How many turns will it take…?

Vehicle of Revolution

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If a 6 inch wheel rolls down a 4 foot track, how many revolutions would it take to get to the end of the track?

Answer: 2.5 turns

Calculating Distances Using Circumference

- Circumference relates to linear distance through the ratio of

  Circumference / Diameter = π

  Circumference = Diameter * π

- Linear Distance / Circumference =

  Number of Revolutions

Project: Vehicle of Revolution

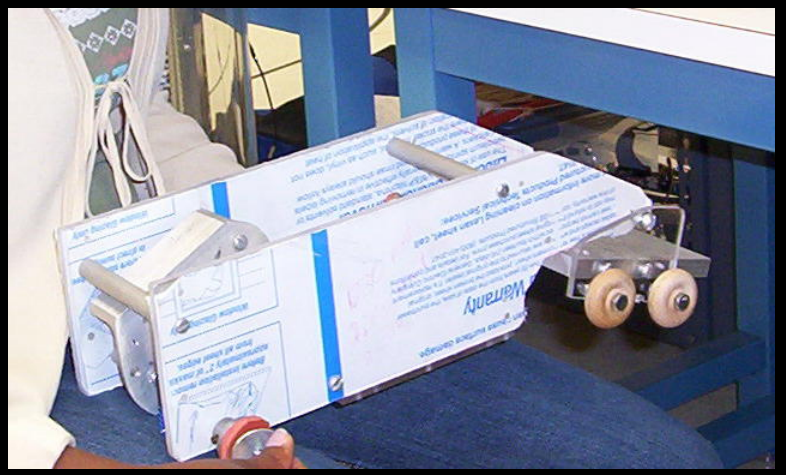
- Hands-on physical application that can be used in concordance with a lesson plan in circumference and linear distances.
- Engage students in the STEM interdisciplinary curriculum.

Materials

- Basic Stamp 2
- Board of Education
- Lots of Lexan material
  (used for the frame of the car and the wheels)
- LCD display
- Resistors
  (3 10kΩ, 3 270Ω)
- .1µF capacitor
- 3 buttons
- DC motor
- Potentiometer
- 4 BJT connectors
- 12 Volt Drill Battery
- Gears
- Aluminum (to build chassis)
- 3” Aluminum channel

Building Process

- Choosing the right model for the car.
- Lexan vs. Plexiglass
- Choosing the right motor.
- Determine wheel sizes that can be used to accommodate the Basic Stamp2.
- Building the track.

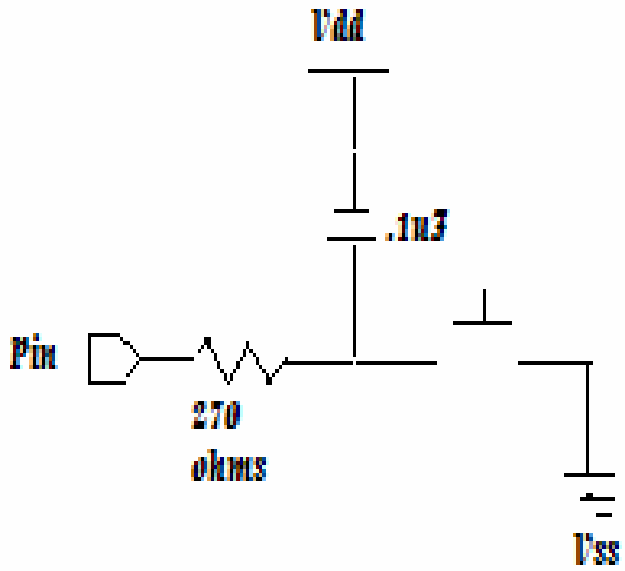


Programming

- BS2 ask for your answer after participant calculates the number of revolutions.
- Then BS2 process that number through a conversion formula:

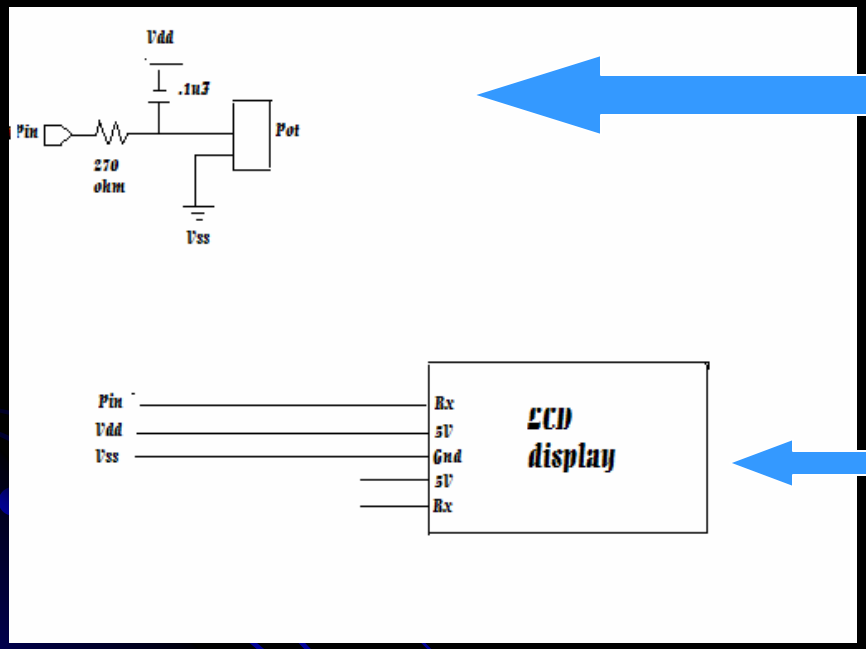
  Turns * 55 (number of pulses per turn)
- When the car hits or misses the target then the car returns to position.

Circuitry (1) - Buttons



This is the schematics of the buttons used.

Circuitry (2) – LCD Display and Potentiometer



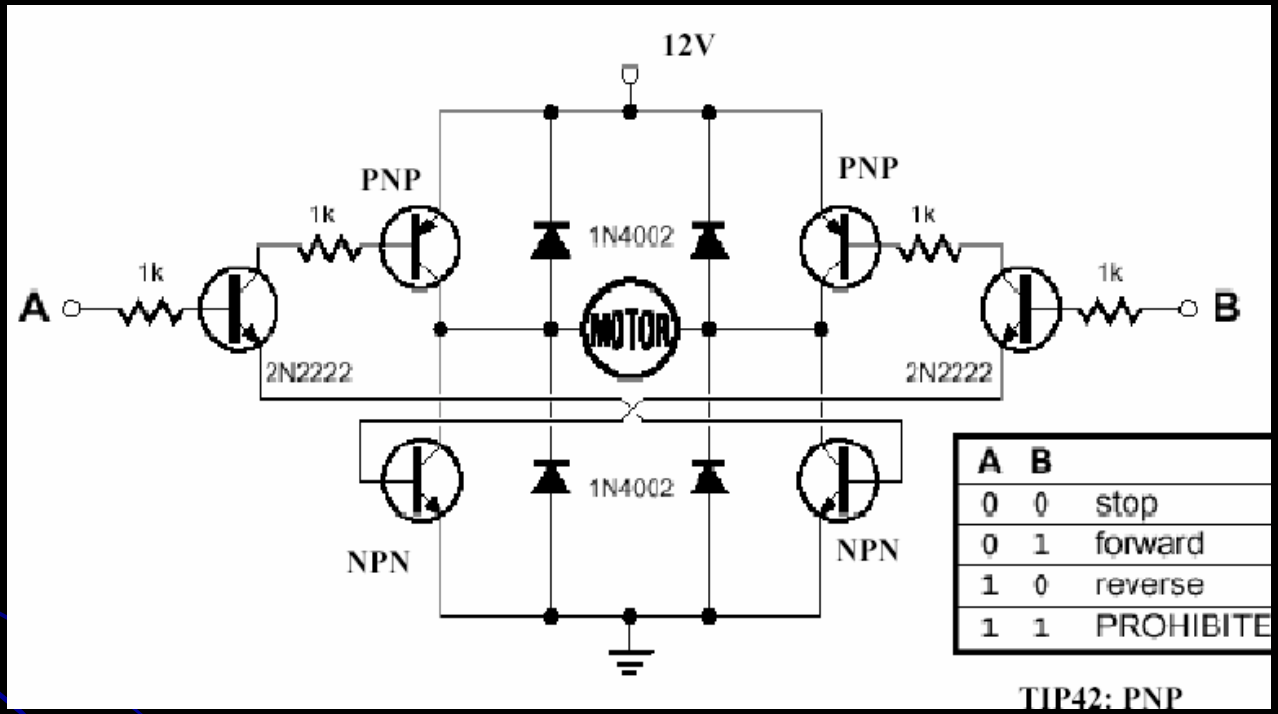
The potentiometer is needed to keep track of the number of turns that the wheels make.

The LCD display is showing the answer being entered and the conversion that BS2 will understand.

DC Motor

- Simple two lead and electrically controlled.
- Linear control using the potentiometer in a series.
- Potentiometer counts the number of turns as the motor moves.
- H-bridge controls the On/Off mechanism.

Circuitry (3) – H-Bridge



The H-bridge is used to drive the DC motor forward and back to the starting position.

Other Observations

- The percent error of the potentiometer maybe greater than ±.25% due to the number of steps in each full turn are not the same. We do not know if the potentiometer is truly linear.
- The momentum of the motor makes it hard to stop precisely. Therefore repeatability suffers.
- H-bridge only controls the on/off mechanism. There is no braking control.
- Problem with possible slippage with the rear drive wheels.
- Problem with Backlash of the Gears

Verbal Problems Involving Calculating the Number of Revolutions

1. If a set of wheels are 6.5” and the distance is 70” away from the starting point, how many revolutions will it take to get to that endpoint?

2. If the endpoint on the track is set at 5 feet and you need about 4.8 revolutions, what size wheels do you put on the car?

3. If a set of wheels are size 5” and the number of revolutions that the wheels on the car make is 4, where is the endpoint?

1. 3.4 revolutions
2. A set of 4 inch wheels
3. 62.8 inches from starting point

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