**Anatomy of a Robot**

**Description**

This lesson is intended to familiarize students with the individual components that comprise a robot. Students will use a graphic organizer to identify the function of each component and the human biological equivalent. They will then categorize the components according to their function.

## Lesson Outcomes

Students will be able to:

* Identify robot components
* Understand the function of robot components

## Assumptions

Students:

* Will have a basic knowledge of technical/machine parts (wheels, batteries, cables, gears, etc.)
* Know how to use basic hand tools like allen keys, screwdrivers and wrenches

The teacher will:

* Have a basic knowledge of constructing using simple fasteners
* Have some experience using a relevant educational robotics platform
* Have gone through the parts list of robot kits and be able to somewhat identify their functions

## Key Terminology

The following outlines the general parts of the three most common education robot kits (LEGO Mindstorms EV3, VEX IQ, VEX EDR). These are the parts that students will identify and determine the biological equivalent of.

For in-depth definitions, please refer to the platform booklet that comes with the kit.

**Bumper switch**: allows a robot to detect an obstacle or limit the movement of a component.

**Colour sensor**: allows a robot to measure colours.

**External control**: a hand-held remote control device (VEX). iOS/Android app for LEGO Mindstorms programming software.

**Gyro sensor**: allows a robot to measure turn rate and angles.



This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License unless otherwise indicated.

**Input devices**: sensors that gather information from the physical world.

**Limit switch**: similar to a bumper switch but with a flexible lever arm triggering the switch. It allows for more flexible mounting options than the bumper switch.

**Line tracker**: allows a robot to follow a line over a surface.

**Mechanical encoders**: an encoder that works using a mechanical switch to generate the electrical pulses. Mechanical encoders may have a "click-click" feel to them and typically operate at lower speed and with lower resolution than optical encoders.

**Output device**: a device that allow the processing unit to affect the robot’s environment, through movement (motors, solenoids), light, sound or other means.

**Power supply**: the main source of electrical power for the robot.

**Processing unit**: also known as the brain or the brick, this is the part of the robot that stores the program information, receives instructions from the user, reads the sensors and controls the outputs.

**Reflective object sensor**: similar to a colour sensor, but includes a light source and detects the presence or absence of a reflective object at very short range (typically < 5 mm). An arrangement of two or more reflective object sensors can form a *line tracker*.

## Estimated Time

45 minutes

## Recommended Number of Students

Up to 30 students

## Facilities

Sufficient workspace for teams of students to investigate the robot components. Ideally an arrangement of large desks, plus storage space for the robot kits.

## Tools

No additional tools are required for this activity.

## Materials

Each group of students will need a robot kit to explore. Graphic organizer on page 5

**Resources**

An unboxing video of the LEGO Mindstorms EV3 Education kit: https://[www.youtube.com/watch?v=t6JVZ2W2KzY](http://www.youtube.com/watch?v=t6JVZ2W2KzY)

A list of LEGO Mindstorms EV3 parts: <http://brickset.com/inventories/31313-1>

VEX and VEX IQ parts and documentation can be found on the VEX Robotics website: <http://www.vexrobotics.com/>

More specific references can be found in the VEX curriculum documentation:

#### For VEX IQ:

<http://www.vexrobotics.com/vexiq/education/iq-curriculum/lets-get-started>

#### For VEX EDR:

<http://curriculum.vexrobotics.com/curriculum/intro-to-robotics/vex-robotics-design-system>

## Procedure

1. To start this activity the teacher should briefly discuss the basics of constructing the platform to be used. There are differences between LEGO, VEX IQ and VEX EDR. LEGO and VEX IQ use a piece-to-piece, snap-together style of construction much like mainstream LEGO. The VEX kits use fasteners such as screws, rivets, nuts, couplers, universal joints and hinges. It should also be mentioned that, specifically with the LEGO and VEX IQ kits, the plastic should not be torqued unnecessarily or breakage might occur.
2. Have students open their kits and identify the parts using the booklet provided. Teachers can have them read up on the components or give an explanation of each.
3. Pass out the graphic organizer. Have students fill in the components and their biological equivalents. The third column asks for the function of both (wheels and feet allow for movement; bump sensor and skin allow for sensing objects; limit switch and joints allow for a given range of motion, etc.).
4. Have students move on to the next portion of the graphic organizer. They are to categorize the components using their own headings. Ideally they will use categories like structures, sensors, wires/cables, fasteners, processing, output, etc.
5. When finished, have students share their findings with another group.

## Assessment

The evaluation of this lesson is based on the Lesson Outcomes outlined above.

Prior to teachers using the evaluation grid it is recommended that students should perform some form of peer assessment and self-assessment.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Outcome To Be Assessed** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **Outcome 1** | **Identify robot components** | | | | | | | |
| **1.1** | Identifies the components of a robot. |  |  |  |  |  |  |  |
| **Outcome 2** | **Understand the function of robot components** | | | | | | | |
| **2.1** | Understands the variety of component functions. |  |  |  |  |  |  |  |
| **2.2** | Is able to categorize components. |  |  |  |  |  |  |  |

### Total Points:

|  |  |  |
| --- | --- | --- |
| 6 | Completed successfully at the exceptional level | Exemplary |
| 5 | Completed successfully at higher than the expected level | Accomplished |
| 4 | Completed successfully to the expected level | Emerging |
| 3 | Attempted successfully at the minimum level | Developing |
| 2 | Attempted - Unsuccessful - Close to Successful | Beginning |
| 1 | Attempted - Unsuccessful | Basic |
| 0 | Not Attempted | N/A |

**Comments:**

**Anatomy of a Robot Graphic Organizer**

Name:

Use the table below to define robot components and their biological equivalents.

|  |  |  |
| --- | --- | --- |
| **Robotics Component** | **Biological Equivalent** | **What is their function?** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

When you are finished, please categorize the components as best as you can using your own headings.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |