MOVING OBJECTS & STALL DETECTION

BY SANJAY AND ARVIND SESHAN
LESSON OBJECTIVES

- Learn how to move non-drive motors
- Learn about motor stalls
- Note: Although images shown may be a SPIKE Prime, the same techniques apply to Robot Inventor
SINGLE MOTOR FUNCTIONS (ACTIONS)

- To control motors, they must first be initialized
  ```python
  motor = Motor('D')
  ```

- To run for a certain duration, use the following methods (motor.METHOD)
  ```python
  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
  ```python
  start(speed=None)
  start_at_power(power)
  stop()
  ```

- To run the motor to a specific position
  ```python
  run_to_degrees_counted(degrees, speed=None)
  run_to_position(degrees, direction='shortest path', speed=None)
  'clockwise'
  'counterclockwise'
  ```
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 configuration settings with `set_stop_action(action)` where `action` can be 'coast', 'brake', or 'hold'. The default speed of the motor can be set with `set_default_speed(default_speed)`. You can also read different measurement methods associated with the motor such as `get_speed()`, `get_position()`, and `get_default_speed()`.
NEGATIVE VALUES

- 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.

**Negative Power = Backwards**

**Positive Power = Forward**
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 method:
  ```
  set_stall_detection(False)
  ```

- You can even detect if a motor stall or interrupt has occurred by doing
  ```
  was_stalled()
  was_interrupted()
  ```
Create a simple attachment arm for Droid Bot IV for the Large Motor connected to Port D
CHALLENGE 1: LEARN ABOUT STALL WITH DROID BOT IV

- Create one program with stall detection turned on and one with stall detection turned off.
- 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.
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
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?
This lesson was created by Sanjay and Arvind Seshan for Prime Lessons

More lessons are available at www.primelessons.org