Omniwheels x4

This model will help you to learn about the functions and programming of a mobile robot with 4 Omniwheels.

Build the model using the building instructions. **Note:** Ensure that the hub nuts on the wheels are firmly tightened. This ensures that the wheels will not spin on the axles.

The “Omniwheels x4” model is divided into 4 programming tasks:

Task 1	Programming level 2 Drive command – Drive back and forth along a set path (time or pulse-controlled)
Task 2	Programming level 2 Drive laterally to the left or right
Task 3	Programming level 2 Drive diagonally

Controller configuration

First, start the “ROBO Pro Coding” program and then complete the controller configuration. Please see the building instructions once again for the wiring for the actuators and sensors.

You will need 4 encoder motors and the associated counter for the tasks.

Task 1

In the first task, the goal is for the vehicle to drive forward for a specific length of time, then drive back. Then, the program should stop. To do so, you must activate both pairs of wheels at the same time.

Assign the following name to the project:

Omniwheels_x4_forward_backward_time

As in the previous programs, you will begin with the automatic specified program start.

In the previous model (Omniwheel X2), you learned the definition of variables. In this model, you will learn the definition of a function and what you can use it for.

To do so, open the “Functions” group and drag the command “Define do something” to the program screen beside the program start.

Change the text “do something” to “forward”.

Insert the command “Set motor ...” from the “Motor” group. Add the “+” to the command on the 4 motors for M1-M4.

Important note: All motors turn “left” for “forward”

Next, define the function for reverse. Copy the first function to do so. Change the name to “backward” and set “right” as the direction of rotation.

Define another function to stop the motors. Use the “Stop motor” command to do so from the “Motor” block. Then, add “+” to “4” motors.
Name the function “stop”.

Integrate the three functions into the main program. Drag the three commands into your main program via the “Functions” group. Start with “forward”. Insert a wait time of 1 second a “Util” - “wait s (1)” between the next command “stop”. Then, the “Stop command” follows, and a wait time of 2 seconds. Then, insert the “backward” command. The model should drive backwards for 1 more second, then stop.

The program is now complete, and you can test it using your model. Don’t forget to save the program.

When the program is started, the model will move forward a short distance, then back.

In the next program, the vehicle should be moved across a certain distance (pulse controlled).

Assign it the name

Omniwheels_x4_forward_backward_dist

You don't have to change anything about the configuration of the controller.

You will need two functions: "backward" and "forward". Define the functions and insert them into the main program. The following command lines are the same in the two functions, with the only difference being that in "backward" the wheels turn to the "right".

First, insert the command "set motor speed – increment" from the "Motor" group, then add 3 "+". Then, insert the command "is the total of two numbers" and the command "one number" twice from the "Maths" command block.

A "wait until" command follows, where you should insert the command "If motor has reached .. position" from the "Motor".

Then, change the values for the increments to 0.68 x 200" (see calculating a distance with Omniwheels in the model "Omniwheel_X2). Then, you will also need to change the motor information (M2, M3, M4). The increment is requested for motor M1.

Copy the commands into the "backward" function and change the direction of rotation to "right".

First, insert the function "forward" and then a wait time of 2 seconds in the main program. Then, insert the function "backward" and another wait time of 2 seconds.

Finally, test and save your program.

Task 2

Let's start the next task. You can use the previous program once again here – at least the first "forward" functional program. The function will be the same in the main program as well, since the vehicle should drive forward 200 mm.

To do so, first save the previous program a second time under the name

Omniwheel-x4_forward_rot90_dist

To cause the vehicle to turn to the "right" after a wait time of 1 second, create a variable named "counter_rotation90°" and a variable named "counter_dist".

There are multiple steps in this task, based on the axial points of the rotation.

Rotation around the centre point of an axis – right rotation.

If you need the exact travel distance for the wheels, you will have to calculate it as in the tasks for the previous model (Omniwheel X2).

However, you can also use the fixed value of **1.66** as in the previous model.

You can leave the travel forward for 200 mm from the previous program. Simply delete the rest by dragging the commands left and into the blocks. Also delete the motor block for M3 and M4.

Insert an endless loop into the main program containing only the function "forward" and the wait time.

Since all wheels move in the same direction, you can add a “+” for M3 and M4 to the motor block. You only need to change the designations there.

Next, create a function named “counter_rotation90°”. You can go ahead and insert this into the main program, followed by a wait time of 2 seconds.

Drag the command “set counter_rotation90° to...” from the endless loop, then add the mathematical function “**1.69 x 90”**.

Change the speed to **300**.

Now, create the function “counter_rotation90°”. To do so, drag the motor command from the Motor block into the function window. Here as well, click “+” to add it to the selection. Change the running direction of the wheels. M1 and M3 turn to the left, and M2 and M4 to the right. For the increment, insert the command “counter_rotation90°” from the “Variable” block. Finally, copy the command “wait until ...” from the “forward” function and insert it after the motor commands.

The program is now complete, and you can save and test it.

In addition to the directions “forward”, “back” or “turn”, Omniwheels have a specific feature – they can move your vehicle to the side, and it's not a magic trick.

Save the previous program under a new name:

Omniwheel-x4_forward_sideways_right

You only need to make 4 changes to the program.

Change the name of the function “counter_rotation90°” to “sideways_right”. The name is changed automatically in the main program.

Delete the command “set counter_rotation90° ...” in the main program.

Copy the increment from the first function and insert it into the increment for the 2nd function.

Change the running direction of the individual motors. Change M1 and M4 to the left, and M2 and M3 to the right.

To avoid working with decimal points, change the command for the increment. To do so, delete the command “Increment ...” and replace it with the command

from the “Maths” group.

Add the command “is the product of two numbers” to this command - also from the “Maths” group. Right click on the inserted command to select “external inputs” in the selection window.

Insert the command “counter_dist” at the first docking point, from the “Functions” group. Change the “+” sign to an “x” sign.
Insert the command “Square root” and “2” as the value at the second docking point from the “Maths” group.

This is necessary because the distances travelled by the Omniwheels during lateral or diagonal travel are smaller by a factor of “√2 (square root/2)”. Therefore, this value must be used as a multiplier to be able to travel the entered distance.
The program is now converted, and you can save and test it.

Task 3

Another direction of travel is to move diagonally.

Save the previous program under the name

Omniwheel-x4_forward_diagonal_right_forward

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As you can see in the right image, you only need to make 2 changes to the program.

Change the name “sideways_right” to “diagonal_right”. Delete the latter two motors, change “M2 to “M4” and the direction of rotation to “left”. Here as well, you need to insert the rounding command and the square root function.

Save and test out the program.

After you have programmed all directions of travel, you can complete the 4th task.

To do so, load the program

Omniwheel-x4_forward_sideways_right_forward

and save it under the new name

Omniwheel-x4_forward_sideways_right_left

First, copy the function “sideways_right” and change the name in the copy to “sideways_left”. In the 2nd step, change the direction of rotation for the wheels – M1 and M4 to the right and M2 and M3 to the left.

Finally, change the main program as well by inserting the function “sideways_left”, a wait time of 2 seconds, and then the function “forward”. Then, save the program once again and test it.

There are two other interesting programs for the basic Omniwheelx4 vehicle. To do so, use the selection bar

to open the selection window, where you can activate the “Project – New”.

A selection window will appear. To do so, select the “Example” button.

Confirm with

Use the small arrow to browse in the selection window until the cover of the “Robotics Hightech” building kit appears.

Confirm here by clicking “NEXT”. Use the small arrow to browse until the model “**omniwheels_x4_demo**” appears.

Confirm here once again with “NEXT”.

Simply select the button

in the following window. After a short time, the program will be displayed.

In this example program, the buttons defined in the display configuration on the TXT 4.0 display are of interest.

You can use these buttons to access the individual sections of the program, such as using the big button to switch on your selection. If the model should travel forward, drag the “F” slider for “forward” to the right. The vehicle will drive forward for a certain distance, then stop.

If you activate the “all” slider, all possible driving manoeuvres will be executed.

Transmit the program to your TXT 4.0 Controller as usual and test the program by trying out the different sliders.

You will also find another program in the directory for the previous model

omniwheel_x4_move

that shows you how the model moves. Download it and test it out. Check out the program as well – it might teach you a few more programming tips and tricks.

After you have tried out all of the programs, you can turn to the next challenge.

We hope you have fun programming!