

Lesson 10

Fan-tastic!

Suggested Time

One 40-minute session

Lesson Overview

Students will build and program a LEGO fan to be controlled by the tilt sensor. Students will program the fan to have 3 settings: off, low and high. In doing so, they will explore the WeDo programming language. They will learn how to program with motor speeds, wait statements and loops.

- Class discussion of different building methods.
- Building of LEGO fan.
- Overview of programming the fan for different tilt settings.
- Exploration of loops, wait statements and motor speeds.
- Recording design and test results in Engineering Journal.

Learning Objectives

By the end of this lesson, students will be able to:

- Define WeDo programming terms.
- Be familiar with the WeDo programming language.
- Define engineering design as the process of creating solutions to human problems through creativity and the application of math and science knowledge.

Teacher Background***Introduction to Programming***

Start Block:

This is the initiation of the program. This is needed to make the program go or commence.

Wait Statements:

This is used to stall the program in the state that it is currently in. This activity will use the wait statement to keep the motor running for a specific amount of time.

Power Levels:

When the motor is running, different levels of power, that relate to motor speed can be selected. The higher power level relates to a higher speed.

Motor “This Way” or “That Way”:

The direction of the motor is controlled by the direction of the arrow on the motor programming block. The best way for students to determine the forward direction is to test it.

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Loop:

Loops are used to repeat a section of programming. This is useful in the acceleration and deceleration challenge in that it repeats the motor forward code, but adds or subtracts to the speed for each loop.

Tilt Sensor:

Depending on the direction of the tilt sensor, you can have the program go in a different direction. To do this, a loop must be created to check the orientation of the sensor and then a decision statement in the form of a message.

Engineering Design

Engineers typically work together to solve the problems that face society. Engineering design is the process of creating solutions to human problems through creativity and the application of math and science knowledge. The basic steps within the design process include:

- i. Identifying a problem –**
Observing a problem and seeing a need for a solution.
- ii. Researching possible solutions –**
Coming up with ideas to address the problem.
- iii. Picking the best solution –**
Determining which idea best addresses the problem. This decision may involve monetary, practicality, material, and property concerns.
- iv. Building a prototype –**
Build a working model of the chosen design
- v. Testing the prototype –**
Be sure the working model solves the problem and holds up to any important material property tests.
- vi. Repeating any steps needed to improve the design –**
The engineering design process is not always a step-by-step process, as engineers often repeat steps or go back and forth between the other five steps.

Vocabulary

Engineering – the process of creating solutions to human problems through creativity and the application of math and science knowledge.

Start Block – the start block is used to begin or start the program.

Speed – the distance traveled over a specific time. $V = d/t$

Motor Statement – turn the motor on in a specific direction. Other motor commands include: Motor On For Block, Motor Power Block, and

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Motor Off Block.

Power Level – the power level is the speed at which the motor will spin. This is used with the Motor Power Block

Wait Statement – this causes the program to continue in its current state until a specified time has elapsed.

Loop Statement – this repeats a section of code. Use this when you are going to need to do the same thing over and over again.

Add or Subtract Block – add or subtract numbers to the current display number. This is useful when increasing or decreasing power levels or changing wait statement times.

Tilt Block – this is used to base a decision statement on the direction of the tilt sensor.

Materials**For each student**

- Engineer's Journal Part 1

For each student pair

- WeDo kit

For the class

- Handout with program terminology of the programming blocks.



Start Block



Start On Key Press Block



Start On Message Block

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Motor This Way Block



Motor That Way Block



Motor Power Block



Motor On For Block



Motor Off Block



Play Sound Block



Display Block



Add to Display Block



Subtract from Display Block



Multiply by Display Block



Divide by Display Block



Display Background Block

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-  Send Message Block
-  Wait For Block
-  Repeat Block
-  Text Input
-  Number Input
-  Random Input

 Record Stop Play

-  Motion Sensor Input
-  Tilt Sensor Input
-  Tilt Up
-  Tilt Down
-  Tilt This Way
-  Tilt That Way
-  Any Tilt
-  Sound Sensor Input

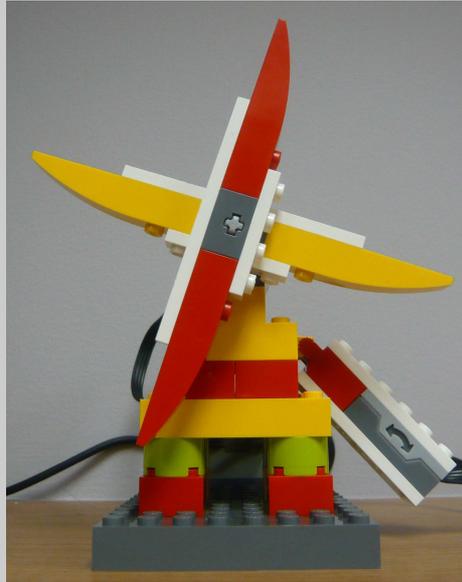
-  Display Input
-  Bubble

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Preparation

- Distribute Engineering Journals
- Prepare an example program for the tilt sensor

Instructions for Teachers**Fan-tastic**

1. Begin with a class discussion about programming and sensors. Explain how window fans use sensors in the form of switches to determine the fan speed.
2. Show students the basics of programming. It would be helpful to do this on a projector with the students. If this is not possible, show the students before they get on the computer. Make sure students understand the terms of the WeDo programming language. Also, clarify any questions they may have.
3. Tell the students that they will be building and programming a LEGO fan that can be controlled by the tilt sensor. They will set up the fan to have three settings: Off, Low, and High.
4. Allow 10 minutes for students to build a LEGO fan.
5. Have students program the fan to speed up then slow down without a sensor option. Answer any questions they may have while programming. When students are ready, have them demonstrate this and record their program in their Engineering Journals.
6. They can move on to program the fan with the tilt sensor. Have them demonstrate and record their program in their Engineering Journals. If they are having trouble with this, explain how using loops and message blocks can change the motor speed.

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- Gather students to discuss what they learned. Make sure to point out any problems that students ran into while programming their fans. Demonstrate your fan that switches speeds depending on the motion sensor. Also display your program for the class to see.



When “F” is pushed, a message is sent to each loop. The tilt sensor determines the value of the display which also determines the speed of the motor.



This program starts the fan from rest, accelerates it to a power level of 10, and then decelerates back to rest.