Engineering Lab

Turning Investigation

Investigation Description

In this investigation we will complete calculations for swing turns and point turns.

Swing turn - in this type of turn the set of wheels or treads on one side of the robot are powered and the other set of wheels or treads remain still.

Point turn - in this type of turn the set of wheels or treads on one side of the robot are powered forward and the other set is powered in reverse, causing the robot to turn on its central axis.

Procedure:

Write a program that allows your robot to execute a 90 degree swing turn. At this point in your programming career, all that you know how to adjust is timing and power levels. Iteratively test and improve your program until you produce an exact 90 degree turn.

Now write a program that allows your robot to complete a 90 degree point turn. Iteratively test and adjust your program until your robot turns exactly 90 degrees.

Now that you have the basics, complete the investigation by completing the table on the next page. Test each instance multiple times to ensure that your results are reproducible.

Swing Turn Pseudocode
1. Power the right motor in the forward direction for an amount of time
2. Also apply no power (or brake) the left motor for the amount of time
3. Turn both motors off

Point Turn Pseudocode
1. Power the right motor in the forward direction for an amount of time
2. Also power the left motor in the reverse direction for the amount of time
3. Turn both motors off

Answer the following questions. Use the back of this paper or another sheet of paper if you need more space to write your answers.

What variable(s) did you adjust for the motors to execute a 90 degree swing turn? If you mathematically manipulated the time variable, did you get the results that you expected? (For instance, if you doubled the amount of time, did your robot turn 180 degree?) Or did the robot turn more or less? Why?

What variable(s) did you adjust to make your 90 degree point turn? When you mathematically manipulated those variables, did you get the results that you expected?

Did you try adjusting the variable power during this investigation? What happened when you increased the power level to a higher number? Did this increase or decrease your robot's turning accuracy?

Which type of turn type is more reliable: point turns or swing turns? Why?

Which type of turn is faster?

When you complete the data table on the next page, graph your results. Is there a proportional relationship between time and angle turned or power and time? Be prepared to present your results.

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Lab Procedure Sheet

Complete the data sheets below. Be as precise as possible with your measurements.

Use the following equation to calculate % of error:

$$\frac{\text{predicted angle - actual angle}}{\text{predicted angle}} \text{ X } 100\%$$

Swing Turn Data Sheet

Power Level	Method	Turn Type	Predicted Time in Milliseconds	Actual Degree Turned	% of Error
motor[rightMotor] = 31;	Iterative Test	90 degree	Actual Time		
motor[rightMotor] = 31;	Calculated	45 degree			
motor[rightMotor] = 31;	Calculated	180 degree			
motor[rightMotor] = 63;	Iterative Test	90 degree	Actual Time		
motor[rightMotor] = 63;	Calculated	45 degree			
motor[rightMotor] = 63;	Calculated	180 degree			
motor[rightMotor] = 96;	Iterative Test	90 degree	Actual Time		
motor[rightMotor] = 96;	Calculated	45 degree			
motor[rightMotor] = 96;	Calculated	180 degree			

Point Turn Data Sheet

Power Level	Method	Turn Type	Predicted Time in Milliseconds	Actual Degree Turned	% of Error
motor[rightMotor] = 31; motor[leftMotor] = -31;	Iterative Test	90 degree	Actual Time		
motor[rightMotor] = 31; motor[leftMotor] = -31;	Calculated	45 degree			
motor[rightMotor] = 31; motor[leftMotor] = -31;	Calculated	180 degree			
motor[rightMotor] = 63; motor[leftMotor] = -63;	Iterative Test	90 degree	Actual Time		
motor[rightMotor] = 63; motor[leftMotor] = -63;	Calculated	45 degree			
motor[rightMotor] = 63; motor[leftMotor] = -63;	Calculated	180 degree			
motor[rightMotor] = 96; motor[leftMotor] = -96;	Iterative Test	90 degree	Actual Time		
motor[rightMotor] = 96; motor[leftMotor] = -96;	Calculated	45 degree			
motor[rightMotor] = 96; motor[leftMotor] = -96;	Calculated	180 degree			