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THE TINKER SERIES

Projects For Young Inventors

Barnabas Mini-Golf

Revision 1.01

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Revision History

- 1.00: First revision
- 1.01: Updated materials list, added photos

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The Barnabas Mini-Golf Game



Overview

Learn about servo motors and servo controllers while making a miniature golf game!

Topics Covered

Wiring diagrams, servo motors, servo controllers, mechanical calibration

Materials Needed

Materials listed required to build one robot.

Item	Qty	Notes	How To Purchase
9g servo motor	1	With servo horn attached.	
Single-winged or Double-winged Servo Horn	1		
Servo Tester	1	To control the servo motor	

Double-Stick Foam	2	Small ¼" squares	
6V AA Battery Holder	1	Holds 4 x AA Batteries	
AA Batteries	4		
Cardboard Golf Club	1	Made using cardboard, half a popsicle stick glued together using a glue gun	
Condiment Cup	1	With a small hole on the top using a push pin	Dollar Tree
Construction Paper	1	For decorating flag	
Green Construction Paper (12" x 18")	1	For the grass. You can also use 2 pieces of 12" x 9"	
Cardboard Sand trap	1	Cut to random shape	
Cardboard Piece (12" x 18")	1	For the field. A Priority Mail Large box can make 4 of them	
Toothpick	1	For flag	
Blue Foam Sheet	1	Cut to shape of a pond	
Rubber Duckie	1	Or other plastic animals found on golf course	Amazon
Straws	4	Use as bumpers	
Gobstopper	1	Used as ball	
Tinker Sample	1	If you are teaching	
OPTIONAL			
Scorecards	1	Print out template for kids to keep track of number of strokes	
Rock	1		Dollar Tree
Screwdriver (optional)	1		
¼" Servo Screw (optional)	1		

Introducing the Project (5 min)

Explain to the kids that they will be building a miniature golf game. Show them the working demo. Use this time to explain the parts of today's project that can be a little tricky. Also show the kids that they will be able to change their course up (i.e. they will be able to move their obstacles around).

Designing the Golf Course (25 min)

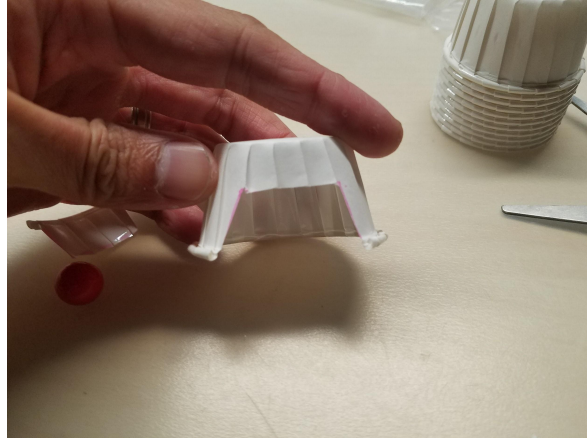
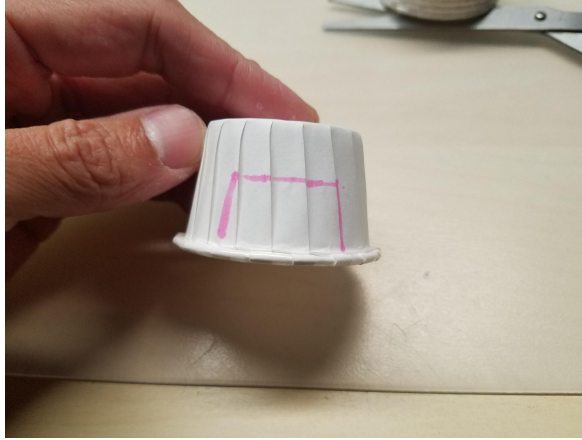
The Grass (10 min)

1. Take the green construction paper and tape it on the edges so that it covers the 12"x18" cardboard
2. Write the name of their golf course
3. Take the straws, cut them in half and then tape them around the perimeter of the golf course to create bumpers



The Goal (5 min)

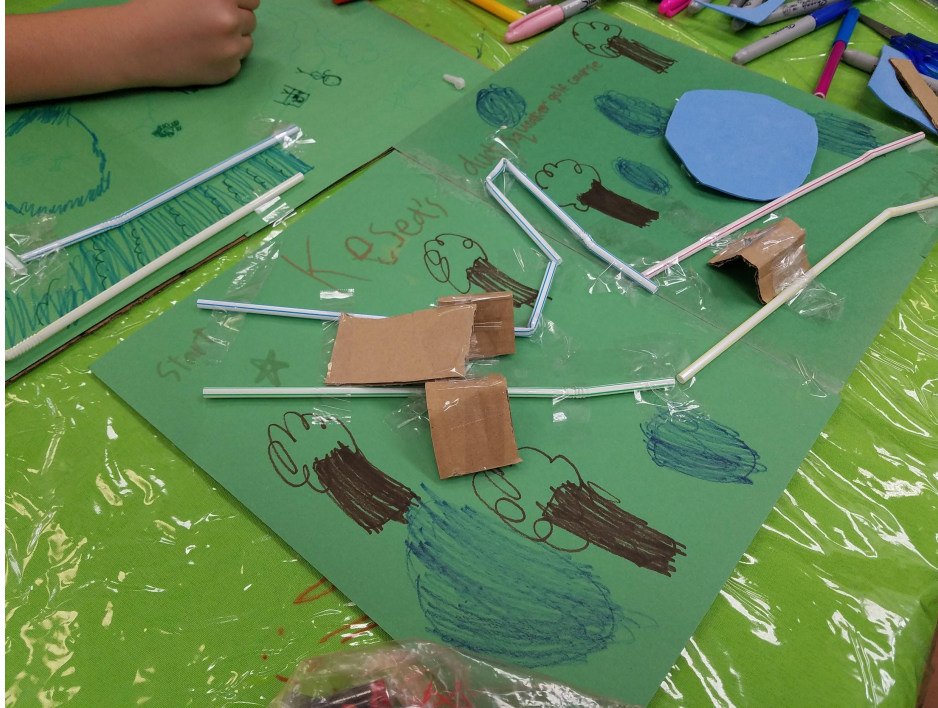
1. Designing the goal. Draw the following in order:
 - a. Ketchup cup with hole
 - b. Flag
2. Have the kids use marker to draw the cave opening and then cut it out. Place the flag on top.
3. Place the goal on their grass



Obstacles and Decorations (10 min)

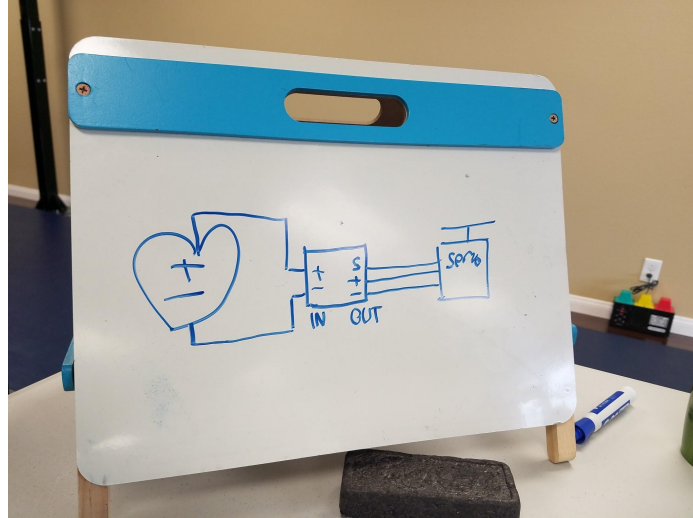
1. Handout the blue foam pieces and have the kids cut out a pond. Have them place their pond on their grass.
2. Handout a the sand trap and have them place it on their grass.
3. Handout the rock. Have them place the rock on their grass.
4. Take a few minutes to decorate their course. They can also take this time to create additional obstacles such as: trees, alligators, etc.





Building the Robot Golfer (20 min)

1. Designing the robot's feet. Draw the following in order:
 - a. Battery Holder + 4 x AA Batteries
 - b. Servo Motor on top of the battery holder with sticky foam connecting them
 - Review that the servo motor only moves half a circle = 180 degrees.
 - c. Servo Controller on top of the servo motor with sticky foam connecting them
 - Review that the servo controller is the brain of our robot.
2. Build the robot's feet.
3. Designing the robot's arm and club. Draw the following in order:
 - a. Servo Coupling (aka servo horn) + servo screw
 - b. Golf club
4. Draw the servo controller to servo motor wiring diagram



5. Connect the servo motor, battery and servo tester.
6. The modes. Discuss with the kids the three different modes on the servo motor. Have the kids experiment.
 - a. Man: Use the dial to control the servo motor
 - b. Auto: The motor will move back and forth automatically
 - c. Neutral: Moves the motor to the middle position (90 degrees)
7. Calibrating our club. Discuss with the students that whenever we build robots, we want to make sure that mechanical parts are where they need to be before we fasten them. Demonstrate what happens if we fasten the club on in a way where the club doesn't even swing to the bottom. Follow the directions below to calibrate your club.
 - a. Put the motor in neutral position my going to neutral mode.
 - b. Fasten your club on so that the club is perpendicular with the ground. This is the 90 degree position. Once you have done this, test your robot to make sure that your robot can swing and hit a ball.

Fore! (5 min)

1. Have the kids spend time playing each other!