AFRL

NEW MEXICO

AFRL NM STEM Academy

Robotics Challenge
Coach Orientation

*An Air Force Research Laboratory (AFRL)
education outreach program at Kirtland Air Force
Base (KAFB) in partnership with New Mexico Tech*

- Welcome and Introductions

- AFRL NM STEM Academy Overview

- Robotics Challenge Overview

- Next Steps

Welcome & Introduction

- AFRL NM STEM Academy Staff

- Participants

  - Name

  - School

  - Grade Level

  - Subject Area

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Air Force Research Laboratory

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Air Force Research Laboratory

Nine Technical Directorates

10,000 employees
> $4B Annual Budget

AFRL New Mexico
1800 Employees, $650M

711th Human Performance

Air Force Office of Scientific Research

Aerospace Systems

Directed Energy
Directed Energy

Information

Materials and Manufacturing

Munitions

Sensors

Space

AFRL NM STEM Academy Overview

- A science, technology, engineering, and math (STEM) education outreach program sponsored by the Air Force Research Laboratory (AFRL) at Kirtland Air Force Base (KAFB).

- Implemented through a Partnership Intermediary Agreement between AFRL and New Mexico Tech.

- Offers hands-on, minds-on STEM activities that engage students in the application of STEM content in context – many of these activities focus on basic STEM concepts behind technologies being developed by AFRL's Directed Energy and Space Vehicles Directorates.

- Provides annual "Missions" aligned with content standards that students can participate in during the school year.

- Participates in a variety of STEM community events.

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AFRL NM STEM Academy Objectives

- Raise student interest in and knowledge of STEM by providing hands-on opportunities to explore these concepts, in context, as they relate to AFRL Directed Energy & Space Vehicles technology areas.

- Involve students in STEM outreach activities, especially those from diverse backgrounds and population groups traditionally underrepresented in STEM fields.

- Involve scientists & engineers in outreach activities to further student and teacher awareness and understanding of STEM career possibilities.

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Why do we provide STEM outreach activities?

Our ultimate goal is to increase the number of qualified candidates for STEM-related careers with an emphasis on increasing the diversity of applicants ready to enter the STEM workforce.

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AFRL NM STEM Academy Mission Overview

DoD STARBASE

25 hours of hands-on STEM
(1000 5th graders)

STARBASE 2.0

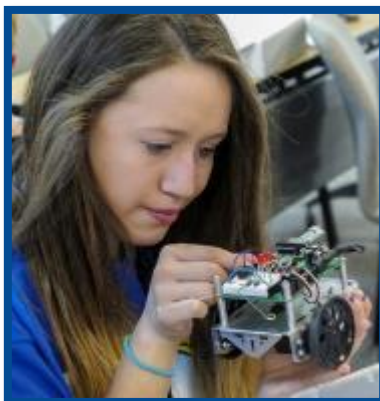20+ mentoring sessions focused
on model rocketry (6th- 8th graders)

TECH Mission

15 hours of hands-on STEM
(600 6th – 8th graders)

Mission to Mars

10-12 weeks classroom prep for simulated
manned mission to Mars
(1000 5th graders)

Robotics Challenge

15 hours of hands-on STEM
curriculum & on-line environment
(300 6th – 8th graders)

STEM Challenge

15 hours of hands-on STEM
curriculum & on-line environment
(300 9th – 12th graders)

- Students will work individually on:

Python Programming

micro:bit Microcontroller
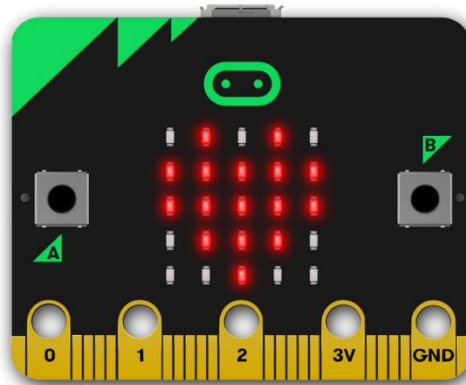
micro:Maqueen Robot
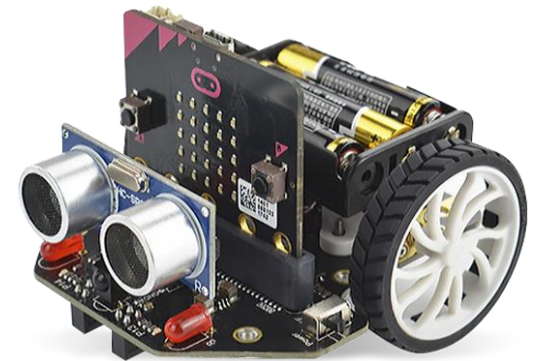
- Students will submit their work using the Canvas learning management system

Robotics Challenge Overview

- AFRL NM STEM Academy will provide student login information for Canvas that allows students to access tutorials and the ability to upload assignments.

- All materials are provided.

- All software is browser based.

- There are 3 modules of tutorials and assignments.

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Robotics Challenge Overview

- Students must complete a module before being eligible to receive the materials for the next module.

- In the first module, students will complete Python tutorials and 2 out of 3 assignments to be able to advance to the next module.
  - Coaches will submit a request for micro:bits for those students who complete the Python assignments.

- In the second module, students will complete micro:bit tutorials and 3 out of 4 assignments to be able to advance to the next module.
  - Coaches will submit a request for robots for those who complete the micro:bit assignments.

- In the third module, students will complete a micro:Maqueen robot tutorial and complete as many assignments as they wish.

- The deadline for materials requests is February 26, 2021.

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Robotics Challenge Overview

- A second level of activities is tentatively planned for the month of March. These activities will substitute for the Robotics Challenge Expo that normally occurs at our facility at KAFB.

  - We hope to get input from Coaches to inform what this will look like.

  - We will adjust the March Expo activities based on Covid-19 school protocols that exist in the Spring.

- An awards celebration Zoom meeting is tentatively scheduled for April 16, 2021.

  - Awards will be announced for the student with the highest point total for all activities and other awards based on the March Expo activities.

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Why use Python?

- One of the most widely used programming languages in education, research and industry.

- Extensive libraries of code and support

- Easier to learn than many other languages

- Easier to do more complex programming than block programming

- Can be used for a wide variety of projects (games, robotics, maps, websites, etc.)

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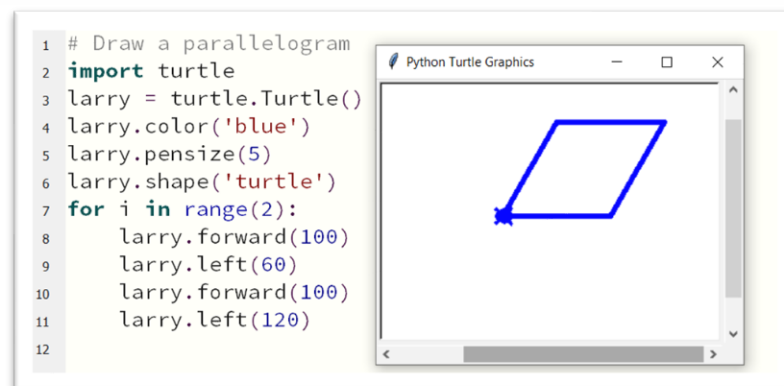
Module 1 – Python Programming Tutorials

- Alternative Editors

- Print Functions

- Variables

- Drawing with Code (Turtle module)

- For Loops

```
main.py
1    # First Program - This program will
     display a message.
2    print("Hello World!")
3
```

```
Hello World!
>
```

```
1    # Draw a parallelogram
2    import turtle
3    larry = turtle.Turtle()
4    larry.color('blue')
5    larry.pensize(5)
6    larry.shape('turtle')
7    for i in range(2):
8        larry.forward(100)
9        larry.left(60)
10       larry.forward(100)
11       larry.left(120)
12
```

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Module 1 – Python Programming Assignments

- Assignment 1 - Writing with Variables

- Assignment 2 - Drawing with Code

- Assignment 3 - Geometric Pattern
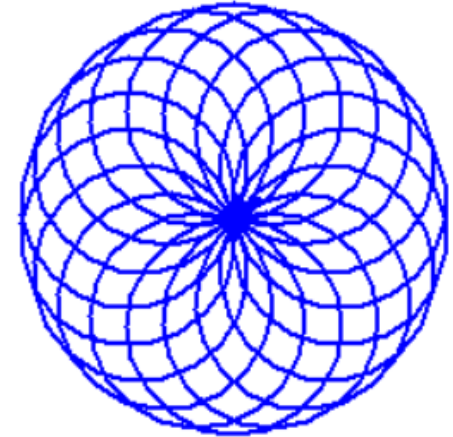
```
1  #Make a sentence with variables
2  count = 7
3  food = "pancakes."
4  name = "Larry"
5  request = "Bring"
6  print(request, name, count, food)
```
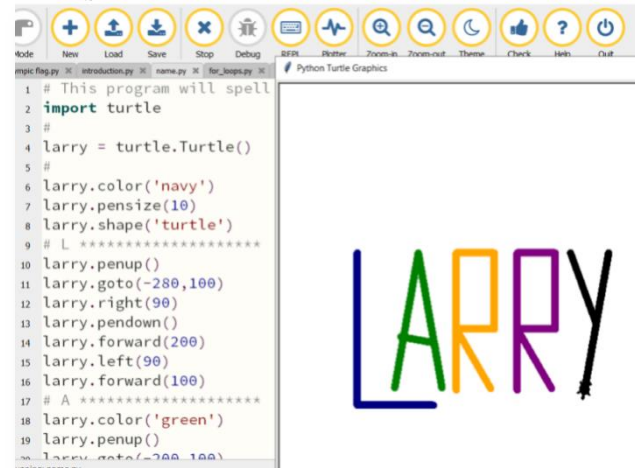
Running: make a sentence.py

```
Bring Larry 7 pancakes.
>>>
```

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Module 1 – Python Programming Assignment Expectations

- Code must be personalized and documented.

- Students will be asked to do screen print and create a document from their device.

- File names must include the name and school of the student and the name of the assignment.

Coaches will make a request for micro:bit distribution anytime after students complete 2 out of 3 assignments up to February 26, 2021.

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Module 2 – The micro:bit Microcontroller Tutorials

- Introduction to the micro:bit

- Buttons and Pins

- Sensors

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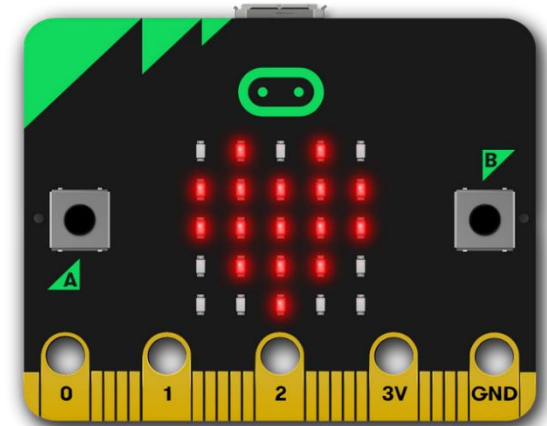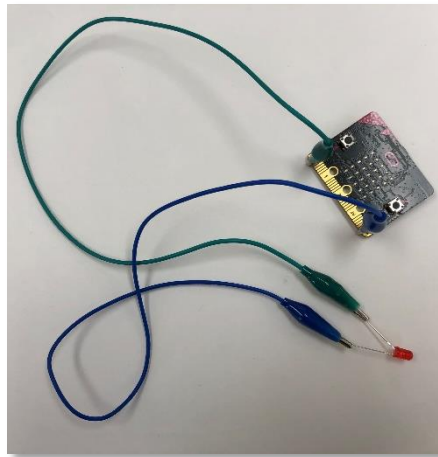
Module 2 - The micro:bit Microcontroller Assignments

- Assignment 4 - Animation

- Assignment 5 - Buttons

- Assignment 6 - Pins
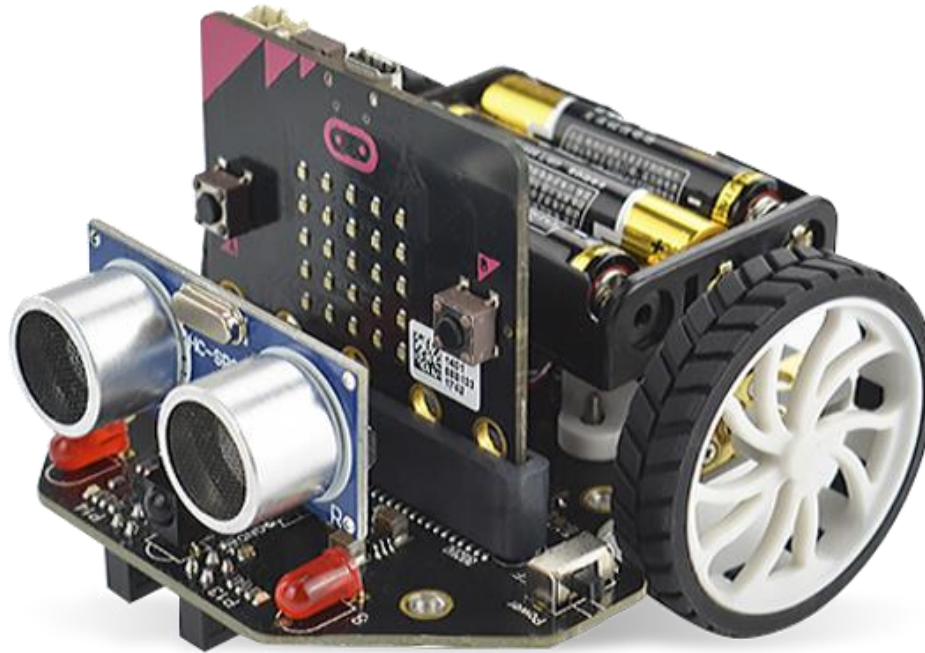
- Assignment 7 - Light Sensor
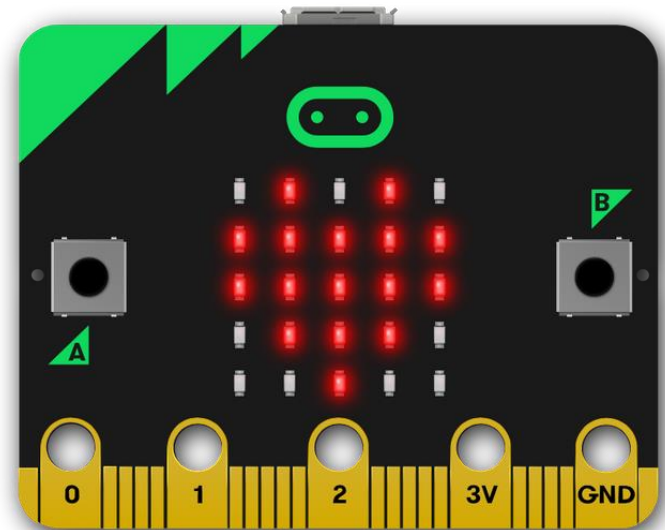
Module 2 - The micro:bit Microcontroller Assignment Expectations

- Students will record video demonstrations of their work.

  - Videos must be converted into mp4 files.
  - Students will introduce themselves and describe their work.
  - The camera must be close enough to see all aspects of their demonstration.
  - It may take several tries to get quality footage. We want to be able to share their work.

- File names must include the name and school of the student and the name of the assignment.
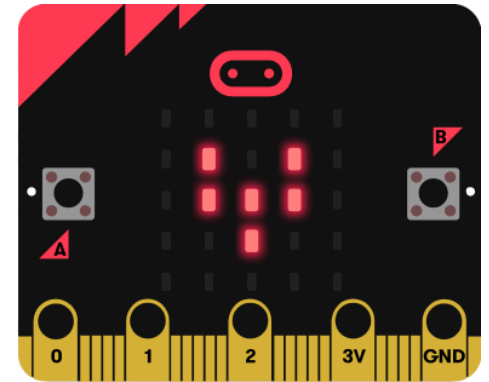
Coaches will make a request for micro:Maqueen distribution anytime after students complete 3 out of 4 assignments up to February 26, 2021.

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Module 3 – The micro:Maqueen Robot Tutorial

Module 3 – The micro:Maqueen Robot Assignments

- Assignment 8 - Figure 8

- Assignment 9 - Curves - Letter S

- Assignment 10 - Robotic Arm

- Assignment 11 - Line Following

- Assignment 12 - Ultrasonic Sensor

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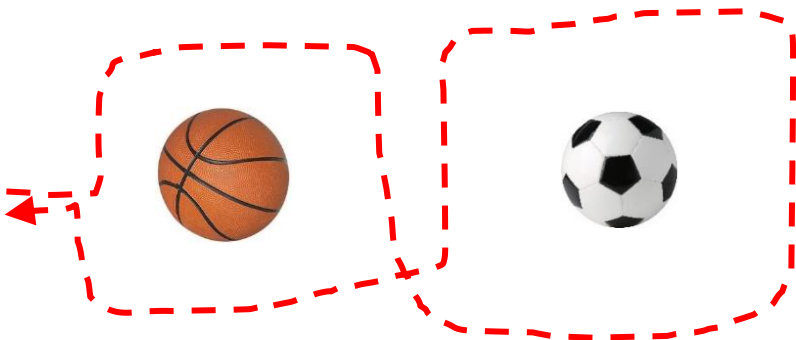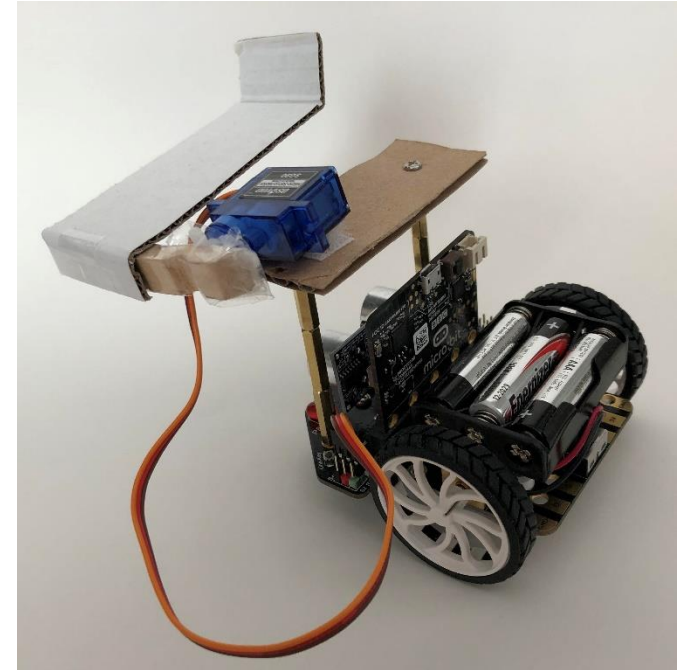
Module 3 – The micro:Maqueen Robot Assignment Expectations

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    - Videos must be converted into mp4 files.
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    - The camera must be close enough to see all aspects of their demonstration.
    - It may take several tries to get quality footage. We want to be able to share their work.

- File names must include the name and school of the student and the name of the assignment.

Students will qualify to participate in the March Expo activities based on their total points earned.

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Module Assignments

Assignment Points:

- Each assignment is worth 10 points and points will be awarded only if all requirements are met.
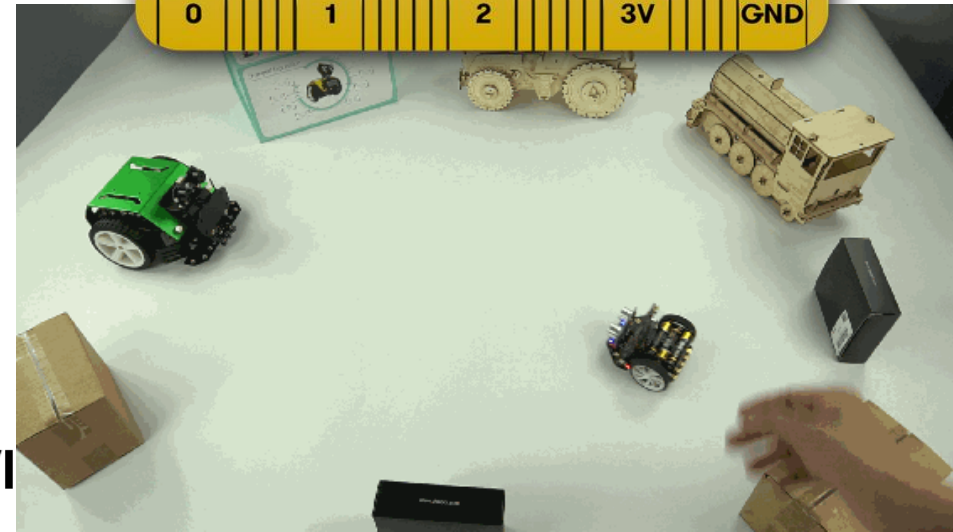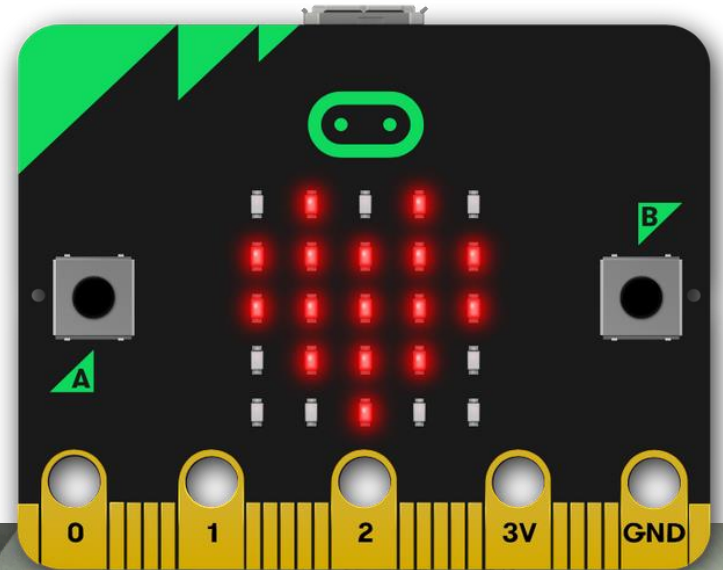- No partial credit will be awarded, but students may resubmit their work.

Assignment Suggestions:

- Be creative
- Record video conference meetings.
- Use the laptop camera.
- Email cell phone video to yourself.
- Use https://convertio.co/ to convert video to mp4.
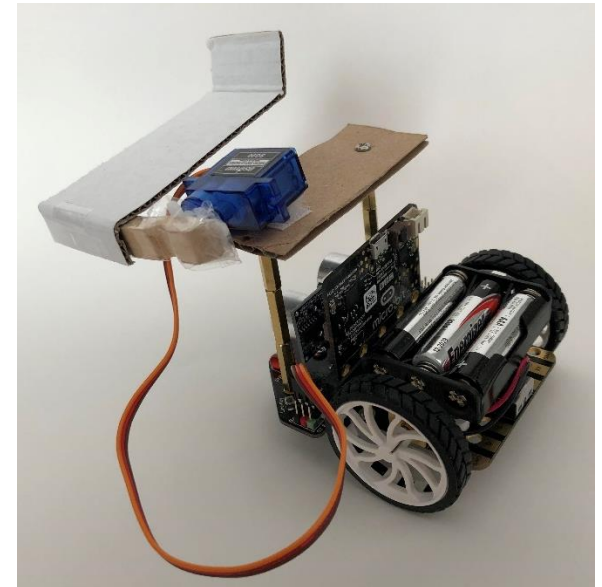

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- Infrared
- Ultrasonic
- Light
- Temperature
- Compass
- Accelerometer

Servos & Prototype Materials

- 2 Servos for making robotic arms
- Hardware for attaching material to the robot
- Alligator clips
- Cardboard
- Scissors
- Screwdriver
- Ruler
- Tape

- There will be a short second level of competition that will be developed based on student participation and Covid-19 protocols in the Spring.
 - We welcome input from coaches on what this will look like.
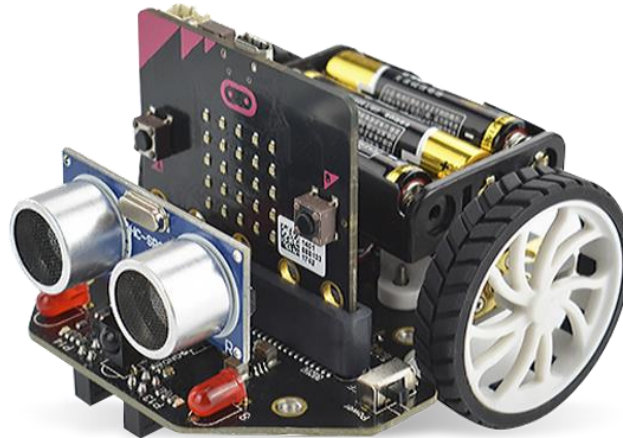
Zoom Awards celebration on April 16.

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Canvas Learning Management System

- AFRL NM STEM Academy will send invitations to Coaches to create their own Canvas accounts.
  - Please don't share your invitation.

- Coaches will complete and return the student list spreadsheet.

- Email addresses will be created that will be used as student Canvas login accounts.

- Example: **robotics+manzano17@afrlnewmexico.com**

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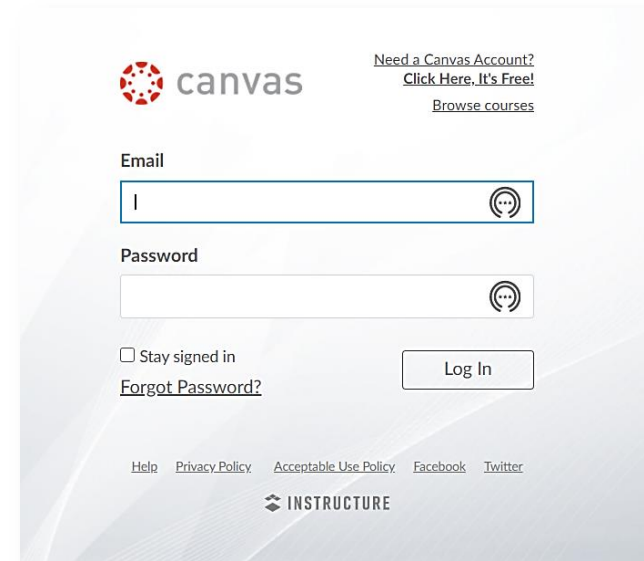
Canvas Learning Management System

- AFRL NM STEM Academy will send a list of email addresses and passwords for student logins.

  - Please do not change the passwords provided.

  - Students must use the login information provided.

  - Unidentified accounts will be deleted.

  - Students will need to login and change their profile name.

  - Students will continue to use the robotics email address to login.

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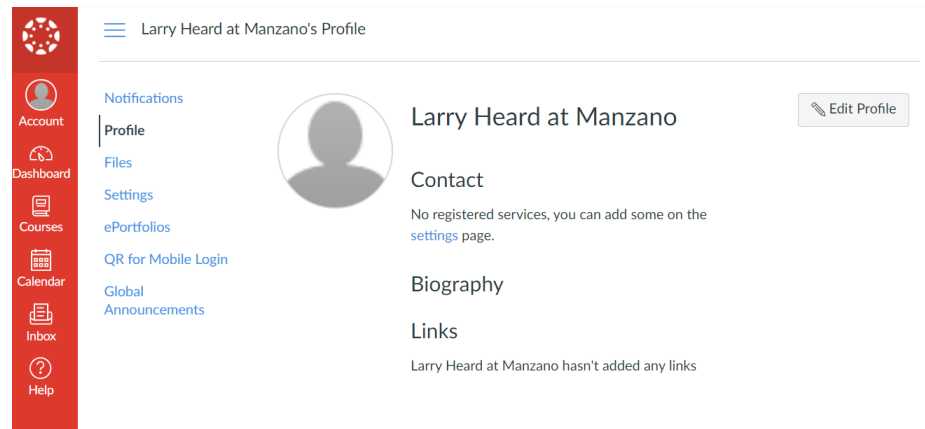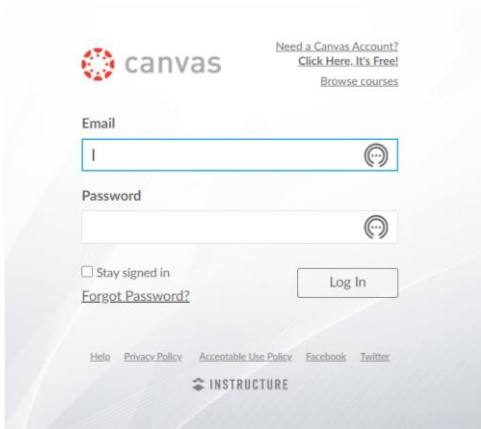
Required Forms

Ensure information required by AFRL NM STEM Academy is provided as soon as possible.

- EPA Modification Form with principal signature: One form per school

- Student & Adult Media Release Forms for all attendees (Google Forms)

- Demographics Form (Google Form)

- Excel spreadsheet with names of students and gender (Excel template will be sent)

- Teacher, student, parent feedback forms (Google forms)

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- Complete Python tutorials and assignments before the holiday break.

- Complete micro:bit tutorials and assignments by the end of January.

- Complete at least some of the robot assignments by the end of February to prepare for the Expo activities in March.

Next Steps

- Sample Kit Distribution

- Complete & Submit Forms

- Coaches Login to Canvas

- Coach Zoom Training Meetings *(as needed)*

- Students Login to Canvas

- Start Learning Python

Let's have fun!

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Wrap-Up
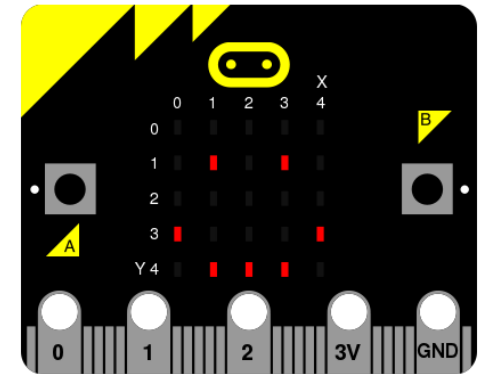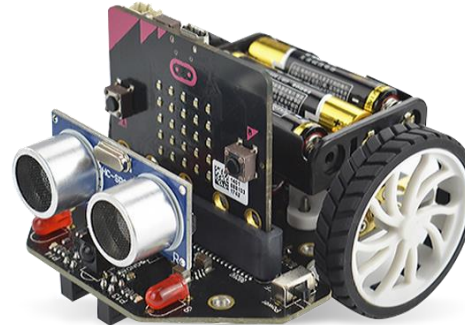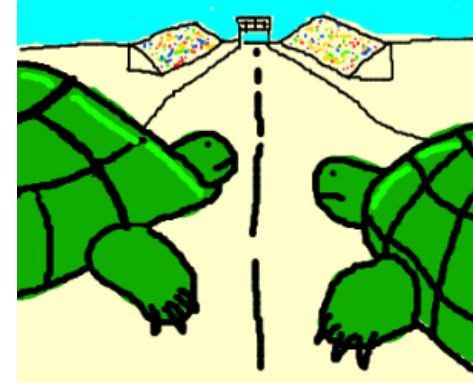
Contact us if you need help or have questions:

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