

Play Hangman

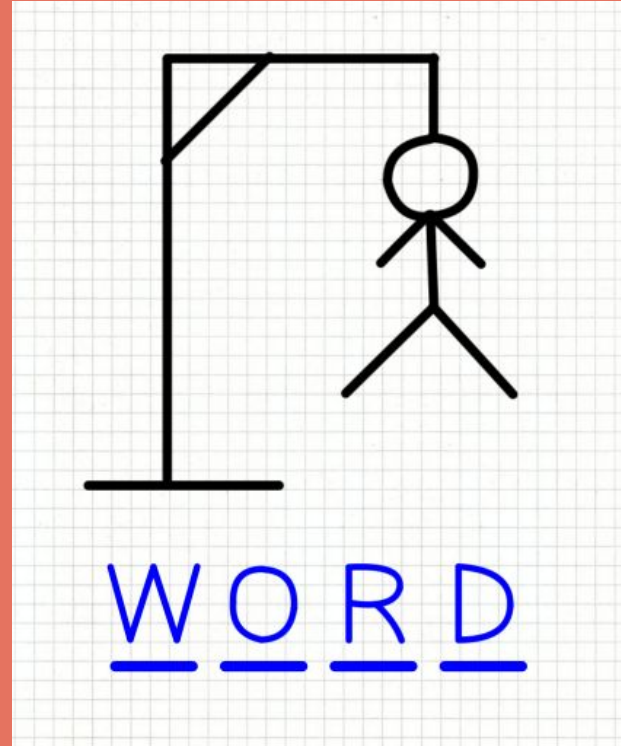
15-494: Cognitive Robotics

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The Problem

We want to teach the Vex robot to play Hangman, with features including score tracking and intuitive guessing.

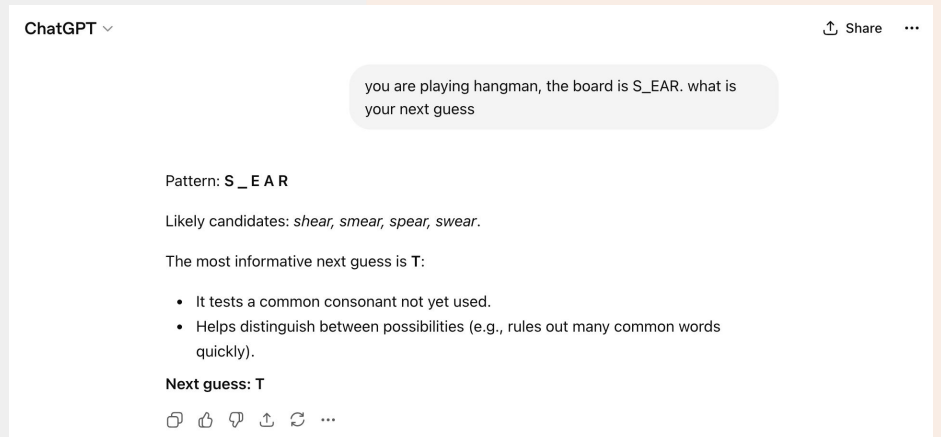


Our Approach

-  **1** Use GPT 4.0 for preliminary game logic.
-  **2** Access camera and analyze game board after each turn.
-  **3** Use #flash function to display number of incorrect guesses.
-  **4** Display score and previous guesses on screen.

Most Interesting Aspect

GPT-4.0 is not very good at guessing the next letter. It seems to hallucinate previously guessed consonants, which prevents it from guessing the correct letter.



What Worked and What Didn't Work



INDICATING INDEX

Writing the index number under each space helped the robot identify the state of the board.



INCORRECT GUESSES

Relying on GPT-4.0 for incorrect guess tracking didn't work. Needed to code functionality.



DISPLAY STATES

Lights and UI display help display internal logic to debug. The display also helps users understand and trust the system.



REAL TIME INTERACTION

Required user coordination, which breaks full autonomy. Hard to synchronize perception with actual game state changes

Future

In the future, we can extend our experiment to more complex behaviors.

- 1** Have the vex robot **come up with words** and direct the person to be the “guesser”.
- 2** **Move to the board** and indicate which space it thinks the letter should be in.
- 3** Display probabilities of each letter and **guessing logic**.

Final Updates

- Added **“word-giver”** functionality: Celeste chooses a PG word and the person is the “guesser”
 - Some small mistakes still occur (ex. Hard time differentiating “N” and “end” in “word-giver” mode). Try “the letter N” instead.
- Updated **letter-guessing logic** to make informed guesses based on likely probabilities for the full word, instead of choosing most-used letters. Displayed this logic in UI.
- Physically moving to the board was difficult. The Vex robot was often inaccurate in positioning and also had a hard time guessing which space the new letter would be in (especially in initial guesses)

Letter-guessing Logic

```
#camera
HANGMAN RAW RESPONSE:
*PATTERN: L I _ E \nCHANGED: YES \nPOSSIBILITY 1: K | 50 | possible words: LIKE, LIVE \nPOSSIBILITY 2: F | 30 | possible words: LIFE \nPOSSIBILITY 3: T | 10 | possible words: LITE \nPOSSIBILITY 4: N | 5 | possible words: LINE \nPOSSIBILITY 5: C | 5 | possible words: LICE \nNEXT: K'
Speaking: 'Guessed letters: E, R, A, L, I, K. I'll guess K. Please update the board and tell me when you're ready.'
```

Celeste Hangman
Status: GUESSING
YOU ARE THE: WORD GIVER
CELESTE IS THE: GUESSER
L I _ E

Guessed: E, R, A, L, I, K
Wrong letters: R, A
Wrong guesses: 2/6

GPT guess reasoning: top possibilities

K	50%	LIKE, LIVE
F	30%	LIFE
T	10%	LITE
N	5%	LINE
C	5%	LICE

Robot View

“Word-giver” Functionality

```
Speaking: 'Talk to me'
<Hangman hangman>
C> Raw utterance: 'hangman'
Heard: 'hangman'
[*hangman_start]
Speaking: 'Do you want to be the guesser, or do you want me to guess?'
```

Celeste Hangman
Status: SELECT_ROLE
DO YOU WANT TO BE THE...

GUESSER
Say: I want to guess

WORD GIVER
Say: You guess

These boxes are not clickable; choose by speaking to Celeste.

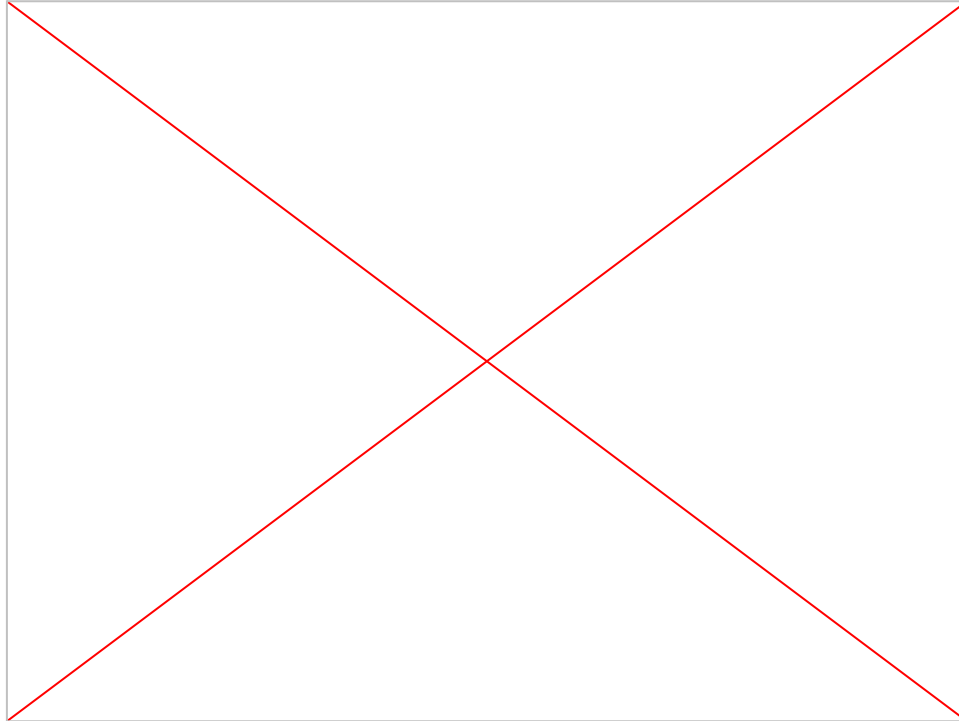
```
CmdFlash: '#flash (RED, RED, RED, RED, RED, TRANSPARENT)'
Speaking: 'Wrong. You have 5 wrong guesses. Guess another letter.'
Raw utterance: 'the letter H'
Heard: 'the letter h'
HUMAN_GUESS_HEARD: 'the letter h'
CmdFlash: '#flash (RED, RED, RED, RED, RED)'
Speaking: 'You lost. The word was PUZZLE.'
```

Celeste Hangman
Status: HUMAN_LOST
YOU ARE THE: GUESSER
CELESTE IS THE: WORD GIVER
_ U _ _ L E

Guessed: L, A, N, U, E, F, R, S, H
Wrong letters: A, N, F, R, S, H
Wrong guesses: 6/6

DEMO

Demo



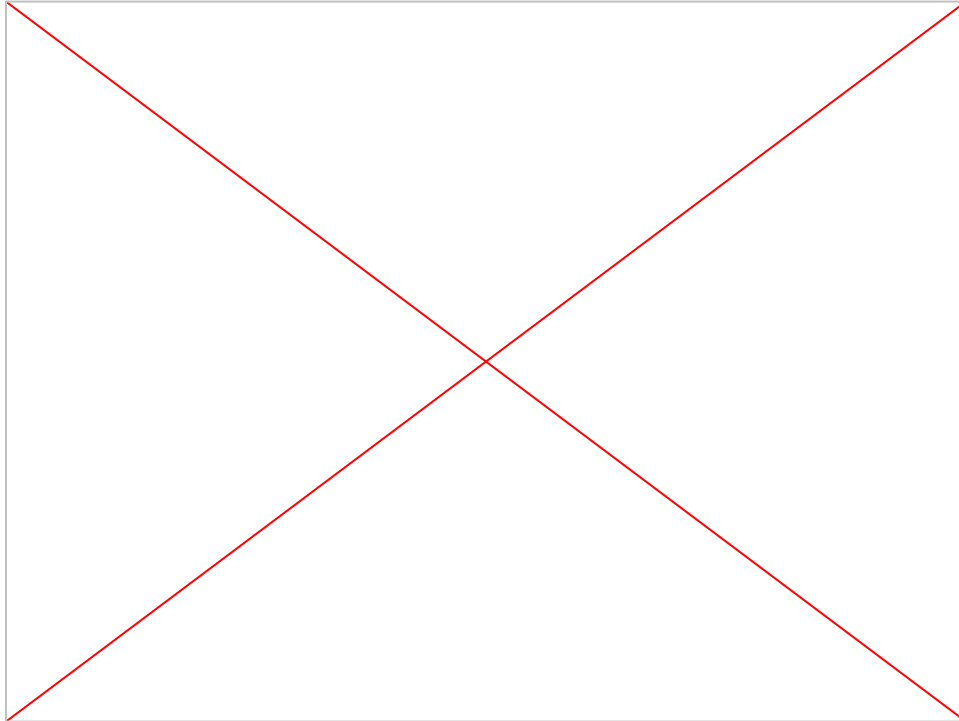
DEMO

Demo



DEMO

Demo: Wrong Guess



Thank You!