MOVING OBJECTS & STALL DETECTION

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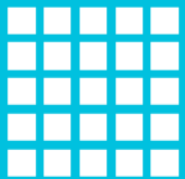
LESSON OBJECTIVES

1. Learn how to move non-drive motors
2. Learn about motor stalls

SINGLE MOTOR FUNCTIONS (ACTIONS)

■ To control motors, they must first be initialized

```
motor = Motor('D')
```

■ To run for a certain duration, use

```
run_for_degrees(degrees, speed=None)
run_for_rotations(rotations, speed=None)
run_for_seconds(seconds, speed=None)
```

■ To start running the motors, until stopped at a later spot

```
start(speed=None)
start_at_power(power)
stop()
```

■ To run the motor to a specific location

```
run_to_degrees_counted(degrees, speed=None)
run_to_position(degrees, direction='shortest path', speed=None)
                                    'clockwise'
                                    'counterclockwise'
```

SINGLE MOTOR FUNCTIONS (MEASUREMENTS/SETTINGS)

■ The rotation sensor in the motor can be used to tell the number of degrees the motor has turned

■ To do this, use set_degrees_counted(degrees_counted) and get_degrees_counted()

■ Just like motor pairs, you can alter various settings

set_stop_action(action) 'coast'
'brake'
'hold'

set_default_speed(default_speed)

■ You can also read different measurements associated with the motor

get_speed()

get_position()

get_default_speed()

STALL DETECTION

- Often times, you program the motor to move a particular amount. However, the motor gets stuck before it reaches that amount.

- Stall Detection allows your program to automatically move on to the next line in the code when a particular motor command is stuck (unable to complete its move)

- SPIKE Prime has a built-in Stall Detection

- By default, Stall Detection is **on** when using single motor functions. However, you can turn this feature off using this function:
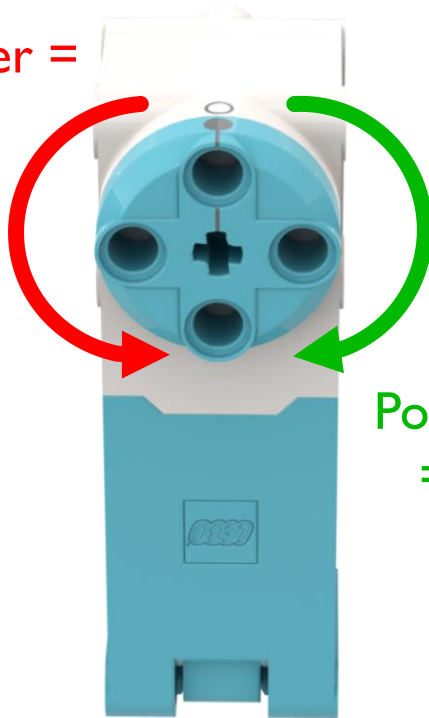
```
set_stall_detection(False)
```

- You can even detect if a motor stall or interrupt has occurred by doing

```
was_stalled()
```

```
was_interrupted()
```

NEGATIVE VALUES

Negative Power =
Backwards

Positive Power
= Forward

- You can enter negative values for power or distance

- This will make the robot move backwards

- If you negate two values (e.g. power and distance or distance and backwards direction), the robot will move forward.

ATTACHMENT ARM

- Create a simple attachment arm for Droid Bot IV for the Large Motor connected to Port D
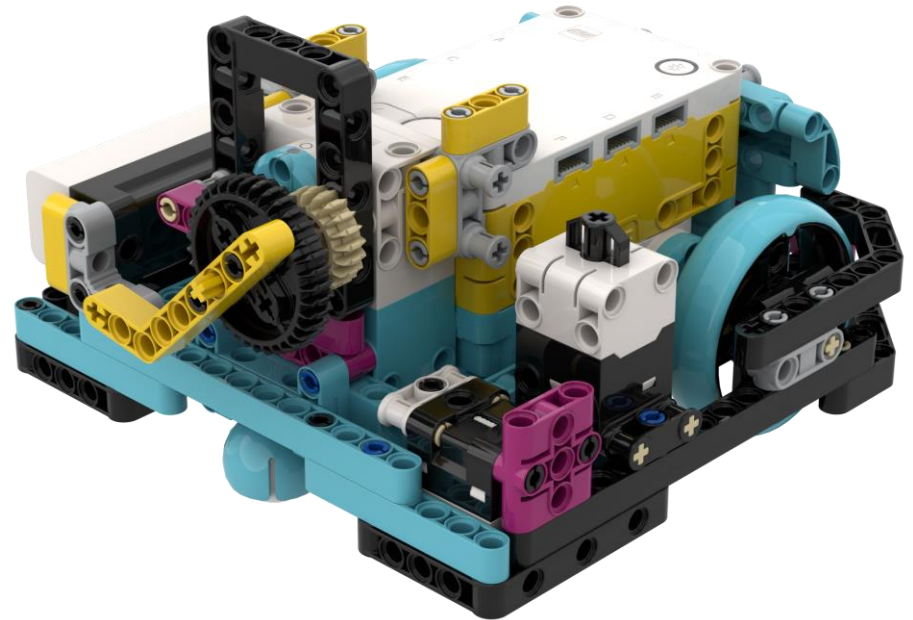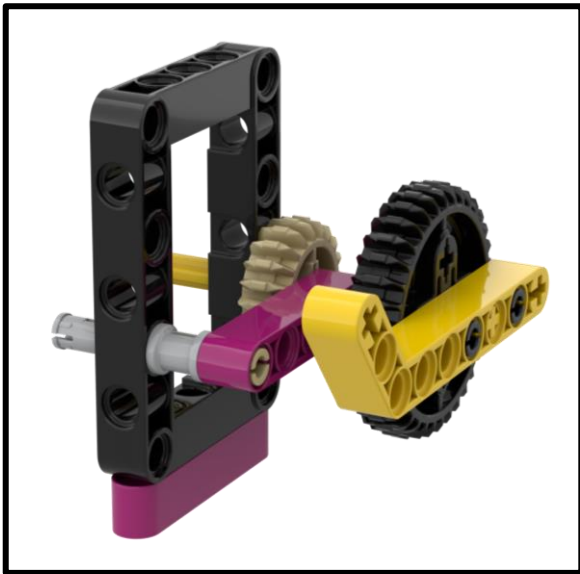

Droid Bot IV Configuration
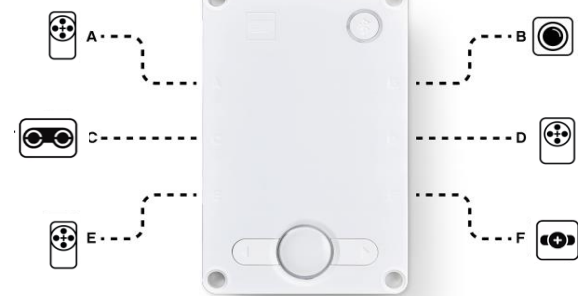
CHALLENGE 1: LEARN ABOUT STALL WITH DROID BOT IV

- Create one program with <u>stall detection turned on</u> and one with <u>stall detection turned off</u>.
- Using Droid Bot IV or similar, program the motor to turn 1000 degrees.
- Add a beeping sound after the motor command.
- Hold the arm with your hand to prevent motor from completing 1000 degrees. Hold for a couple of seconds.
- Compare what happens in each program. Will the sound play in both or only one program?

set_stall_detection(True)   set_stall_detection(False)

Cause a stall by holding the liftarm and preventing it from turning. Hold if for a second of two
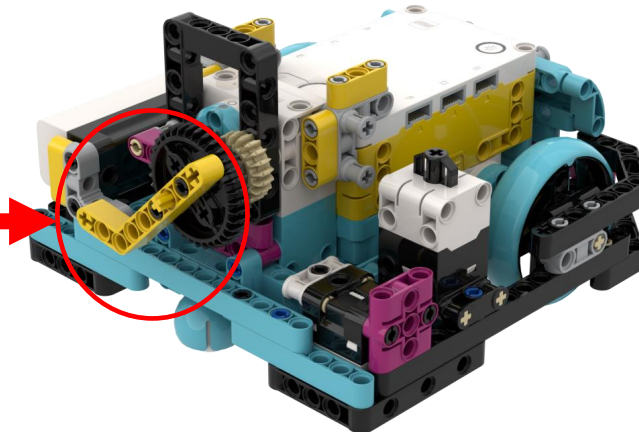
CHALLENGE 1 SOLUTION

■ Stall detection "on" allowed the code to move on to the next line even when the arm got stuck

```
motor = Motor('D')
motor.set_stop_action('brake')
motor.set_default_speed(30)
motor.set_stall_detection(True)
motor.run_for_degrees(1000)
hub.speaker.beep()
```

```
motor = Motor('D')
motor.set_stop_action('brake')
motor.set_default_speed(30)
motor.set_stall_detection(False)
motor.run_for_degrees(1000)
hub.speaker.beep()
```
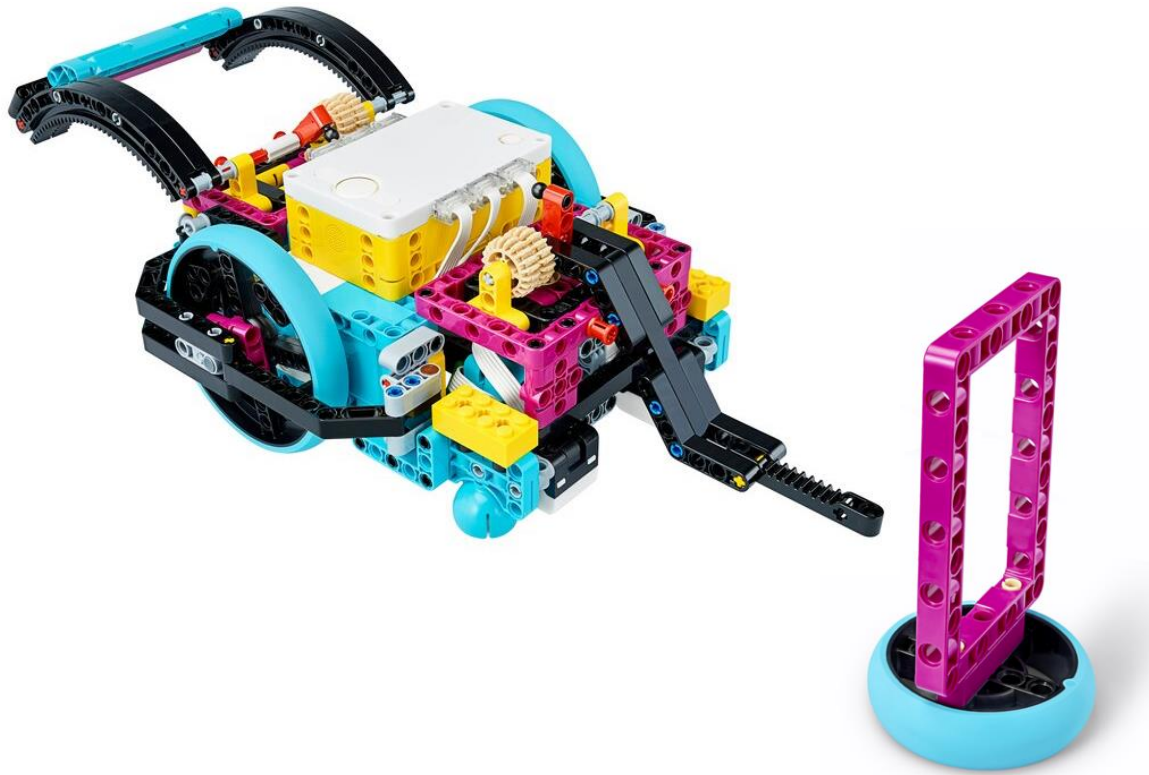
The beep plays even if you hold the arm and prevent it from moving.

The beep will not play until you release the arm and allow the motor to complete its move

CHALLENGE 2: PICK UP OBJECT (ADB CHALLENGE)

■ Drive forward, pick up a hoop and return to the start

■ Make sure to use stall detection in case the motor gets stuck while trying to collect the hoop

CHALLENGE 2 SOLUTION

```
motor = Motor('D')
motor.set_stop_action('brake')
motor.set_default_speed(30)
motor.set_stall_detection(True)
motor_pair = MotorPair('A', 'E')
motor_pair.set_stop_action('brake')
motor_pair.set_motor_rotation(27.63, 'cm')
motor_pair.set_default_speed(50)
motor_pair.move(10, 'cm')
motor.run_for_degrees(100)
motor_pair.move(-10, 'cm')
```

Configure motors. This program is configured for the ADB robot and large SPIKE Prime tires.
Turn stall detection on in case it was turned off in an earlier program

Move forward up to your object
Rotate the arm up to pick up the hoop
Move back to starting point

EXTENSIONS

- Think about situations in FIRST LEGO League when stall detection would be helpful
  - When might the robot get stuck?

CREDITS

- This lesson was created by Arvind Seshan for SPIKE Prime Lessons

- More lessons are available at www.primelessons.org