Practical Applications of AI in Education with VEX AIM

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VEX AIM

Workshop Goals

- Learn how VEX AIM supports teaching about responsible AI in a safe way
- Practice using AI Vision to accomplish a task
- Explore AI Vision and factors that affect it
- Connect what we learn about AI Vision to teaching about AI more generally

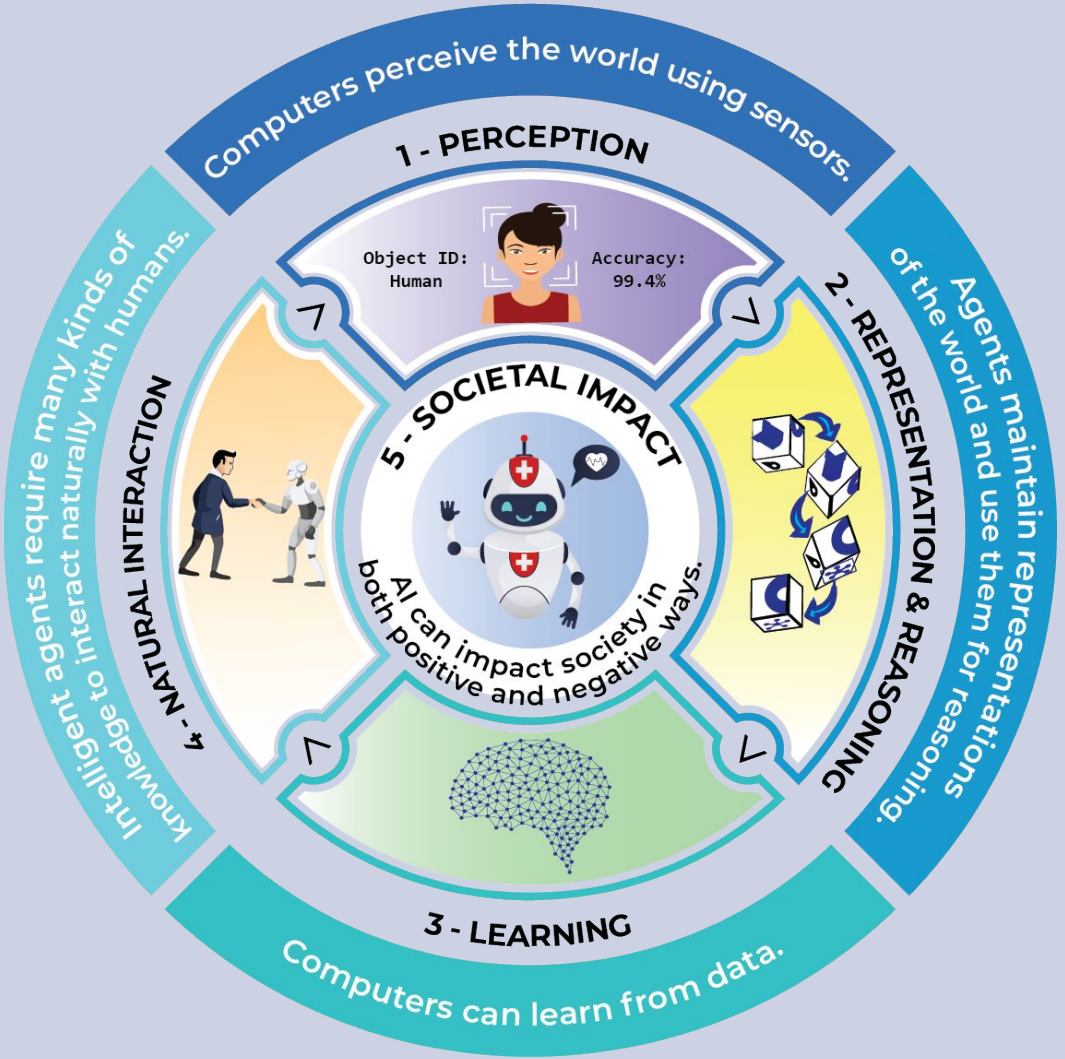
What is Artificial Intelligence?

"Artificial Intelligence is a branch of computer science concerned with techniques that allow computers to do things that, when people do them, are considered evidence of intelligence."

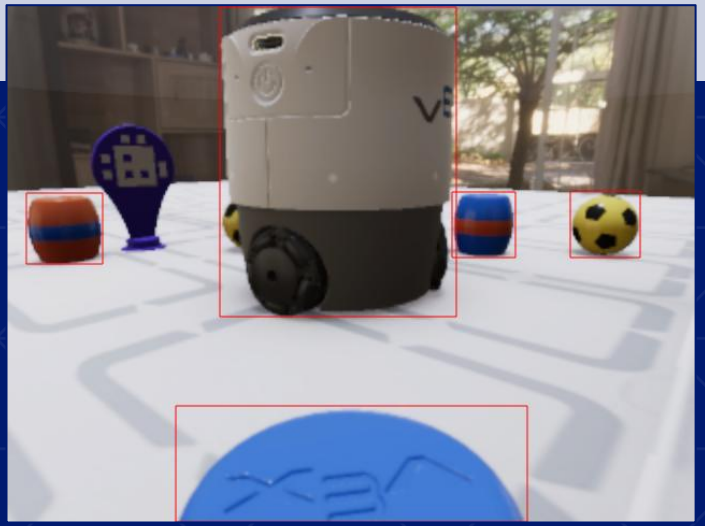
- Dr. David S. Touretzky

AI4K12:

5 Big Ideas



- Think critically about AI tools
- Awareness of the capabilities and limitations of different AI tools
- Understand enough to be able to problem solve with those tools



How VEX Teaches AI

- No student data is transmitted outside
- All processing happens locally
- Compliance with laws such as FERPA, GDPR

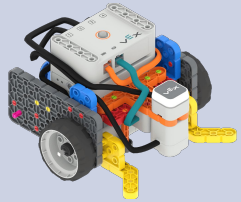
What is VEX AIM?

The VEX Continuum

VEX 123

Coding Starts Early

Ages 4+



VEX GO

STEM Starts Early

Ages 8+

VEX AIM

Real World Coding

Ages 8+

VEX IQ

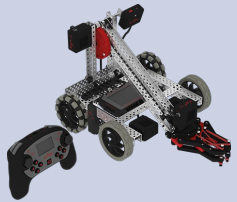
Applied STEM Learning

Ages 11+

VEX EXP

Real World STEM for Classrooms

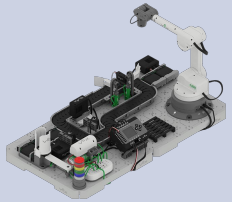
Ages 14+



VEX V5

Real World STEM for Competition

Ages 14+



VEX CTE

Workforce Readiness

Ages 14+

VEX AIR

STEM Skills Take Flight

Ages 14+

VEX CODE VR

Virtual Robot Coding

Ages 8+

Start exploring with AI Vision

Let’s get driving!

Drive to move an object

- Pick up any object and move it through the goal using the **joystick** and **left/right buttons**.

Now add AI Vision!

- Use the **Up button** to get an object.
- Use the **Down button** to kick or place the object through the goal.

What is happening when you use the Up button?

How is the Down button using AI Vision?

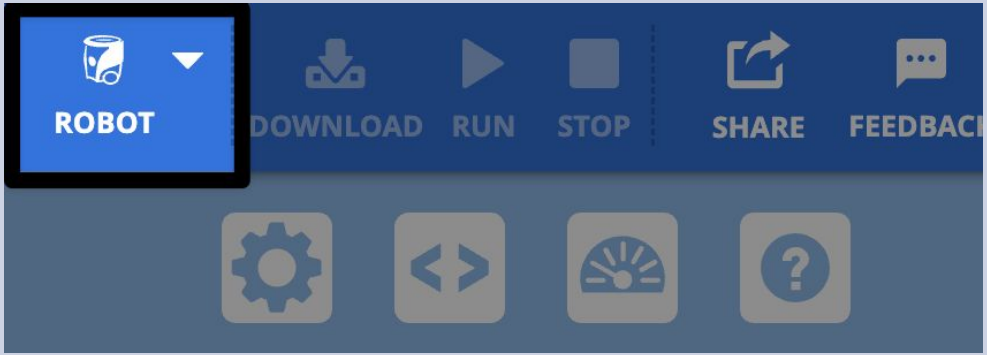
Take it a step further with code...

- Macro blocks enable us to use AI Vision in a project, without adding a lot of complexity

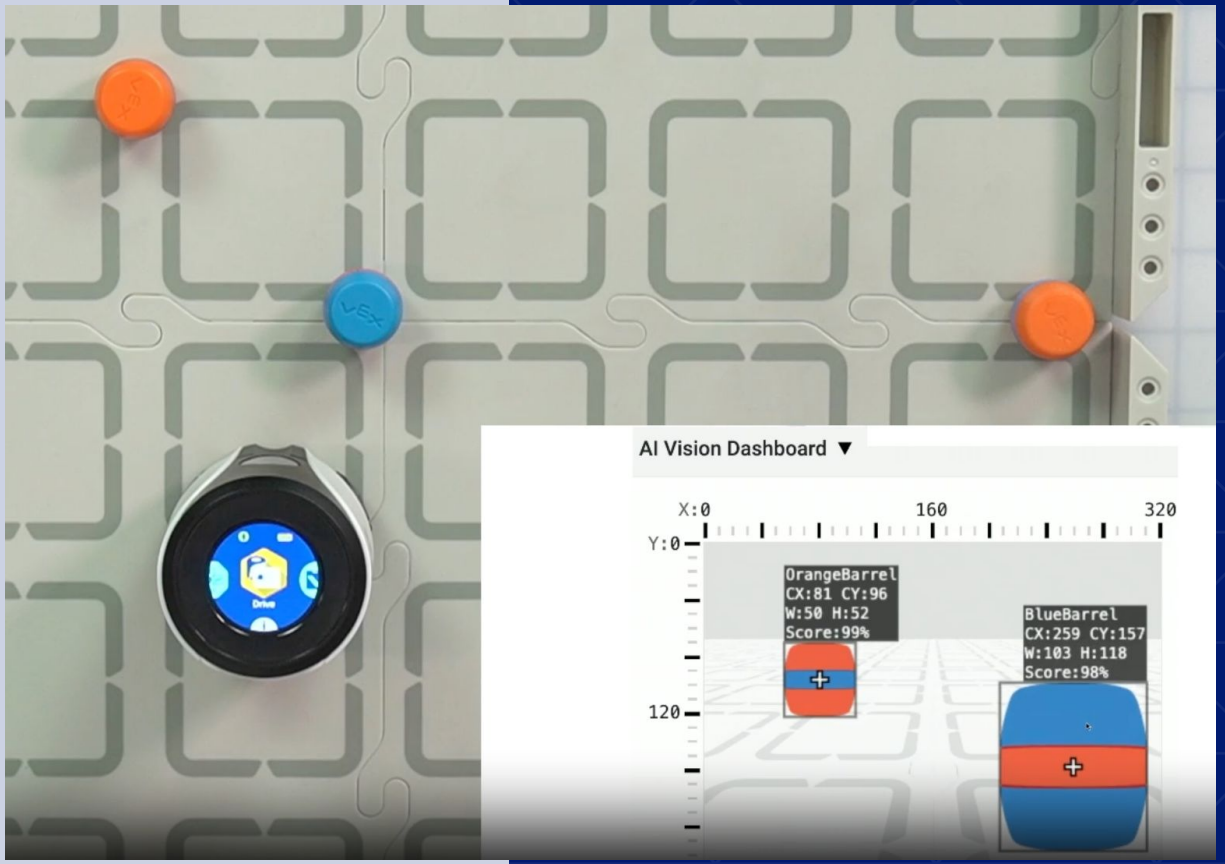
VEXcode AIM

Bluetooth connection to download and run

- Select **Robot** icon
- Select **Connect via Bluetooth**
- Select your robot ID from the list



Use the **AI Vision Dashboard** to see what your robot is “seeing”.



How do you think AI Vision in working in your project?

Did coding with AI Vision change your perception after driving?
Why or why not?

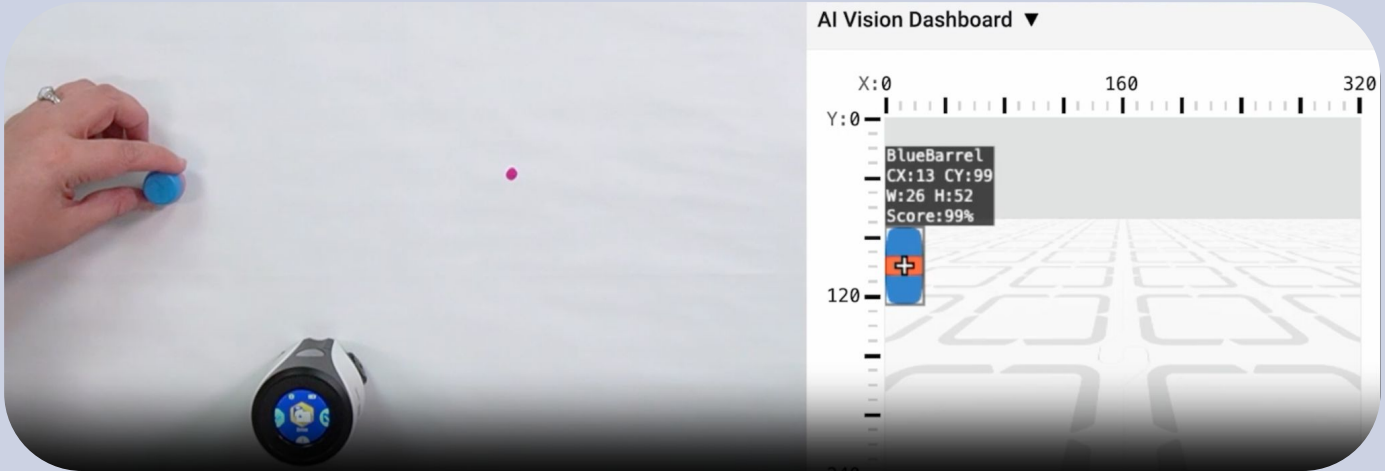
Exploring how AI Vision works

Field of View

Field of view (FOV), or angle of view, refers to how much of the environment the AI Vision sensor can detect at a given moment, and is measured as an angle in degrees.

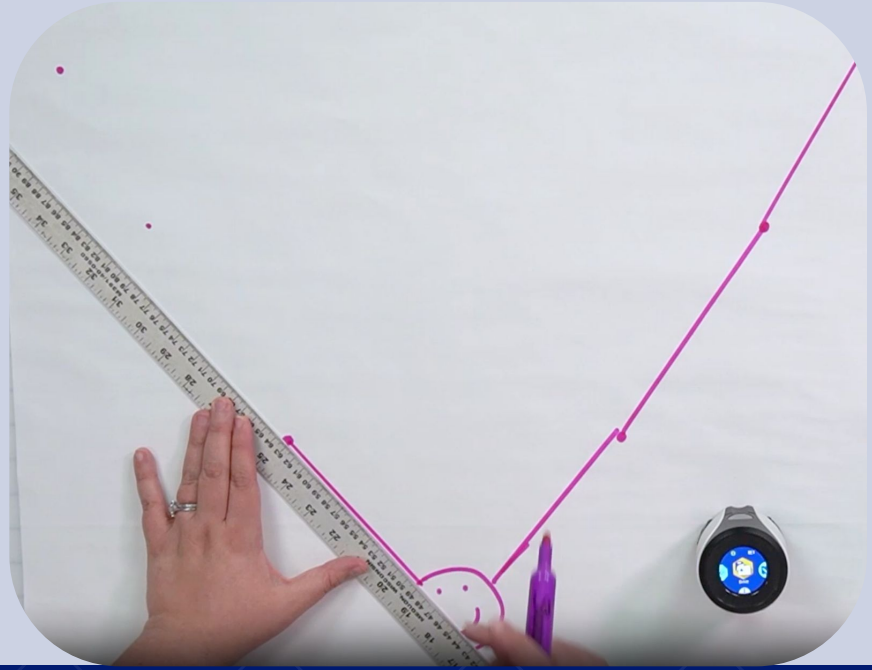
Finding the Field of View

- Place your robot on the paper.
- Use the AI Vision Dashboard to determine where your robot can detect the barrel.
- Mark your paper where it goes out of view.



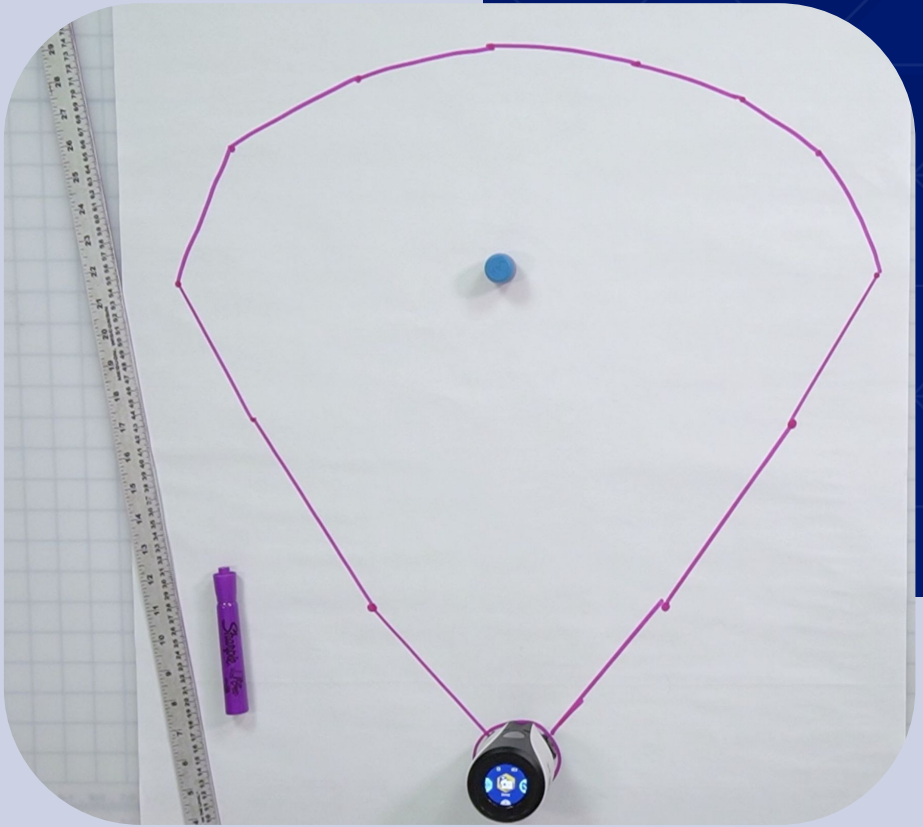
Connect the dots...

- Connect the dots to see the shape of the FOV
- Move the robot to connect the lines and measure the angle of view at their intersection



How does knowing the field of view help you use AI Vision?

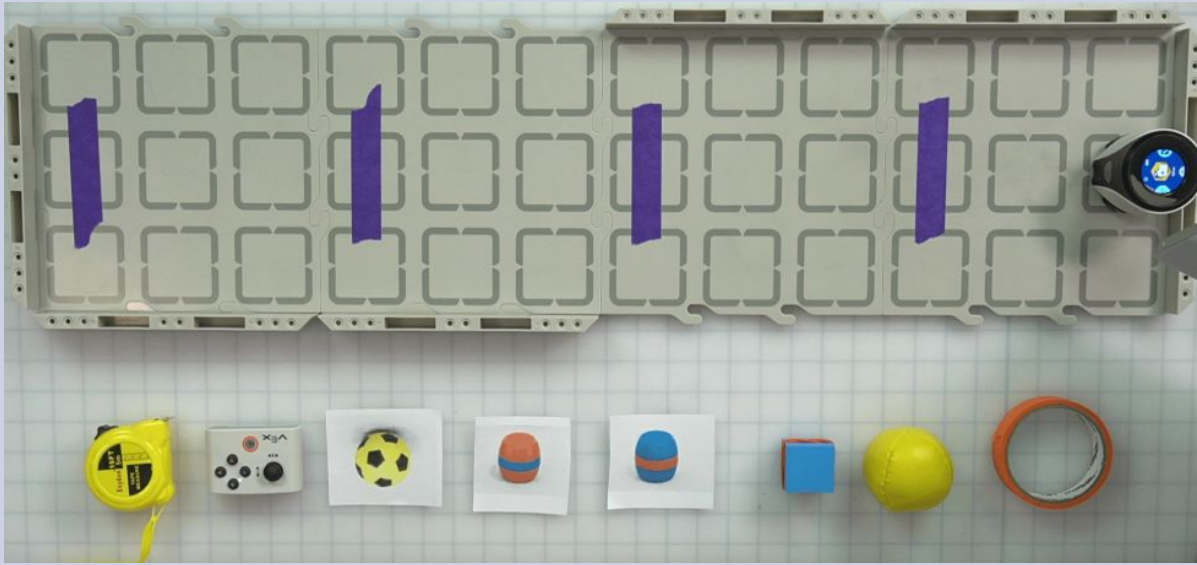
Are they all the same? Why or why not?



Trick the Sensor!

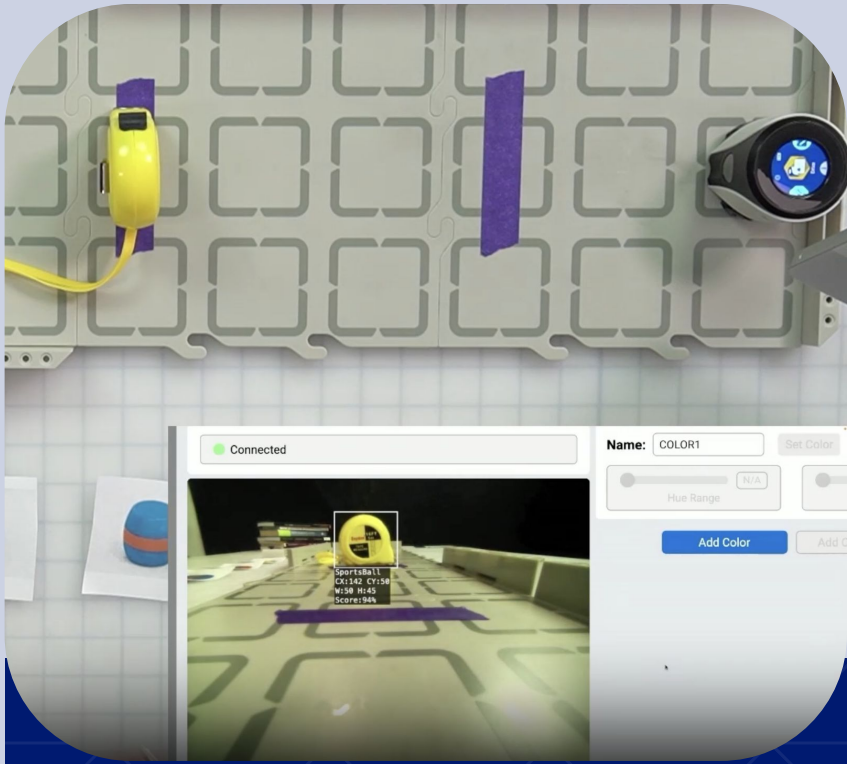
AIM AI Vision is a *pre-trained model*.

Try different objects to see if they are detected, and if so, as what.



Using the AI Vision Utility to test

- Open AI Vision Utility *with wired connection*
- Place the robot at the end of the field.
- Place the object on each line and check if it is detected, and where.
- Create your own objects to try to trick the sensor!



Did you trick the sensor?
How?

What do you notice about object detection at different distances?

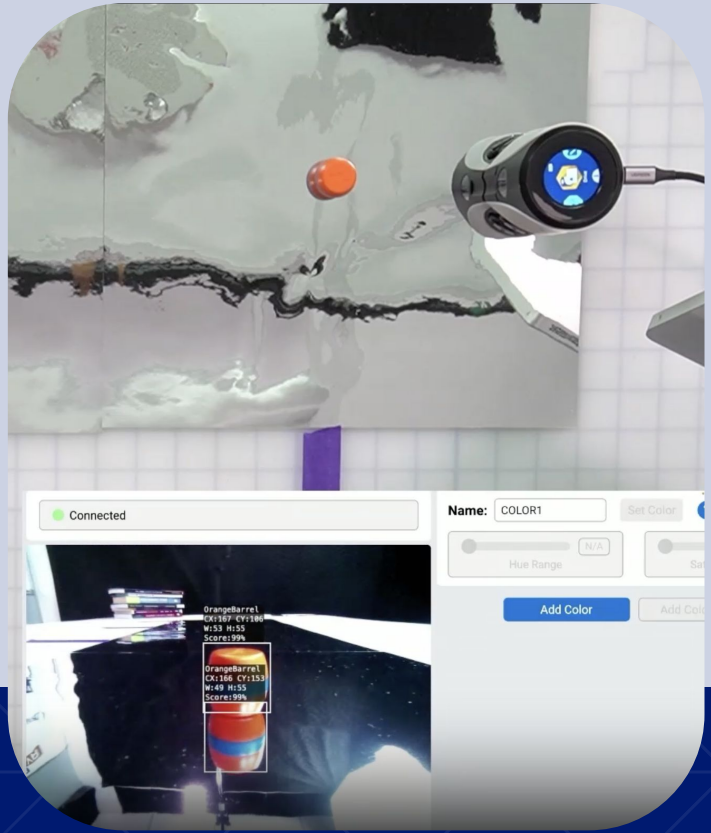
Why can we trick AI Vision?

IMAGE_497.jpg
AI Database
VEX IMAGE 680 480 3 0
Ball na 0 0 25 0 109 40
BlueBarrel na 0 0 489 360 531 408
OrangeBarrel na 0 0 432 0 521 64
Robot na 0 0 56459 680 250
Ball na 0 0 111 361 159 407
OrangeBarrel na 0 0 430 9 488 84
Robot na 0 0230 133 349 282
Ball na 0 0 345 307 402 365
BlueBarrel na 0 0 245 279 296 316
OrangeBarrel na 0 0 0 271 65 351

Environmental Factors

Vision relies on the environment surrounding the sensor.

Light, reflectivity, surfaces, colors can all influence sensor detection.

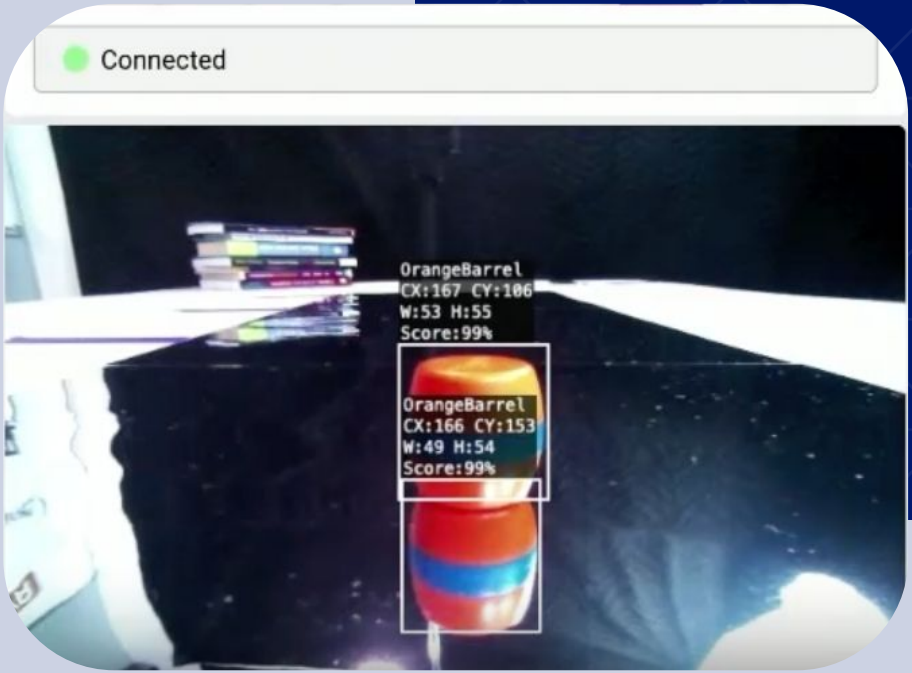


Testing environmental factors

- **Use the AI Vision Dashboard or Utility to test detection in different environments.**
- **Change one factor at a time:**
  - Light - brightness, warmth
  - Reflectivity
  - Surface
  - Color

How does the environment affect the accuracy of AI Vision?

How do these explorations affect your understanding of AI Vision?

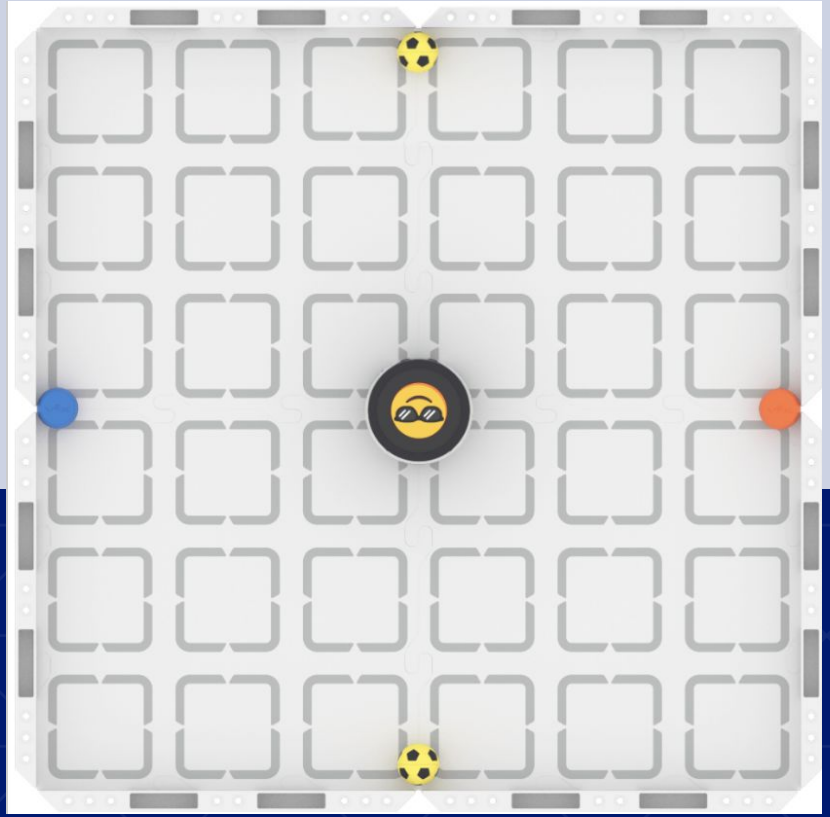


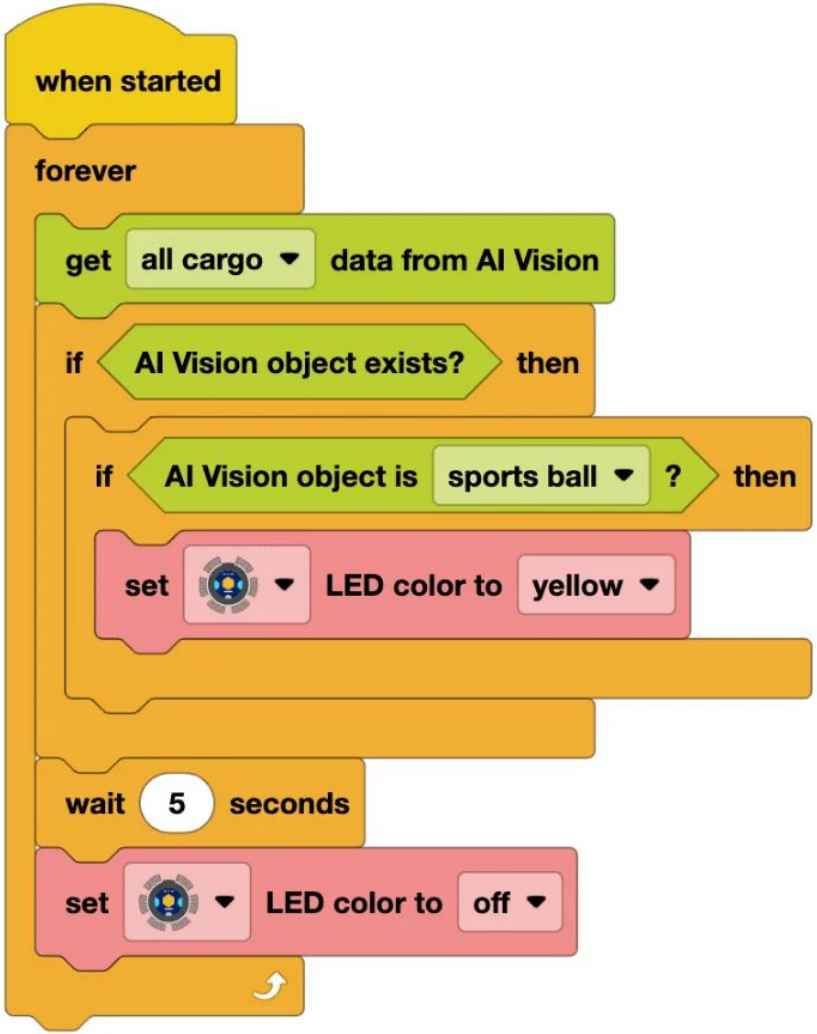
Apply your learning...

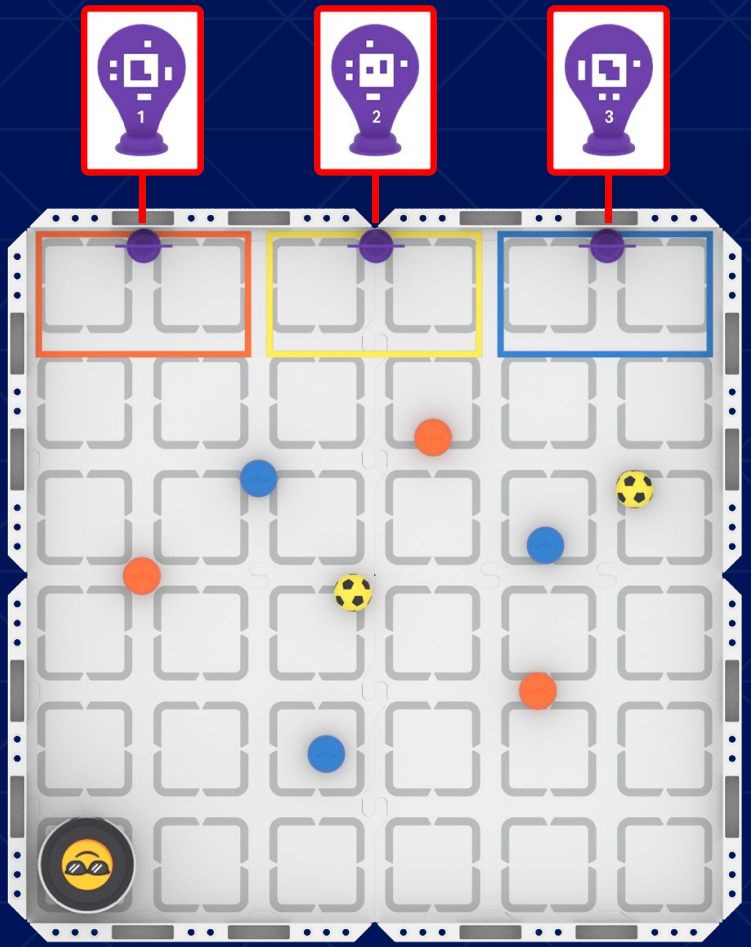
Detect & React!

Apply what you learned to code robot reactions!

Code your robot to detect cargo and react, depending on what is detected.



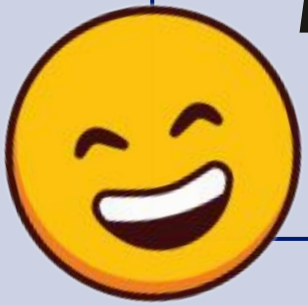

when started
forever
get all cargo data from AI Vision
if AI Vision object exists? then
if AI Vision object is sports ball ? then
set LED color to yellow
wait 5 seconds
set LED color to off



How can we apply our learning to counter misconceptions around teaching with AI?

Myth: Students need to train a model themselves to learn about AI

We used a pretrained model to help us learn more about how to use AI Vision data to complete a task.



Myth: Outputs from AI models are always accurate. “*Well Chat said…*”

Garbage in → Garbage out

Understanding how a model is trained helps us understand what we get from it.

The more we know about how how AI Vision works, the better we can leverage that information.

Myth: Students need to understand all of the complexity behind AI to use it in a project

We can scaffold student understanding with Macros, and explore how the sensor works. Then build up to more complex usage of AI Vision data.

Myth: You need to know Python (or text-based coding) to work with AI

We created meaningful, intentional projects with blocks!

Coding languages may change over time, but understanding the logic behind coding with AI Vision is lasting.

Stay Connected

Let's Connect!

Tag me in the **VEX PD+ Community!**
@Audra_Selkowitz

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