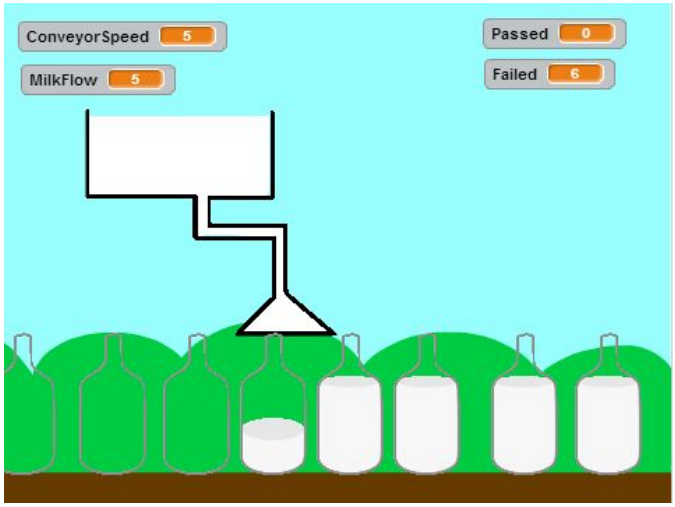
Longlevens Library Code Club
Scratch - Milk Bottle Factory

Description

This is a scratch program that shows how a control system operates. Empty bottles are fed along a conveyor belt, they fill up as they pass under the milk hopper. Bottles are counted at the end of the conveyor according to whether they pass (have the correct amount of milk in them), or fail (are too full or too empty). The conveyor belt speed and milk flow rate can be altered by the player.



Walkthrough

Load this project: bit.ly/LLCC-S-MBF, login to Scratch and then select “remix” to save your own copy. This project only has the sprites that we will be using for the bottles and milk hopper. We will start by creating some variables:

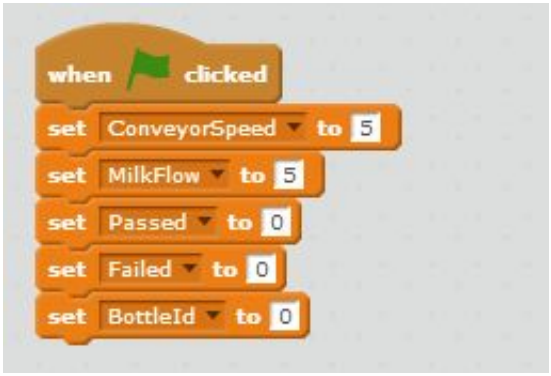
Select the milk hopper sprite, then from the “Data” category create the following variables:
“ConveyorSpeed” (for all sprites) - This will represent the speed that the conveyor belt moves.
“MilkFlow” (for all sprites) - This will represent how fast the milk is flowing out of the hopper.
“Passed” (for all sprites) - This will count how many bottles are correctly filled..
“Failed” (for all sprites) - This will count how many bottles are over or under filled.
“BottleId” (for all sprites) - This will be used to help us create a number of bottles on the conveyor belt.

Select the milk bottle sprite and create the following variables:
“myBottleId” (**for this sprite only**) - This is this bottle’s unique number.
“amountOfMilk” (**for this sprite only**) - This will be used to monitor the quantity of milk in the bottle.

Create the main controls.

First we are going to create the main controls for our bottle factory. **Select the milk hopper sprite**, and check that the “Scripts” tab is selected.

From “Events” category, drag “when <Flag> clicked” to the script area. Then from the “Data” category drag a “set …. to …” five times and lock them under the “when <Flag> clicked” block. Change the drop down for each of these to “ConveyorSpeed”, “MilkFlow”, “Passed”, “Failed” and “BottleId”. Set the value for both “ConveyorSpeed” and “MilkFlow” to 5, leave the others at zero.



From the “Control” category, drag the “repeat …” loop. Change the repeat count to “8”. Now drag a “create clone of …” and place it inside the loop. Change the cloned item from “myself” to “bottle”. From the “Date” category, drag “change ... by ...” and lock it inside the repeat loop, below the “create clone of bottle”. Select “BottleId” as the variable to be changed.

Now from the “Events” category, drag four “when space key pressed” elements to the script area. Change the key in each of these to “up arrow”, “down arrow”, “left arrow” and “right arrow”.

We will use “up arrow” and “down arrow” to control the rate at which the milk flows. From the “Data” category drag a “change … by …” under the “when up arrow” clicked and another one under the “when down arrow clicked”. For both of these select the variable “MilkFlow” from the drop down. When up arrow is pressed we should increase the flow rate by one, so that’s ok. However, when the down arrow is pressed we must decrease the milk flow rate, so change it to “-1”.

We will use the left and right arrow keys to increase or decrease the conveyor belt speed. Drag a “change … by …” under each of those. Select the “ConveyorSpeed” variable from the drop down. For the left arrow set the value to “-1”.

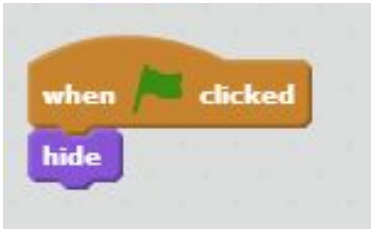
Fill the Bottles With Milk

The bottles need to move along the conveyor. As they pass under the hopper they will be filled with milk, we will change their “costume” to show how full they are (take a look at the different milk bottle costumes). When each bottle reaches the end of the conveyor belt we will increase “Passed” or “Failed” depending upon whether it has the right amount of milk in it or not. We will then reset the bottle to empty bottle and put it back at the start of the conveyor belt.

Select the milk bottle sprite, and check that the “Scripts” tab is selected.

We only want the bottle clones created above to be used, this “model” bottle won’t be used and should be hidden.

From the “Events” category drag a “when <Flag> clicked“ element to the script area. Then from the “Looks” category, drag a “hide” element and lock it below the “when <Flag> clicked”.



From the “Control” category drag a “when I start as a clone” element to the script area. From the “Data” category drag a “set … to …” and lock it below the “when I start as a clone” block.

Select the “myBottleId” as the variable to set, and drag the “BottleId” variable as the value to set it to. This is how we give each “cloned” bottle its unique number.

We need to place the bottles along the conveyor belt. We do this by using the bottle’s number to calculate its initial X position.

From the “Motion” category, drag the “set x to …” and place it under the previous block.

From the “Operators” category drag a Minus (“... - …”) into the “to” part of the previous element and then a Multiply (“... * …”) into the left hand side of the Minus element. From the “Data” category drag the “myBottleId” to the left hand side of the Multiply, set the right hand side of the Multiply to “60” and the right hand side of the Minus to “240”.

The Y position does not need to change. From the “Motion” category, drag the “set y to …” and place it under the previous block. Set the y value to “-100”. Now the cloned sprite can be shown; from the “Looks” category drag a “show” element and place it under the “set y to …” block.

You can now test that your sprite cloning works by running your program (click on the green flag). A row of identical bottles will appear. Note that they all start with whichever costume your bottle has selected. Now we want to make the bottles move along the conveyor belt.

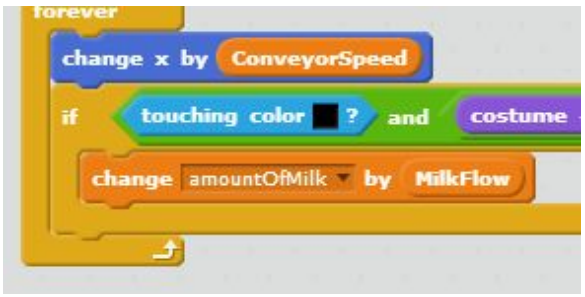
From the “Control” category, drag a “forever” loop area. From the “Motion” category, drag a “change x by …” element and place it inside the forever loop. From the “Data” category, drag the “ConveyorSpeed” variable into the “change x by” value.

We now want the milk bottle to fill **if** it is under the hopper **and** it is not already overflowing.

From the “Control” drag an “if …” block and lock it inside the “forever” loop, below the “change x by” block. From the “Operators” category, drag a “... and …” and place it inside the if condition, then drag a less than (“... < …”) and place it in the right hand side of the “and” block.

From the “Sensing” category, drag a “touching colour …” and place it in the left hand side of the “and” block. Click the colour square of the “touching colour” block and then click on the black border at the bottom of the milk hopper in the game panel. From the “Looks” category drag the “costume #” to the left side of the less than and enter “14” in the right hand side.

From the “Data” category drag a “change … by …” and place it inside the if block. Select “amountOfMilk” from the drop down list. Then drag “MilkFlow” from the “Data” category and place it inside the value to be changed. This makes the amount of milk in the bottle change by the milk flow rate.



We now need to change the costume as the amount of milk in the bottle increases. We will change the costume for each 8 units of milk (this is just an arbitrary number).

From the “Control” category, drag a “repeat until …” block and place it inside the “if” block under the “change amountOfMilk” block. From the “Operators” category drag an “or” (“... or …”) block and place it in the repeat until condition, drag a “less than” (“... < ….”) block to the left side of the “or” and an “equal” (“... = …”) block to the right side of the “or” block.

From the “Data” category, drag the “amountOfMilk” variable to the left side of less than, enter “8” in the right side of the less than.
From the “Looks” category drag the “costume #” to the left side of the equals block and enter “14” in the right side of the equal block.

From the “Data” category drag a “change … by …” and place it inside the “repeat until” loop. Select “amountOfMlk” as the variable to change, and “-8” as the value to change it by. From the “Looks” category drag a “next costume” block and place it inside the “repeat until” loop.

You can now test your program by clicking the green flag. You should see the cloned bottles appear and move along the conveyor belt, as the pass under the milk hopper you see them fill with milk. Click the red “stop” button after you have checked that it works.

We now need to feed in new empty bottles at the start of the conveyor belt. We will do this by recycling the bottles that get to the end, convert them into empty bottles and move them to the start position.

From the “Control” category drag an “if …” block and place it inside the “forever” loop, below the “if touching color” block. From the “Operators” category drag a greater than (“... > …”) block and place it in the if condition. From the “Motion” category drag an “x position” to the left side of the greater than and set the right side of the greater than to “240”.

When the bottle reaches the end, we want to check if the amount of milk in it is correct and count it as a pass or fail.
From the “Control” category drag an “if … else ….” and place it inside the previous “if …”. From the “Operators” category drag a equals (“... = …”) and place it in the “if / else” condition. From the “Looks” category drag “costume #” to the left side of the equals and set the right side of the equals to “13”

From the “Data” category drag a “change … by …” and place it in inside the the “if” block, and drag another one inside the else block. Select the “Passed” variable for the “if” part and the “Failed” variable to the “else” part. Leave both values as “1”.

From the “Motion” category drag a “go to x: … y: …” and place it inside the “if x position > 240” block below the “if costume # = 13” block. Set the x value to “-240” and the y value to “-100”.
From the “Looks” category, drag a “switch costume to …” and place it directly under the “go to ..” block. Select “Bottle0-0” as the costume to use. From the “Data” category drag a “set … to …” and place it under the “switch costume” block. Select “amountOfMilk” as the variable to set, and “0” for the value. Finally, from the “Control” category drag a “wait … secs”

and place it just inside the “forever” loop, change the wait value to “0.1”.

You program is complete. You can now run it by clicking the green flag.

Remember that that the up/down arrow keys increase or decrease the milk flow rate, while the left/right arrow keys increase or decrease the conveyor belt speed. Can you change these to nicely fill each bottle ? How cool is that!

Further Activities:

Add sounds when a milk bottle reaches the end of the conveyor.
Use a different sound for a pass and fail bottle.

Notice that there are no limits on the values for milk flow and conveyor belt speed, you can even make the conveyor go backwards! Fix this by preventing values below 1 from being used. Find out what a sensible maximum value for each of these should be and prevent higher values being used.

Design a bottle top dispenser of your choice. Add code so that correctly filled bottles have a lid placed on them (you will also need to design a new bottle “costume” for bottle with a lid. Make sure that the “Passed” and “Failed” counters still work with your modified program.