

Cozmo Bee



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Solving the New York Times Spelling Bee Game



Find words made from the letters!

Rules:

- 1) Can only include the displayed letters
- 2) Can include repeats
- 3) **MUST** have the middle letter
- 4) At least one pangram (word that contains all letters)

The Goal:

Get Cozmo to spell out the longest pangram (score the most points with one word)

TOPIARY

The Approach

Recognize letters

ChatGPT image recognition and Cozmo's camera



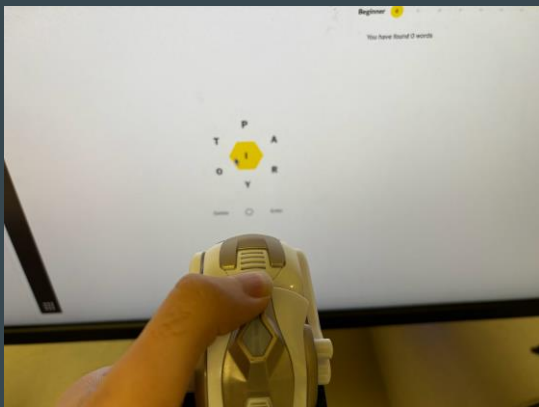
Find Longest Pangram

Check that each word is made by only the 7 unique letters of the puzzle. Add correct word to a list, return longest word of that list



Spell Pangram

Path behind the letter cubes in the correct order using Cozmo vision, particle filter, and RRT

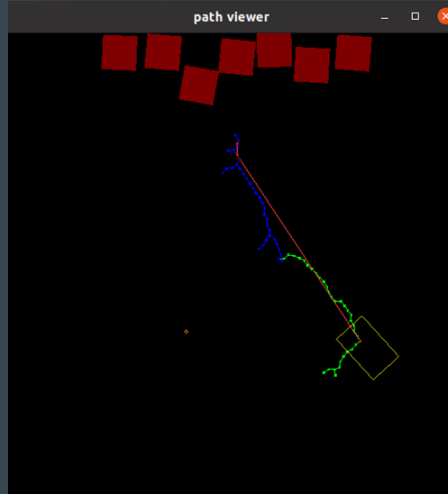


```
103 abstain
104 abstention
105 abstinent
106 abstract
107 abstractor
108 abstruse
109 absurd
110 absurdum
111 abuilding
112 abundant
113 abusable
114 abuse
115 abusive
116 abut
117 abutted
118 abutting
119 abysmal
120 abyss
121 acacia
122 academia
123 academic
124 academican
125 academy
126 acanthus
127 accede
128 accelerate
129 accelerometer
130 accent
```



The Most Interesting Aspect (spelling the word)

- Cozmo's world map of the objects
- Constantly updated and maintained as he travels around
- Use RRT with smoothing to find path to each cube



The Results

- 1) ChatGPT prints out a string of 7 letters after looking at the screen
 - a) Originally thought we would have to use Neural Network
- 2) ChatGPT doesn't play Spelling Bee correctly
 - a) It made up fake words and added letters that weren't in the original puzzle.
- 3) Spelling out the word went through a couple different iterations
 - a) At the very beginning, wanted Cozmo to push the cubes to spaces in front of the wall to spell out the word
 - b) Decided to have Cozmo path to a cube, tell the user to pick up the cube, path to a location in front of the wall, then tell the user to put down the cube.
 - c) In final version, Cozmo paths behind each cube in order and says the letter to spell out the word

Extending the work

- Get a full alphabet of cubes so we can do any puzzle at any time
 - Cozmo SDK only supports 20 custom objects at any time so would need to change that
- A much more involved method of spelling the word
 - Push the cube to a spelling area
 - Physically spell out the word vs “pointing” out the word
 - Would need a full alphabet with multiple repeats of letters
- Draw the word
 - Cozmo could wield a marker to actively write out the word on a whiteboard
 - Would need to account for cozmo’s poor positional awareness (especially when spinning in circles) and the marker making cozmo’s weight unbalanced



```
Quit (core dumped)
jcbarton@nori:~/15-494 Final Project$ simple_cli
2024-04-25 21:55:57,984 cozmo.general INFO App conn
ersion=1.4.10 cozmo.clad_version=3.4.0 app_build_version
2024-04-25 21:55:57,986 cozmo.general INFO Found rob
2024-04-25 21:55:57,991 cozmo.general INFO Connected
l=G0K0KH0263460068
2024-04-25 21:55:58,155 cozmo.general INFO Robot id=1
lized OK
C> ** Robot was picked up! <Vector3 x: -1065.78 y: -432.90
runfsm("Spelling")
<Spelling spelling>

C> launching opengl event loop
Type 'h' in the path viewer for help.
** Robot was picked up! <Vector3 x: -914.30 y: 59.28 z: 10087
```