

# APPLICABLE NEVADA STANDARDS

**ETS1.A - Defining and delimiting engineering problems** - The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful.

**ETS1.B - Developing possible solutions** - A solution needs to be tested, and then modified on the basis of the test results in order to improve it.

**ETS1.C - Optimizing the design solution** - ...each test can provide useful information for the redesign process...

Tech Tips	
1	Web - Teams/Assignments
2	Access Office 365/outlook
3	Inf Campus/IB Grades
4	Immersive Reader/Translate
5	Bookmarks / Snipping Tool
6	Cut/Paste & Alt/Tab
7	Install <a href="#">VEXCode IQ</a>
8	
9	

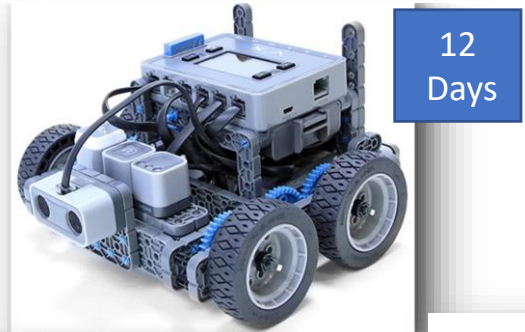
1 or 2 Days

Object Focus

Design Process	
1	Engineering Notebook
2	Criteria A1 - Understand
3	Criteria A2 - Understand
4	Criteria B - Plan
5	Criteria C - Create
6	Criteria D - Reflect



VEX IQ Sensor Challenges	
1	iPad/SensorBot Set up
2	Joystick Examples
3	Manual Maze
4	IQ Sensors / Test Bed
5	Bumper Maze /Sound /Color
6	Distance Maze /Velocity
7	Color Sensor
8	Median Line
9	Speedy Delivery
10	Vision Sensor Setup
11	Follow the Ball

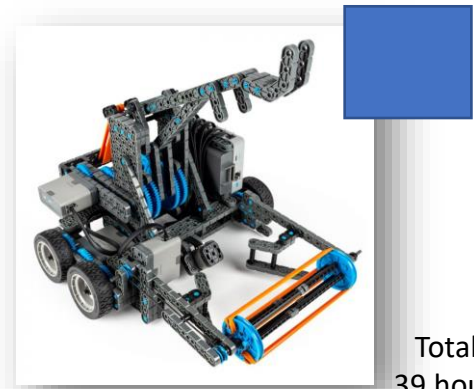


October Break

Design Process	
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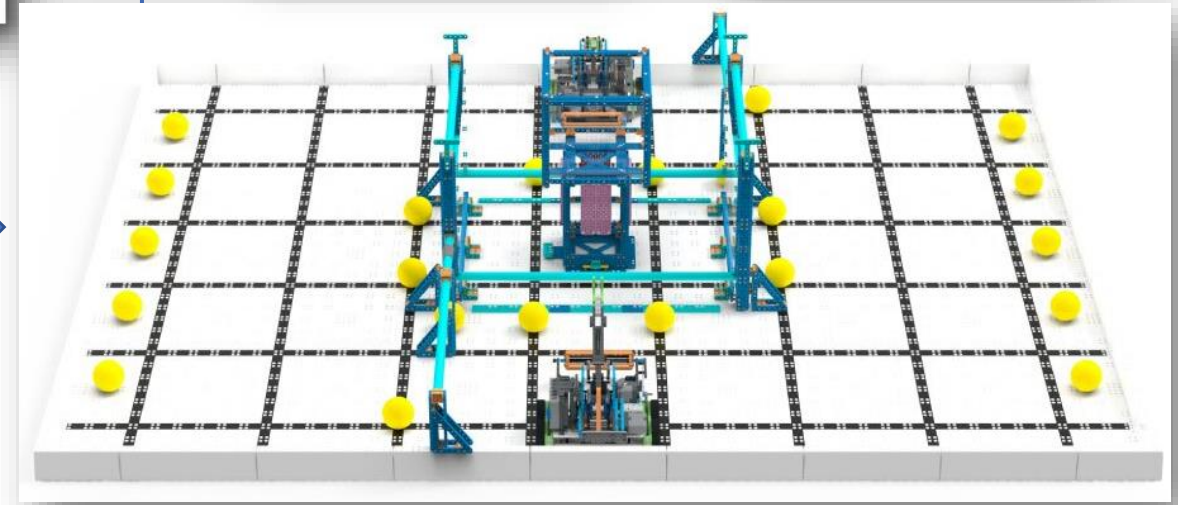
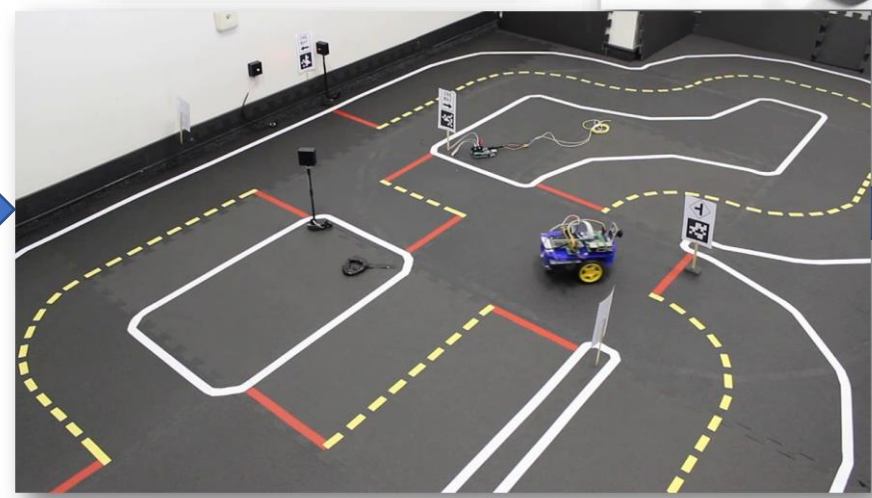


Pitching In Virtual Skills	
1	<a href="#">VIQC Virtual Skills #1</a>
2	<a href="#">VIQC Virtual Skills #2</a>
3	<a href="#">VIQC Virtual Skills #3</a>
4	<a href="#">VIQC Virtual Skills #4</a>
5	<a href="#">VIQC Virtual Skills #5</a>
6	<a href="#">Fling Build Instructions</a>
7	Competition(s)



Total:  
39 hours

Playing Field



What does  
“autonomy” mean?

automatic  
autonomous



MOTION FLOW    LANE LINES    LANE LINES    ROAD FLOW    IN-PATH OBJECTS    ROAD LIGHTS    OBJECTS    ROAD SIGNS

LEFT REARWARD VEHICLE CAMERA  
MEDIUM RANGE VEHICLE CAMERA  
RIGHT REARWARD VEHICLE CAMERA

# The NHTSA Levels of Autonomy

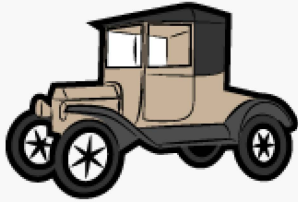
- **Level 0:** the human driver does everything;
- **Level 1:** an automated system on the vehicle can sometimes assist the human driver conduct some parts of the driving task;
- **Level 2:** an automated system on the vehicle can actually conduct some parts of the driving task, while the human continues to monitor the driving environment and performs the rest of the driving task;
- **Level 3:** an automated system can both actually conduct some parts of the driving task and monitor the driving environment in some instances, but the human driver must be **ready to take back control** when the automated system requests;
- **Level 4:** an automated system can conduct the driving task and monitor the driving environment, and the human **need not take back control**, but the automated system can operate **only in certain environments and under certain conditions**
- **Level 5:** the automated system can perform all driving tasks, under all conditions that a human driver could perform them.

# SAE J3016™ LEVELS OF DRIVING AUTOMATION

	SAE LEVEL 0	SAE LEVEL 1	SAE LEVEL 2	SAE LEVEL 3	SAE LEVEL 4	SAE LEVEL 5
What does the human in the driver's seat have to do?	You <u>are</u> driving whenever these driver support features are engaged - even if your feet are off the pedals and you are not steering			You are <u>not</u> driving when these automated driving features are engaged - even if you are seated in "the driver's seat"		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
What do these features do?	These are driver support features			These are automated driving features		
	These features are limited to providing warnings and momentary assistance	These features provide steering <b>OR</b> brake/acceleration support to the driver	These features provide steering <b>AND</b> brake/acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met	This feature can drive the vehicle under all conditions	
	<ul style="list-style-type: none"> <li>• automatic emergency braking</li> <li>• blind spot warning</li> <li>• lane departure warning</li> </ul>	<ul style="list-style-type: none"> <li>• lane centering <b>OR</b></li> <li>• adaptive cruise control</li> </ul>	<ul style="list-style-type: none"> <li>• lane centering <b>AND</b></li> <li>• adaptive cruise control at the same time</li> </ul>	<ul style="list-style-type: none"> <li>• traffic jam chauffeur</li> </ul>	<ul style="list-style-type: none"> <li>• local driverless taxi</li> <li>• pedals/steering wheel may or may not be installed</li> </ul>	<ul style="list-style-type: none"> <li>• same as level 4, but feature can drive everywhere in all conditions</li> </ul>
Example Features						

# AUTOMATION LEVELS OF AUTONOMOUS CARS

## LEVEL 0



There are no autonomous features.

## LEVEL 1



These cars can handle one task at a time, like automatic braking.

## LEVEL 2



These cars would have at least two automated functions.

## LEVEL 3



These cars handle “dynamic driving tasks” but might still need intervention.

## LEVEL 4



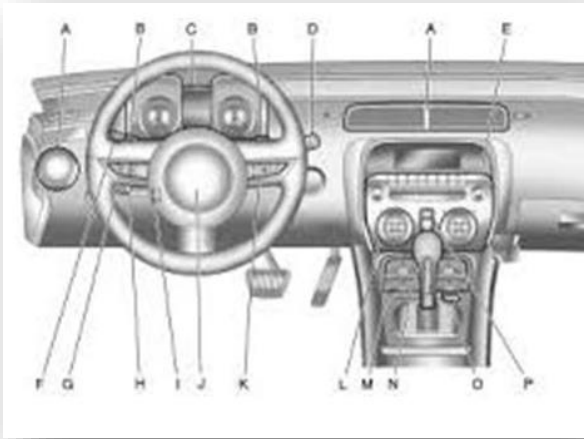
These cars are officially driverless in certain environments.

## LEVEL 5



These cars can operate entirely on their own without any driver presence.

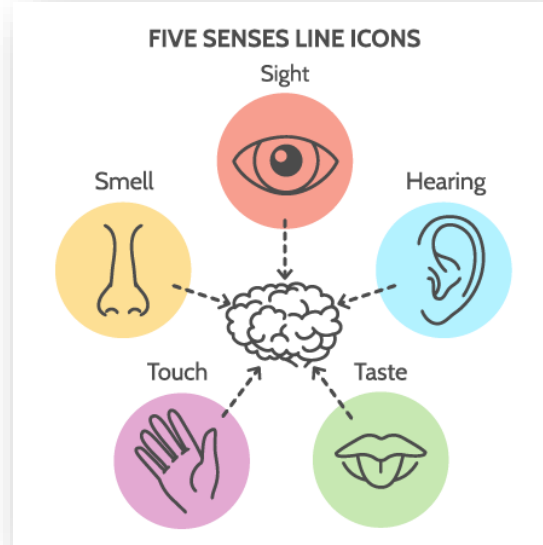
## What are a car's controls?



### Possible Answers

- Go Forward
- Go Back
- Turn
- Stop
- Faster / Slower

## What are a Driver Senses?



### Possible Answers

- Sight: Stop Sign / Traffic
- Sound: Siren / Horn
- Smell/Taste: Smoke / Brakes
- Touch: Curb / Acceleration

DRIVER EXPERIENCE!

## What are the Inputs/Outputs?

- Throttle (velocity)
- Steering
- Forward/Backward



## LEVEL 0

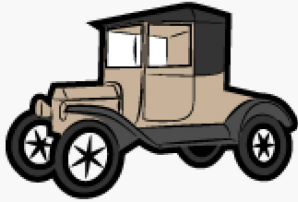


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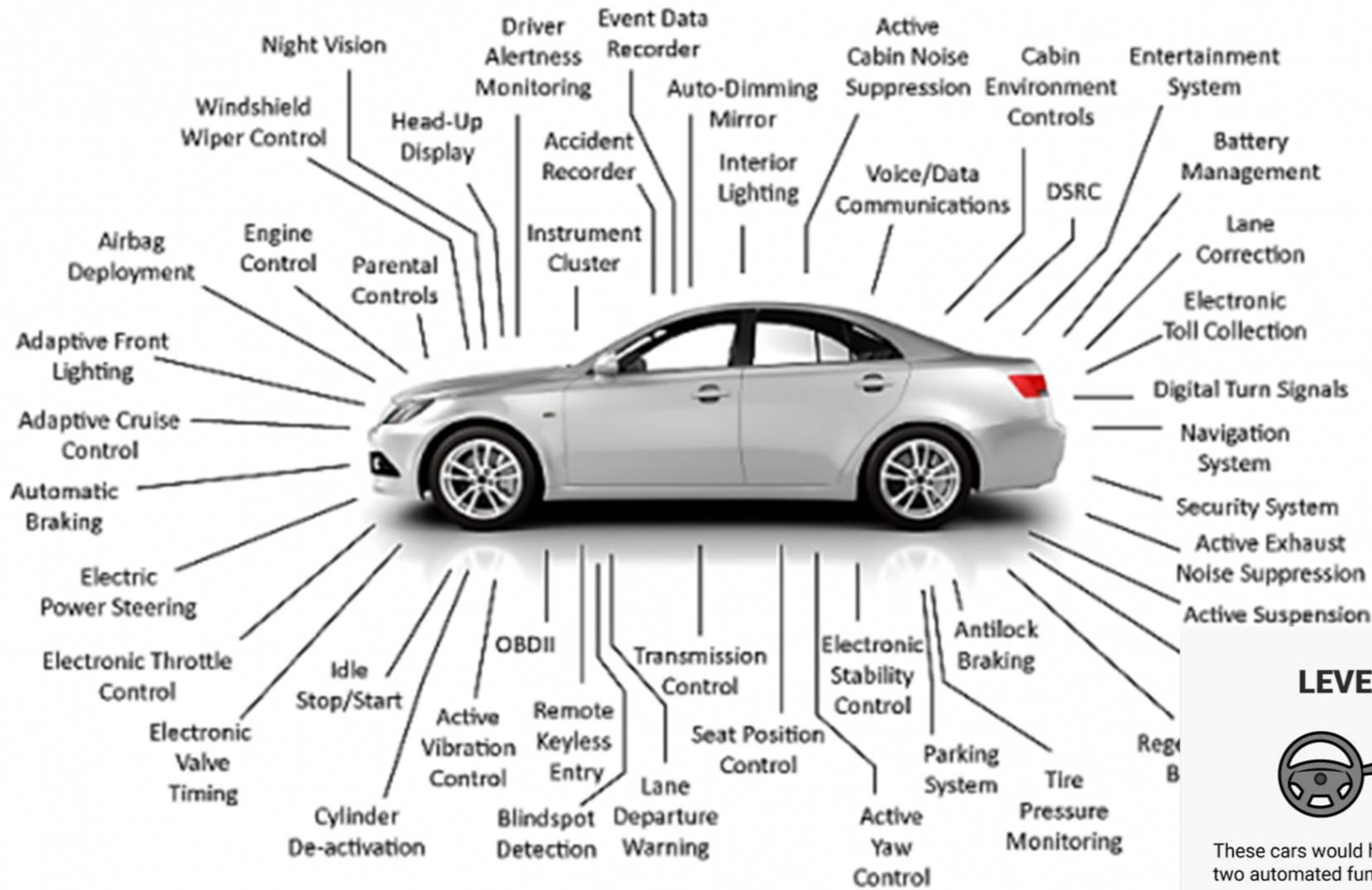


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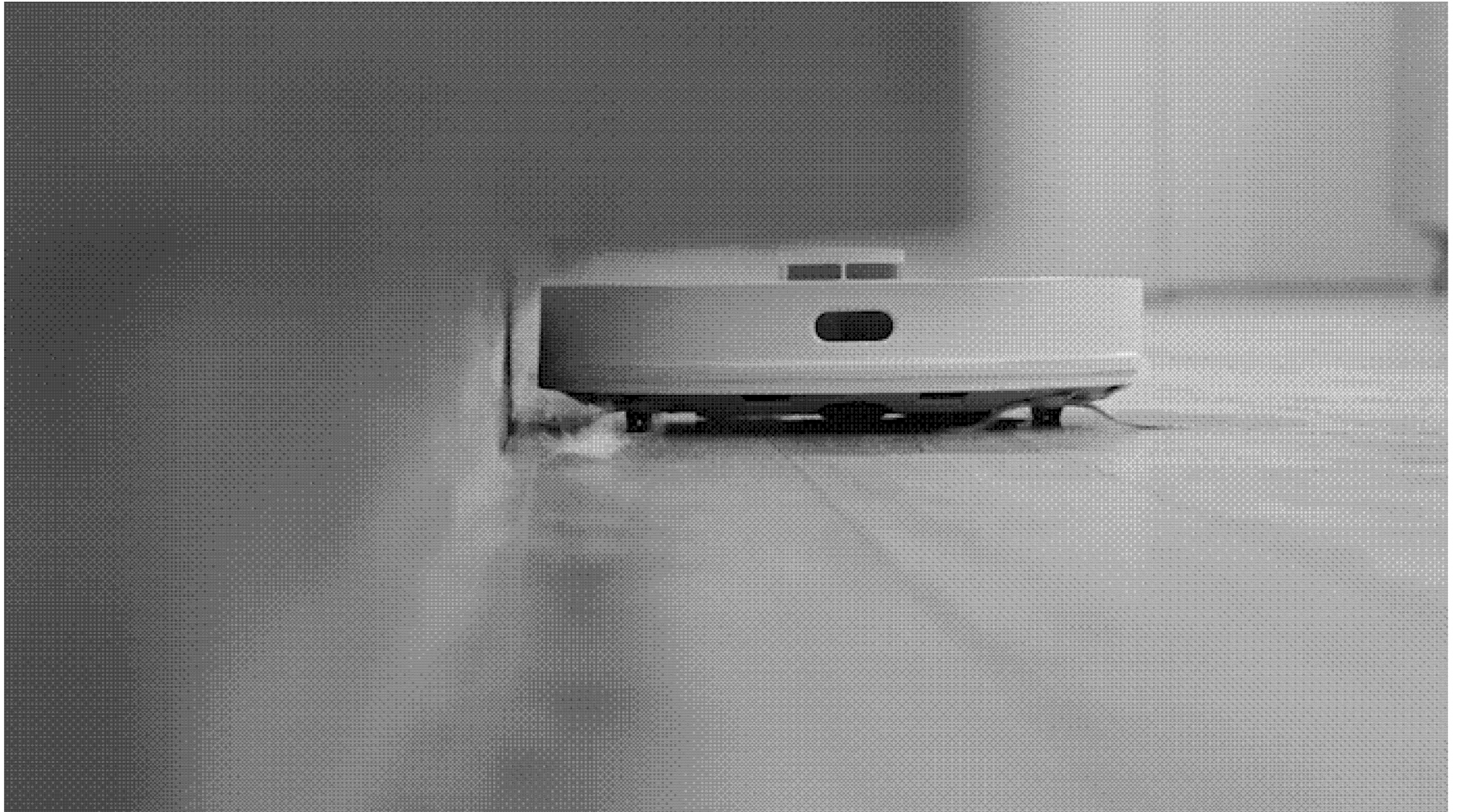


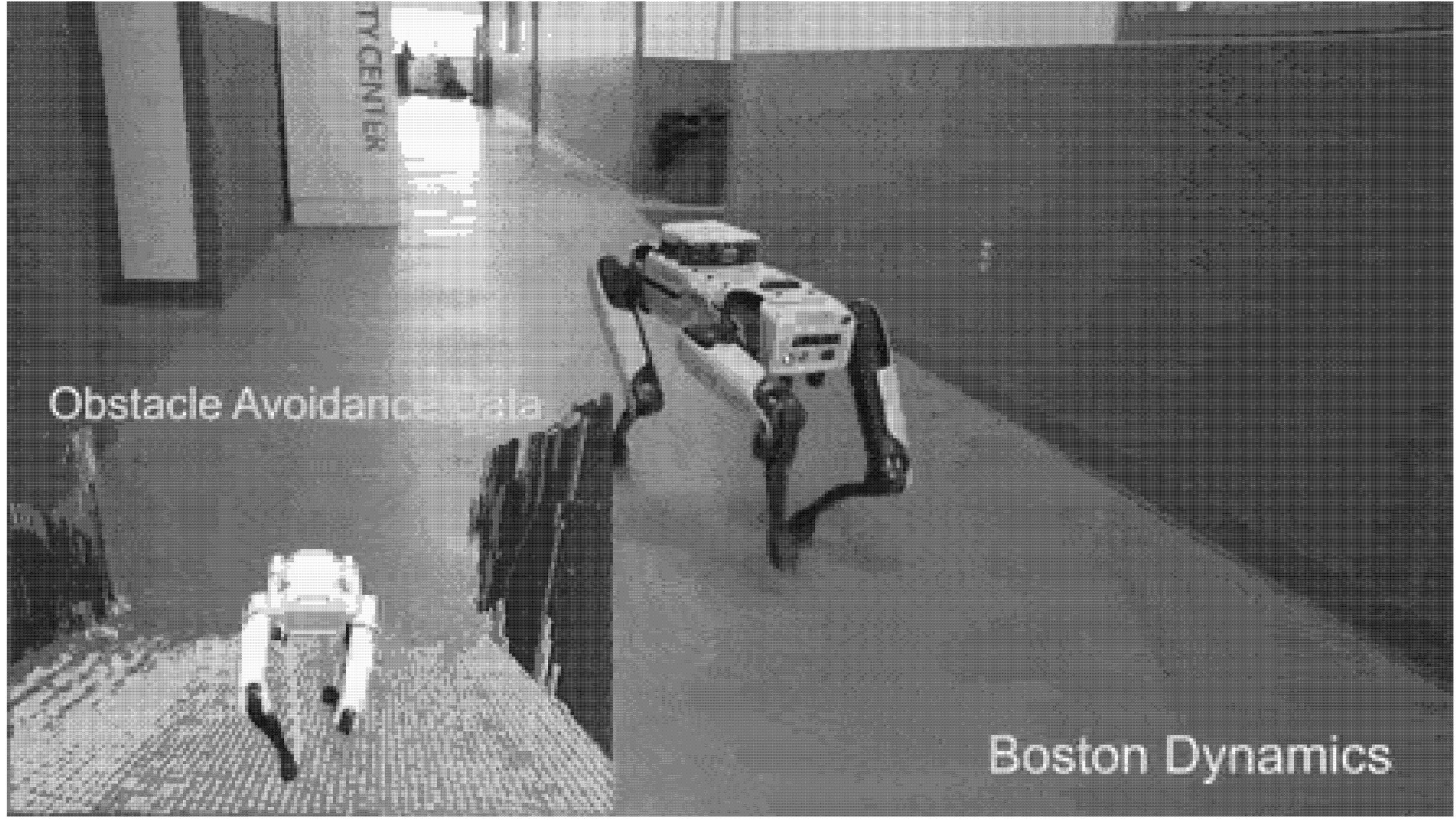


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Obstacle Avoidance Data

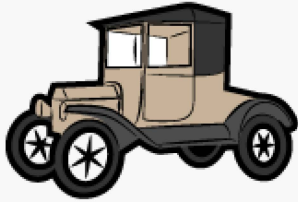
Boston Dynamics

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17:23

94%

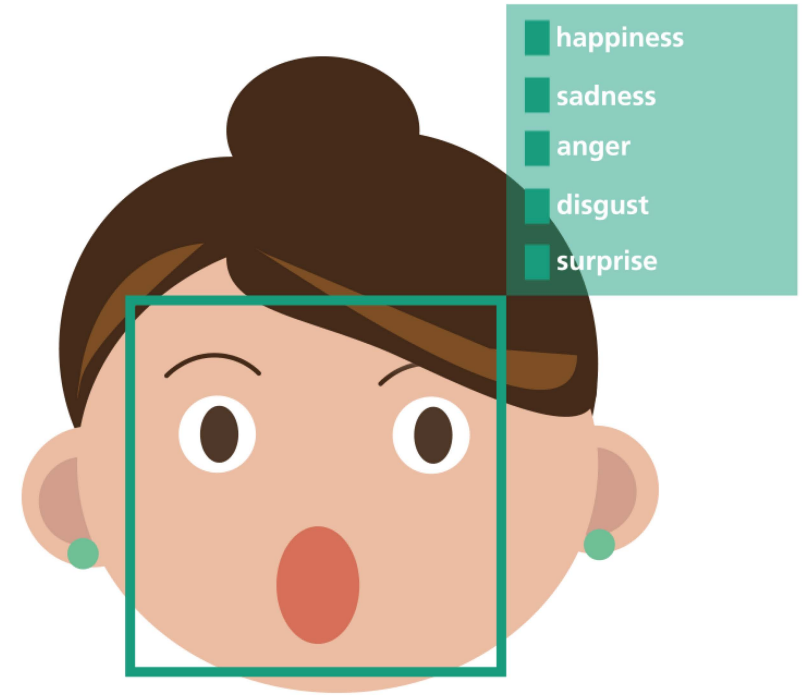
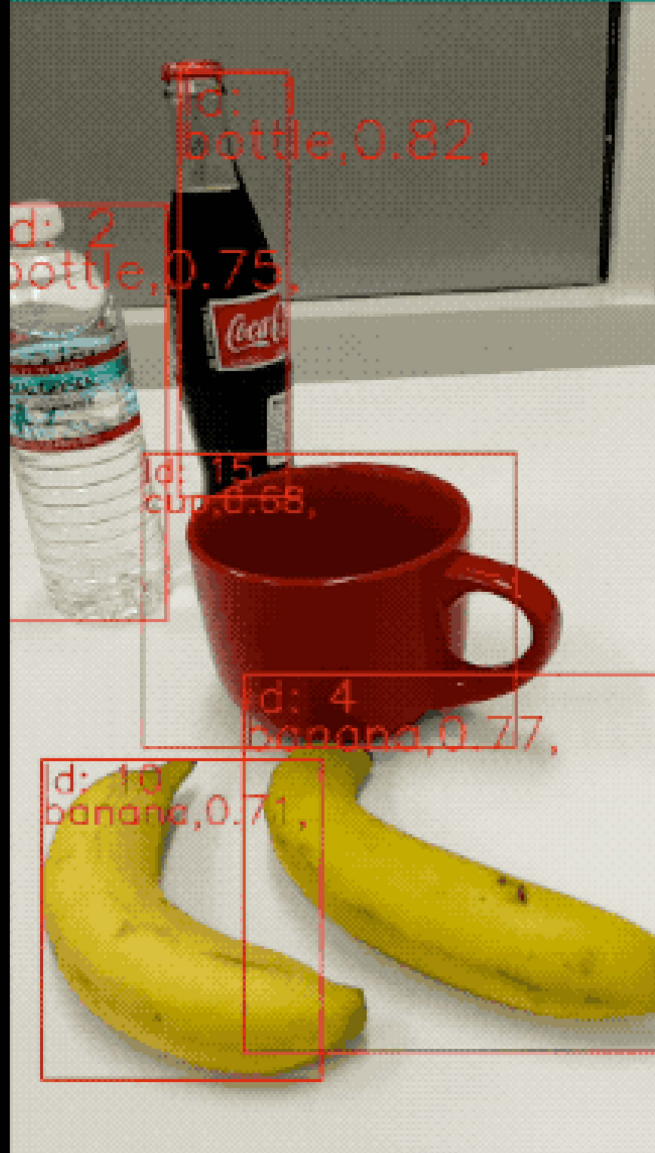
### Object Detection GPU



17%

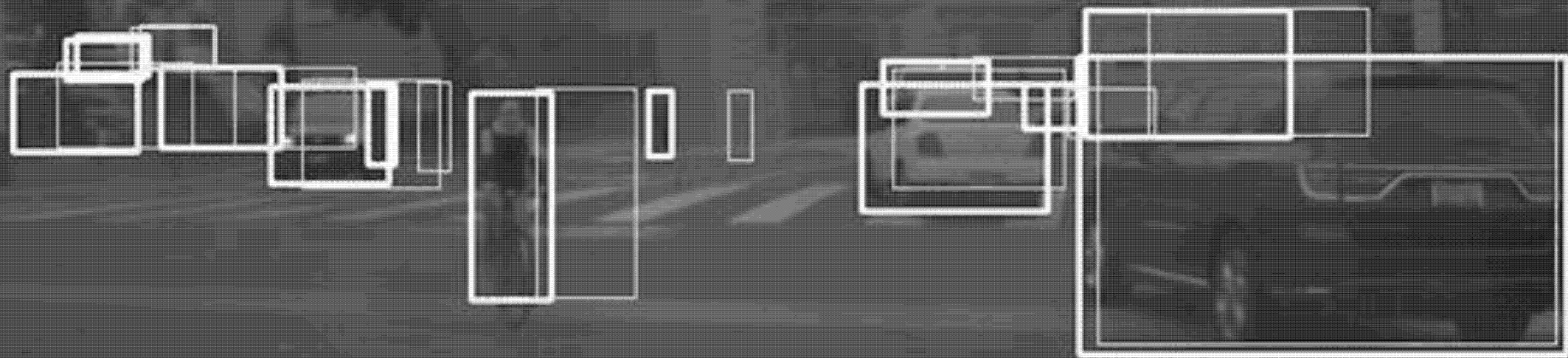
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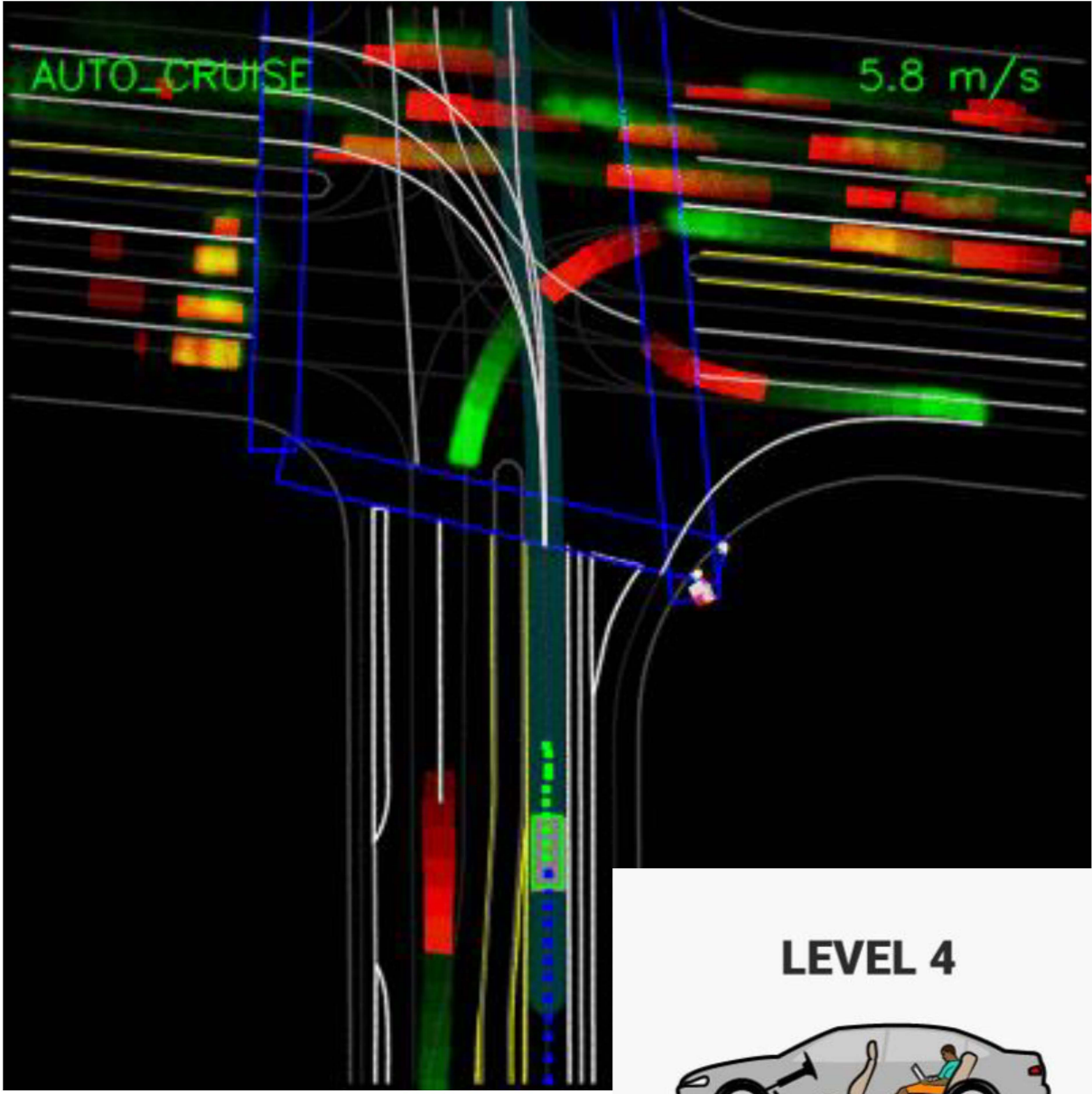
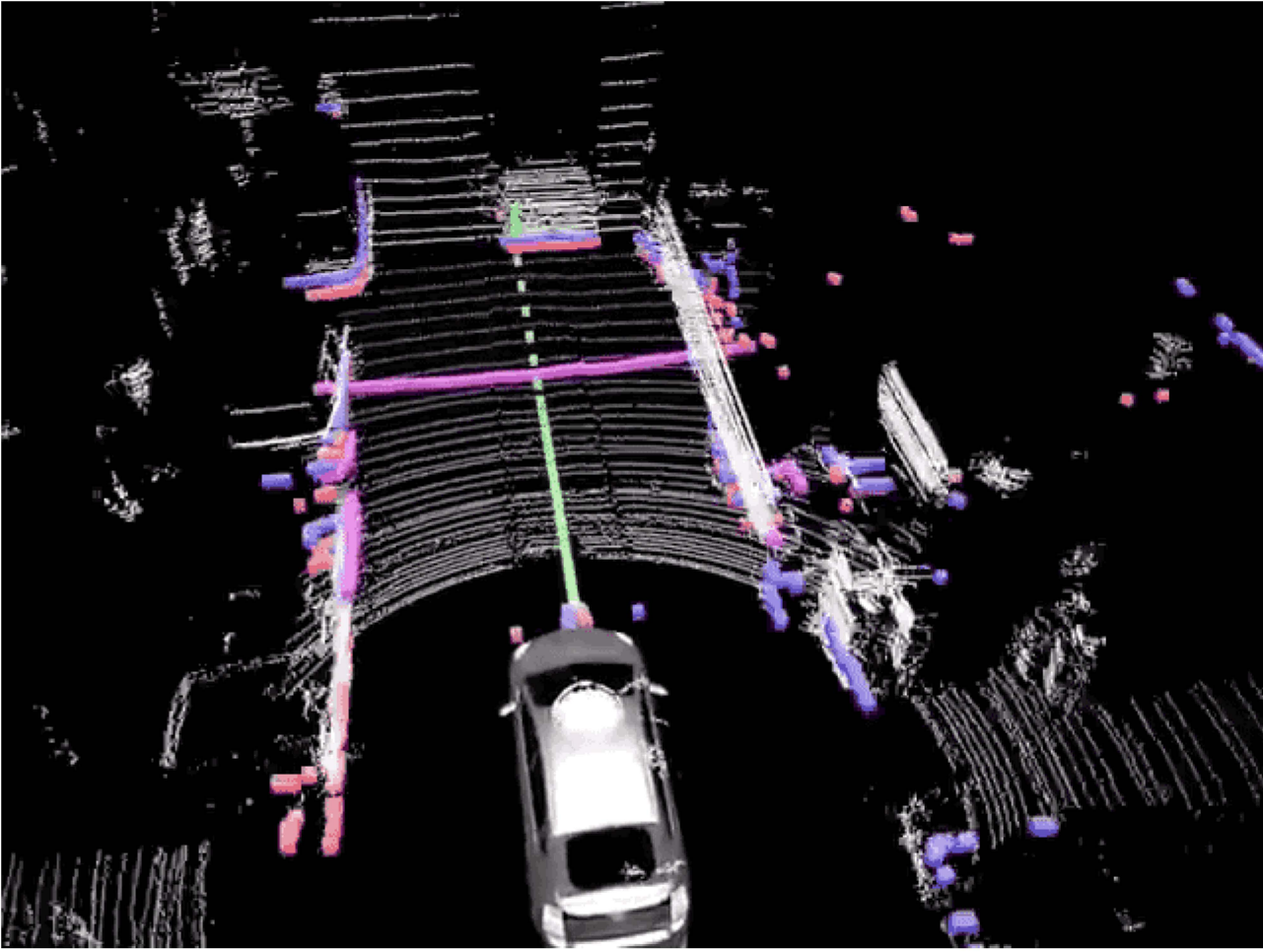
### Object Tracking GPU



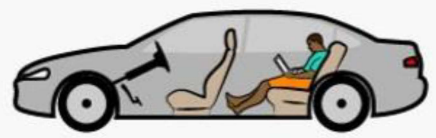
CURRENT

FUTURE PREDICTION





**LEVEL 4**

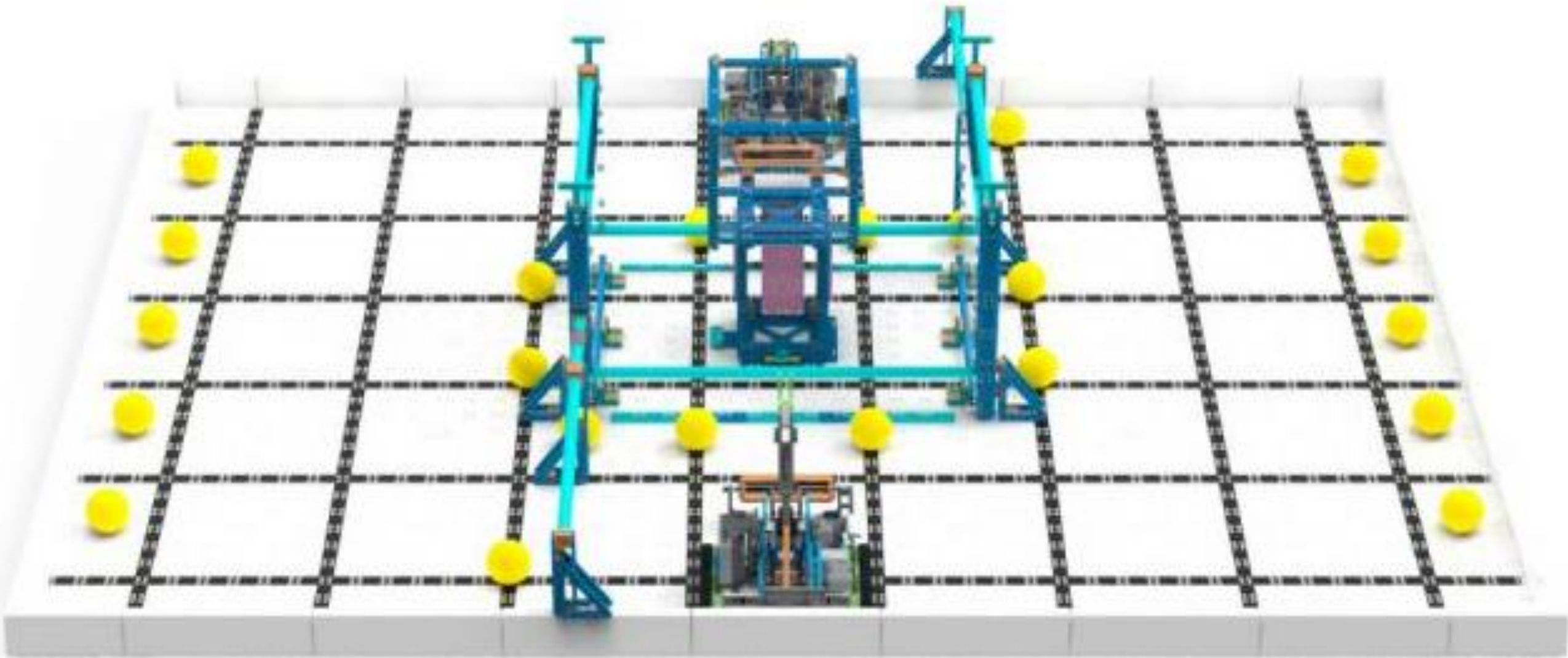


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# Vex IQ Sensors & Abilities





[https://youtu.be/je\\_LJcpxtik](https://youtu.be/je_LJcpxtik)

1. Introduction

2. Methodology

3. Results

4. Discussion

5. Conclusion

