Then *Display Image 1*
If *It's dark*
Then *Display Image 2*

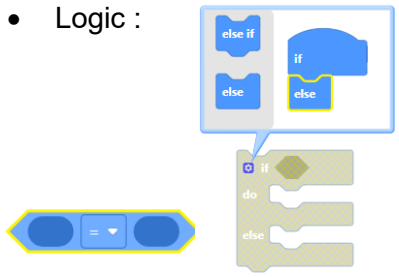
Using the Spaceblock tool, you can reproduce and complete the program shown below.

Block list:

- Loops:

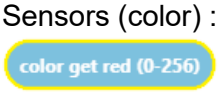


- Logic :



- LED :

- Sensors (color) :

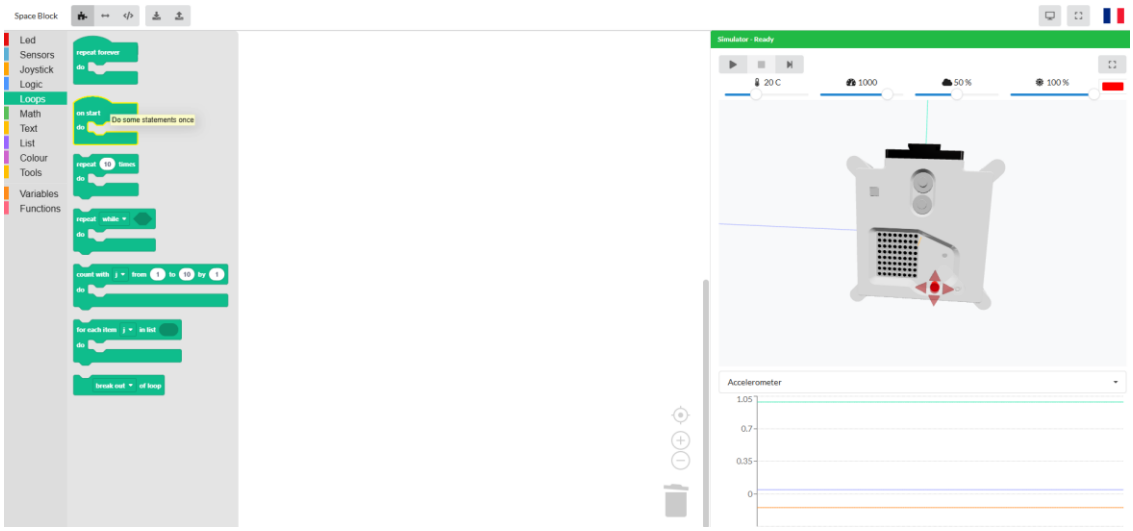


Be sure to grab the bubble by its left edge to insert it into the loop of the "Si" knot.

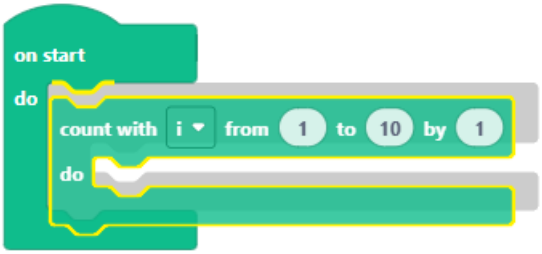
- Math :

- Tools :

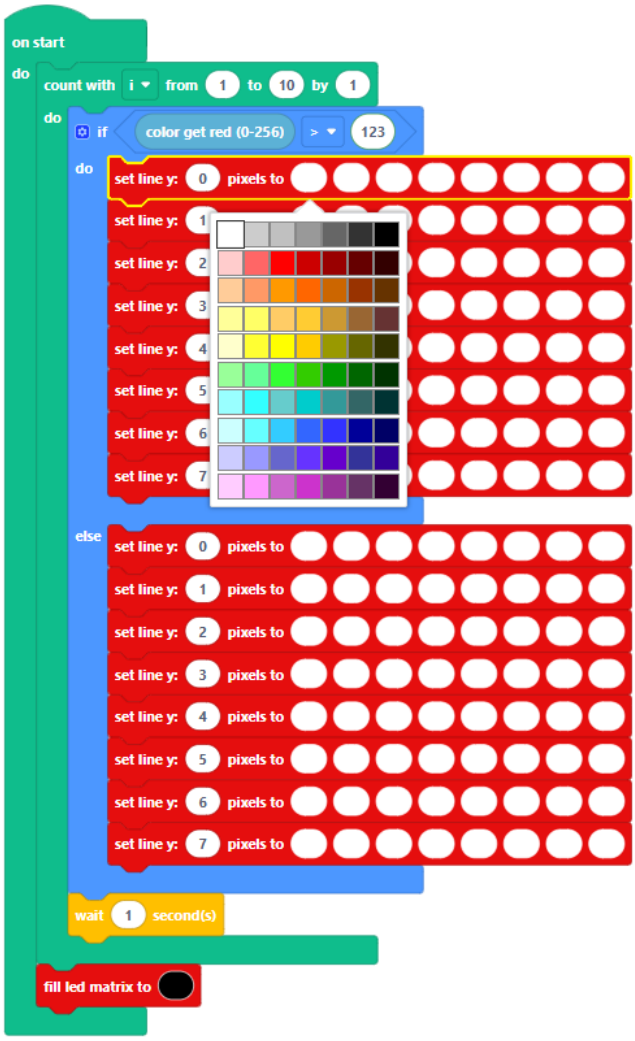
1. Select the block you're interested in from the left-hand column and drag it to the central section.



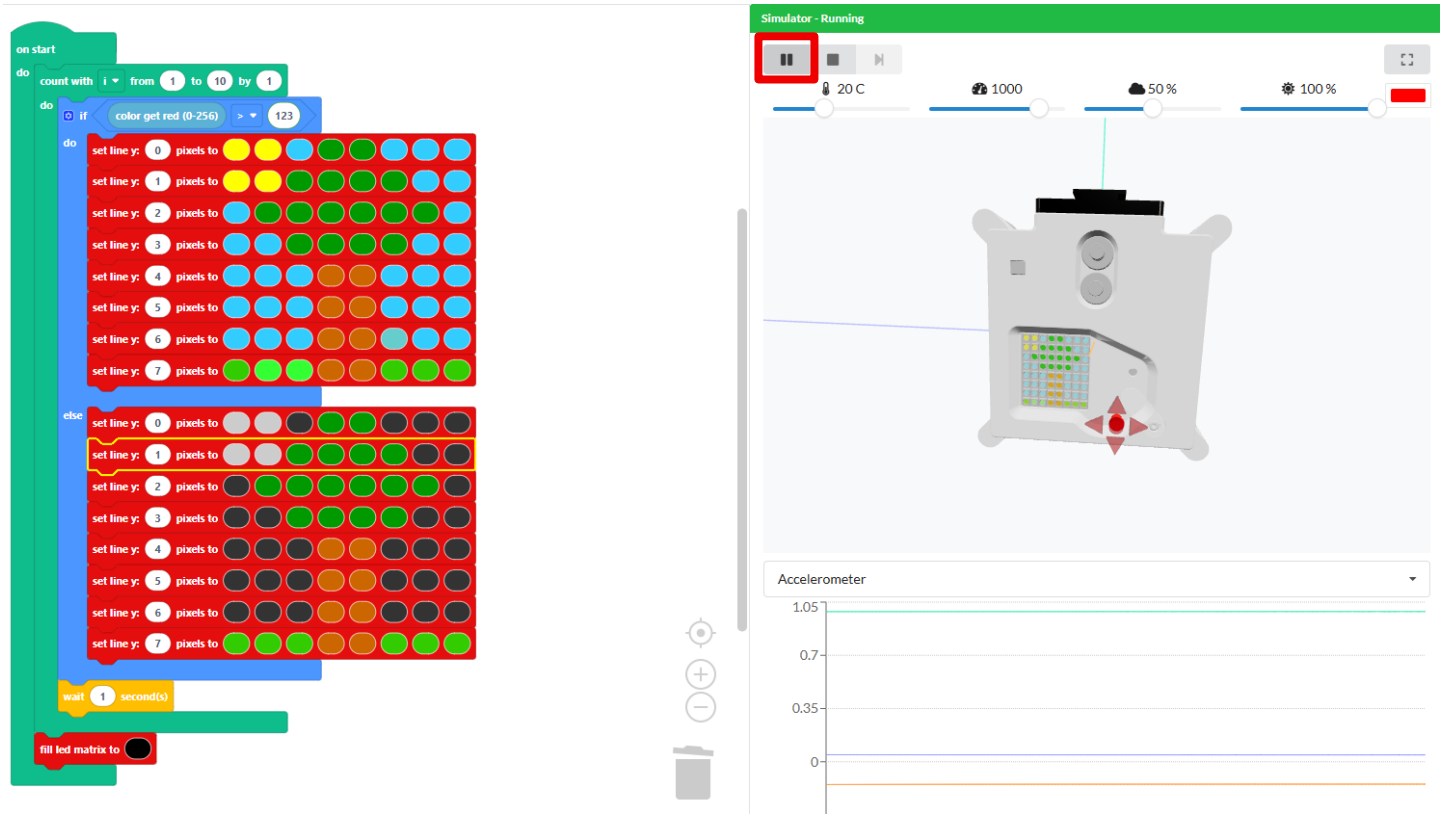
2. Recreate the diagram above.
Note: To include a new block in the "On Start" loop, simply drag it inside. You can also copy and paste a block.



3. Reproduce your two drawings, changing the colors of the cells.



4. Test your program by clicking the “Run” button located in the right-hand tab.



Finally, your mentor submits your program via the [European Space Agency (ESA) website], testing your program and registering your team. Once your code has been validated and executed aboard the ISS, you will receive a certificate of participation from ESA indicating the ISS’s position when your program was executed.

Astro Pi Mission Zero

Raspberry Pi Foundation

esa

ASTRO PI

Want to run your own code in space?

By taking part inthe Astro Pi Mission Zero challenge, you will program an image that displays on the Astro Pi computers on board the ISS.

Your design should be inspired by nature, on Earth or beyond.

e	e	y	e	e	e	e	e
e	e	e	y	y	e	e	e
y	e	q	q	q	q	e	e
y	y	q	q	q	c	q	e
y	y	y	q	q	q	q	e
y	y	q	q	q	q	q	e
y	e	q	y	y	q	e	e
e	e	e	y	e	e	e	e

a	b	c	d	e	f	g	h	j	k	
l	m	n	o	p	q	r	s	t	u	v
w	y	z								

Practise creating an image using the colour key here, and the grids below. Once you are happy with your design, you can begin coding.

READY TO CODE? HEAD TO RPF.IO/CODE-MZ

ASTRO-PI.ORG

Appendix: Offline worksheet

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Adapted by ESERO France and CNES, 2026